SOUTH FLORIDA WATER MANAGEMENT DISTRICT

# UPPER EAST COAST

## WATER SUPPLY PLAN UPDATE

### Planning Document/Appendices

DRAFT

2021

*Cover photos*

*Front: City of Stuart*
*Inset: Florida Oranges*
*Back: St. Lucie River*

# Acknowledgments

The South Florida Water Management District (SFWMD) recognizes and thanks the regional water supply workshop participants for their contributions, comments, advice, information, and assistance throughout the development of this *2021 Upper East Coast Water Supply Plan Update.*

Furthermore, the SFWMD expresses appreciation to all 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 or District) strategic goal for its water supply plans is to identify sufficient water supply sources and projects to meet existing and future reasonable-beneficial uses during 1-in-10-year drought conditions while sustaining water resources and related natural systems. This *2021 Upper East Coast Water Supply Plan Update* (2021 UEC Plan Update) is the fourth update to the 1998 Upper East Coast Water Supply Plan, which previously was updated in 2004, 2011, and 2016. This plan update is consistent with the water supply planning requirements of Chapter 373, Florida Statutes (F.S.), and presents population and water demand projections through 2045, a review of water supply issues and evaluations, and a list of water source options. It also examines local and regional water supply efforts completed since the 2016 plan update and describes water resource and water supply development projects.

This 2021 UEC Plan Update was developed in an open, public forum (**Chapter 1**). Meetings and workshops were held with water users, local governments, utilities, agricultural industry and environmental representatives, and other stakeholders to solicit input, provide information about planning results, and receive comments on draft sections. Due to the COVID-19 pandemic, the SFWMD held virtual workshops for this water supply plan update.

The UEC Planning Area covers more than 1,230 square miles, including all of Martin and St. Lucie counties and the northeastern portion of Okeechobee County, and generally reflects the watersheds of the C-23, C-24, C-25, and C-44 canals. 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. There are more than 226 square miles of wetlands in the UEC Planning Area. Major wetland systems in the UEC Planning Area include the Allapattah Flats, Cane Slough, DuPuis Reserve, Jonathan Dickinson State Park, the Savannas, and Pal-Mar.

Climate change and sea level rise are issues of concern, especially in coastal regions. South Florida is particularly vulnerable to potential changes in climate and sea level because of its location, regional variability in climate, hydrology, geology, low topography, natural resources, and dense population in coastal areas. To plan and prepare for regional climate change and sea level rise, the SFWMD is conducting research and computer modeling to better predict and reduce uncertainties, analyzing vulnerabilities in the current water management system, and developing effective adaptation strategies for the future. Coordination with other resource management entities and governments is vital to ensuring a common approach and shared information moving forward.

# DEMAND ESTIMATES AND PROJECTIONS

As described in **Chapter 2** and **Appendix A**, the UEC Planning Area is home to nearly 469,000 people and supports a large agricultural industry. The permanent population is projected to exceed 686,000 people by 2045, a 47% increase from the 2019 base year estimate for this plan update. Approximately two-thirds of the UEC Planning Area's permanent population resides in St. Lucie County. Details about Public Supply (PS) utilities, including the populations within their service areas, are provided in **Appendix B**.

Agriculture is a substantial part of the regional economy. However, agricultural irrigated acres are projected to decrease 26%, from 107,383 acres in 2019 to 79,004 acres in 2045, due to citrus crop loss from greening disease and a transition of agricultural lands to residential developments. Citrus is the dominant crop in the UEC Planning Area, covering more than 32,000 acres. However, by 2045, citrus is expected to decrease by 12,369 acres, and average demands are projected to decrease by 14.50 million gallons per day (mgd). Sugarcane also is a dominant crop in the region, accounting for more than 24,000 acres in 2019 and 20,000 acres in 2045.

Average water demands for the Agriculture (AG) use category are projected to decrease approximately 26%, from an average total water use of 174.72 mgd in 2019 to 130.10 mgd in 2045 (**Table ES-1**). Projected 1-in-10-year demands for AG are also estimated to decrease 26%.

AG is projected to remain the largest water use category in the UEC Planning Area, accounting for approximately 46% of the total 2045 projected demand. PS is the second largest water use category, representing 29% of the total 2045 projected demand. Domestic Self-Supply (DSS), Commercial/Industrial/Institutional (CII), Landscape/Recreational (L/R), and Power Generation (PG) collectively account for approximately 25% of the total 2045 projected demand. In the UEC Planning Area, the overall demands are projected to decrease by more than 3%. The total demand projection for 2045 in this 2021 UEC Plan Update is 21% lower than the estimated 2040 demand projected in the 2016 UEC Plan Update.

Table ES-1. Estimated and projected gross water demands under average rainfall conditions in the UEC Planning Area for 2019 and 2045.

| Water Use Category | 2019 Estimated Use (mgd) | 2045 Projected Demand (mgd) | Percent Change | Percent of Projected 2045 Total |
|---|---|---|---|---|
| PS | 56.26 | 81.62 | 45.1% | 29.0% |
| DSS | 5.76 | 5.61 | -2.6% | 2.0% |
| AG | 174.72 | 130.10 | -25.5% | 46.3% |
| CII | 4.43 | 5.74 | 29.6% | 2.0% |
| L/R | 32.03 | 40.64 | 26.9% | 14.5% |
| PG | 17.91 | 17.47 | -2.5% | 6.2% |
| **Total** | **291.11** | **281.18** | **-3.4%** | **100.0%** |

AG = Agriculture; DSS = Domestic Self-Supply; CII = Commercial/Industrial/Institutional; L/R= Landscape/Recreational; mgd = million gallons per day; PG = Power Generation; PS = Public Supply; UEC = Upper East Coast.

# DEMAND MANAGEMENT: WATER CONSERVATION

Water conservation by all water use categories continues to be a priority to meet future water needs. Conservation programs often are among the lowest-cost solutions to meet future demands and can reduce costs over the long term if properly planned and implemented (**Chapter 3**). Conservation efforts in the UEC Planning Area have effectively lowered the net (finished) water per capita use rate for PS over the past two decades, from 167 gallons per capita per day in 2000 to approximately 130 gallons per capita per day in 2019. Analysis suggests that users in the UEC Planning Area can collectively save an additional 12.62 mgd by 2045 if various urban and agricultural conservation options are implemented.

# NATURAL SYSTEMS AND RESOURCE PROTECTION

Natural surface water systems in the UEC Planning Area include the St. Lucie Estuary, Indian River Lagoon, Ten Mile Creek, and Lake Okeechobee. The water supply needs for natural systems are protected and addressed through regulatory mechanisms, restoration projects, and water resource development projects.

In the UEC Planning Area, a minimum flow and minimum water level (MFL) and prevention strategy have been adopted for the St. Lucie Estuary (**Chapter 4**, **Appendix C**). The MFLs and recovery strategies for the Northwest Fork of the Loxahatchee River and Lake Okeechobee affect portions of the UEC Planning Area but are described in the Lower East Coast water supply plan updates (last updated in 2018). One water reservation has been adopted in the UEC Planning Area for the protection of fish and wildlife in the North Fork of the St. Lucie River that reserves water needed for proposed ecosystem restoration projects. Restricted allocation area rules have been established for the C-23, C-24, and C-25 Canal System; North Palm Beach County/Loxahatchee River Watershed Waterbodies; Lake Okeechobee and the Lake Okeechobee Service Area (LOSA); and Floridan Aquifer Wells in Martin and St. Lucie Counties.

Large ecosystem restoration projects are under way in the UEC Planning Area (**Chapter 7**) that are vital to improving and maintaining the viability of the region's water resources, including elements identified in the St. Lucie Estuary MFL prevention strategy. The Comprehensive Everglades Restoration Plan (CERP), a partnership between the United States Army Corps of Engineers (USACE) and SFWMD, is a critical component of ecosystem restoration and water supply in the UEC Planning Area. CERP includes numerous capital projects needed to protect and restore natural systems and increase water availability, including the Indian River Lagoon – South Project and the Lake Okeechobee Watershed Restoration Project. The Indian River Lagoon – South Project, which includes the C-44 reservoir and stormwater treatment area, aims to enhance water availability and improve water quality within the St. Lucie Estuary and Indian River Lagoon by reducing damaging effects of watershed runoff, decreasing peak freshwater discharges, and reducing nutrient loads, pesticides, and other pollutants. Although the Lake Okeechobee Watershed Restoration Project is not within the UEC Planning Area boundary, it does affect the region's water resources (i.e., the St. Lucie River and Estuary). The project aims to increase storage capacity in the watershed, resulting in improved lake levels; improve the quantity and timing of discharges to estuaries (including the St. Lucie Estuary); restore wetlands; and improve water supply for existing legal users.

# WATER SOURCE OPTIONS

Water users in the UEC Planning Area rely on surface water, groundwater (fresh and brackish), and reclaimed water (**Chapter 5**) to meet urban and agricultural demands. Surface water from canals and lakes, and fresh groundwater from the surficial aquifer system (SAS) are considered traditional water sources. Alternative water supply sources include brackish groundwater from the Floridan aquifer system (FAS), reclaimed water, seawater, and excess surface water and groundwater captured and stored in aquifer storage and recovery (ASR) wells, reservoirs, and other storage features. Use of alternative water supplies is an integral part of the current and future water supply strategy in the UEC Planning Area.

PS utilities within the UEC Planning Area rely on fresh groundwater from the SAS and brackish groundwater from the FAS. Groundwater sources can meet 2045 PS demands; however, increases in fresh groundwater allocations must meet the SFWMD's water use permitting resource protection criteria. Of the 15 PS utilities in the UEC Planning Area, one utility will need to construct new projects to meet its projected 2045 demands. However, 6 utilities have proposed 23 new projects through 2045. These new projects will increase water supply capacity and distribution through expanded use of the FAS, extension of reclaimed water lines, and construction of reservoirs.

Within the UEC Planning Area, AG users rely primarily on surface water to meet their demands. Groundwater from the SAS is utilized to a much lesser extent. The FAS is used primarily for freeze protection or emergency backup supply due to the brackish water quality that typically requires blending with fresh water prior to its use for irrigation. A decrease in AG demands is expected over the planning horizon; therefore, existing surface water sources can continue to meet 2045 AG demands.

L/R users, including golf courses, rely on surface water, fresh groundwater, and reclaimed water in nearly equal volumes. In addition, some L/R users meet their demands with treated brackish groundwater from the FAS. Increases in L/R irrigation demands are expected to be met primarily through the expansion of reclaimed water systems.

Increases in demands for the CII category through 2045 are expected to continue to be met primarily by fresh groundwater and surface water. PG demands will continue to be met primarily by surface water, fresh groundwater, and brackish groundwater, with use of reclaimed water when available. **Table ES-2** summarizes the variety of water source options that are typically used in the UEC Planning Area, by water use category.

Table ES-2. Typical water source options for the six water use categories.

| Water Use Category | Fresh Surface Water | Fresh Groundwater | Brackish Groundwater | Reclaimed Water |
|---|---|---|---|---|
| Public Supply | ✓ | ✓ | ✓ | |
| Domestic Self-Supply | | ✓ | | |
| Agriculture | ✓ | ✓ | | |
| Landscape/Recreational | ✓ | ✓ | ✓ | ✓ |
| Commercial/Industrial/Institutional | ✓ | ✓ | | ✓ |
| Power Generation | ✓ | ✓ | ✓ | ✓ |

## Surface Water

Surface water supply sources in the UEC Planning Area include the C-23, C-24, C-25, and C-44 canals as well as county and water control district canals, lakes, reservoirs, and on-site ponds. Water availability from the C-23, C-24, C-25, and C-44 canals is limited due to the implementation of restricted allocation area rules (**Chapter 4**).

## Fresh Groundwater

The SAS is the primary source of fresh groundwater in the UEC Planning Area and is used by all water use categories except PG. Large-scale use of the SAS is limited by low aquifer productivity, potential impacts on wetlands, pollution, existing legal users, and the potential for saltwater intrusion. However, new small-scale uses of the SAS are viable in many locations. Saltwater interface mapping of the region indicates little to no movement of the saltwater interface in the SAS from 2009 to 2019 (**Chapter 6**). PS and L/R are the largest users of fresh groundwater from the SAS in the UEC Planning Area. Water availability from the SAS will be determined on an application-by-application basis, considering the quantities required, local resource conditions, existing legal users, and viability of other supply options.

In 2019, the SAS accounted for approximately 31% of PS use and 100% of DSS use in the UEC Planning Area. SAS use for PS is projected to increase from 25.79 mgd in 2019 to 28.82 mgd by 2045, as utilities maximize their permitted allocations from this source. Most PS utilities in the UEC Planning Area are expanding their use of the FAS to meet demand increases and have proposed projects to meet future growth (**Chapter 8**).

## Brackish Groundwater

Brackish groundwater from the FAS is used by seven PS utilities, five golf courses, several AG users, and one PG facility. Two PS utilities have proposed to withdraw from the FAS beginning in 2023 and 2028. The PS utilities use reverse osmosis treatment and have a combined treatment capacity of 59.04 mgd. In 2019, treated FAS water met 69% of PS demand. Current and future FAS demands were simulated using the SFWMD's East Coast Floridan Model to assess the potential impacts of withdrawals on water levels, water quality, and the viability of the source through the planning horizon. The model results indicate no large-scale changes in water levels or water quality in the FAS are expected for most of the model domain through 2045. There are some isolated areas with potential issues that may require further evaluation, such as the northeastern portion of the planning area. Modeling results are provided in **Appendix D**. Review of historical chloride data and model results indicates properly managed FAS wellfields can meet projected demands through 2045.

Current water level and water quality data for the FAS are discussed in **Chapter 6**. Review and analysis of FAS data indicate there have been no substantial regional changes; however, some local changes in water quality have been observed, which may be the result of localized pumping stresses or hydrologic conditions. FAS users may need to spread out withdrawal facilities or reduce individual well pumping rates to mitigate water quality changes. These areas should continue to be monitored through a coordinated effort with utilities and other FAS stakeholders.

## Reclaimed Water

Use of reclaimed water is an important component of managing water supplies in the UEC Planning Area. In 2019, all 20 existing wastewater treatment facilities provided a portion of their treated wastewater for reuse (**Appendix E**). These facilities treated a total of 24.22 mgd and 36% (8.77 mgd) was reused, primarily for irrigation of golf courses, parks, schools, and residences. However, 16.01 mgd of potentially reusable water was disposed, mainly through deep well injection. Wastewater flows are projected to increase to 46.13 mgd by 2045. Many utilities have constructed the required treatment facilities to produce reclaimed water for public access irrigation in anticipation of increased reclaimed water demand in the future. Reclaimed water pipelines are proposed to be extended as new development occurs, substantially increasing the volume of reuse by 2045.

## Water Storage

Capturing surface water and groundwater during wet conditions for use during dry conditions increases the amount of available water. Water storage options include ASR wells and reservoirs, which are considered alternative water supplies. As of 2019, there are no operating ASR wells in the UEC Planning Area. The SFWMD has built and conducted aquifer performance testing for one ASR exploratory well (Port Mayaca), and several ASR wells are planned by the City of Port St. Lucie Utility Systems Department to meet future water demands.

Regional reservoirs (e.g., C-44, C-23/C-24 North and South, C-25) associated with large ecosystem restoration projects (**Chapter 7**) will attenuate stormwater, provide water quality treatment, store excess surface water, and enhance surface water availability during the dry season. On a smaller scale, local agricultural reservoirs can store recycled irrigation water and/or collect stormwater runoff.

# FUTURE DIRECTION

**Chapter 9** contains guidance to help focus future efforts in the region to meet projected water needs. Some of the key suggestions to regional stakeholders, including the SFWMD, utilities, other government agencies, agricultural interests, and environmental groups, are as follows:

- Continue implementation of water conservation programs throughout the UEC Planning Area to increase water use efficiency and reduce the amount of water needed to meet future demands.
- Continue implementation of the St. Lucie Estuary MFL prevention strategy, and review and update the strategy, as appropriate, in conjunction with future water supply plan updates.
- Identify wells critical to long-term monitoring and modeling to ensure they are constructed, maintained, or replaced, as necessary.
- Continue mapping the saltwater interface and identify areas of concern that might require enhanced monitoring or changes in wellfield operations.

- Continue characterizing, monitoring, and designing adaptation solutions in response to climate change and sea level rise impacts to water supply.
- Design new FAS wellfields to maximize withdrawals while minimizing water level and water quality changes. This likely will require a combination of additional wells with greater spacing between wells, lower-capacity wells, and continued refinement of wellfield operational plans.
- Continue supporting ecosystem restoration efforts, including CERP.
- Complete repairs to the Herbert Hoover Dike (performed by the USACE) and implement a new Lake Okeechobee System Operating Manual.
- Continue development of alternative water supplies, including maximizing the use of reclaimed water.
- Develop regional and local reservoirs and other storage systems, where possible, to increase surface water availability for environmental, agricultural, and urban water supply needs.

# CONCLUSIONS

Building on the findings and conclusions of previous UEC water supply plan updates, this 2021 UEC Plan Update assesses water supply demand and available sources for the UEC Planning Area through 2045. This plan update concludes that future water needs of the region can be met through the planning horizon with appropriate management, conservation, and implementation of projects identified herein. Meeting future water needs through 2045 depends on the following:

- Construction of one potable water supply development project by one PS utility;
- Implementation of the CERP Indian River Lagoon – South Project and other ecosystem restoration projects; and
- Completion of repairs to the Herbert Hoover Dike by the USACE and subsequent implementation of a new Lake Okeechobee System Operating Manual.

Successful implementation of this 2021 UEC Plan Update requires coordination and collaboration with local governments, utilities, agricultural interests, and other stakeholders. This partnering should ensure water resources continue to be prudently managed and available to meet future demands, while also protecting water resources, including natural systems.

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# Acronyms and Abbreviations

| | |
|---|---|
| AFSIRS | Agricultural Field-Scale Irrigation Requirements Simulation |
| AG | Agriculture |
| APPZ | Avon Park permeable zone |
| ASR | aquifer storage and recovery |
| AWS | alternative water supply |
| BEBR | Bureau of Economic and Business Research |
| BMP | best management practice |
| CERP | Comprehensive Everglades Restoration Plan |
| CFP | Cooperative Funding Program |
| CII | Commercial/Industrial/Institutional |
| District | South Florida Water Management District |
| DSS | Domestic Self-Supply |
| ECFM | East Coast Floridan Model |
| EQIP | Environmental Quality Incentives Program |
| F.A.C. | Florida Administrative Code |
| F.S. | Florida Statutes |
| FAS | Floridan aquifer system |
| FAWN | Florida Automated Weather Network |
| FDACS | Florida Department of Agriculture and Consumer Services |
| FDEP | Florida Department of Environmental Protection |
| FPL | Florida Power & Light |
| FSAID | Florida Statewide Agricultural Irrigation Demand |
| FY | Fiscal Year |
| gpcd | gallons per capita per day |
| HVAC | heating, ventilation, and air conditioning |
| IRL-S Project | Indian River Lagoon – South Project |
| L/R | Landscape/Recreational |
| LFA | Lower Floridan aquifer |
| LOSA | Lake Okeechobee Service Area |
| LOWRP | Lake Okeechobee Watershed Restoration Project |
| MFL | minimum flow and minimum water level |

| | |
|---|---|
| MIL | mobile irrigation lab |
| mg/L | milligrams per liter |
| mgd | million gallons per day |
| NEEPP | Northern Everglades and Estuaries Protection Program |
| PCUR | per capita use rate |
| PG | Power Generation |
| PS | Public Supply |
| RAA | restricted allocation area |
| RFGW | Regional Floridan Groundwater (monitoring program) |
| RO | reverse osmosis |
| SAS | surficial aquifer system |
| SFWMD | South Florida Water Management District |
| STA | stormwater treatment area |
| UEC | Upper East Coast |
| UF/IFAS | University of Florida Institute of Food and Agricultural Sciences |
| UFA | Upper Floridan aquifer |
| USACE | United States Army Corps of Engineers |
| USGS | United States Geological Survey |
| WWTF | wastewater treatment facility |

# 1

# Introduction

TOPICS

- 2021 UEC Plan Update
- Goal and Objectives
- Legal Authority and Requirements
- Regional and Local Planning Linkage
- Plan Development Process
- Progress Since the 2016 UEC Plan Update

The South Florida Water Management District (SFWMD or District) develops and updates regional water supply plans to address current and future water needs while protecting central and southern Florida's water resources. This *2021 Upper East Coast Water Supply Plan Update* (2021 UEC Plan Update) assesses existing and projected water demands as well as water sources to meet those demands through 2045 for Martin and St. Lucie counties and the northeastern portion of Okeechobee County (**Figure 1-1**). The plan update presents population estimates, water demands and projections (**Chapter 2**), water resource and water supply development projects (**Chapters 7** and **8**, respectively), and related water supply planning information for the 2019 to 2045 planning horizon. Designed to be a planning guide for local governments, utilities, agricultural operations, and other water users, this 2021 UEC Plan Update provides a framework for water supply planning and management decisions in the UEC Planning Area.

The UEC Planning 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 St. Johns River Water Management District, to the west is the Lower Kissimmee Basin Planning Area and Lake Okeechobee, to the south is the Lower East Coast Planning Area, and to the east is the Atlantic Ocean. In the eastern portion of the planning area, there are metropolitan areas from Fort Pierce to Stuart, and in the western portion, there is a mixture of agricultural and urban areas from Okeechobee to Indiantown. Along the eastern boundary of the planning area are the St. Lucie Estuary and Indian River Lagoon, which provide critical habitat to a wide variety of species.

Notable water resources that are partially in and affect the UEC Planning Area include the Northwest Fork of the Loxahatchee River and Lake Okeechobee. Because these two water bodies span more than one planning area, they are noted in this plan update but are fully addressed in the *2018 Lower East Coast Water Supply Plan Update* (SFWMD 2018). The Northwest Fork of the Loxahatchee River extends from southern Martin County into northern Palm Beach County. Lake Okeechobee serves as a boundary for four of the SFWMD's water supply planning areas. The Lake Okeechobee Service Area includes portions of Palm Beach, Martin, Okeechobee, Hendry, Glades, and Lee counties that depend on surface water from Lake Okeechobee and its connected conveyance canals for supplemental water supply.

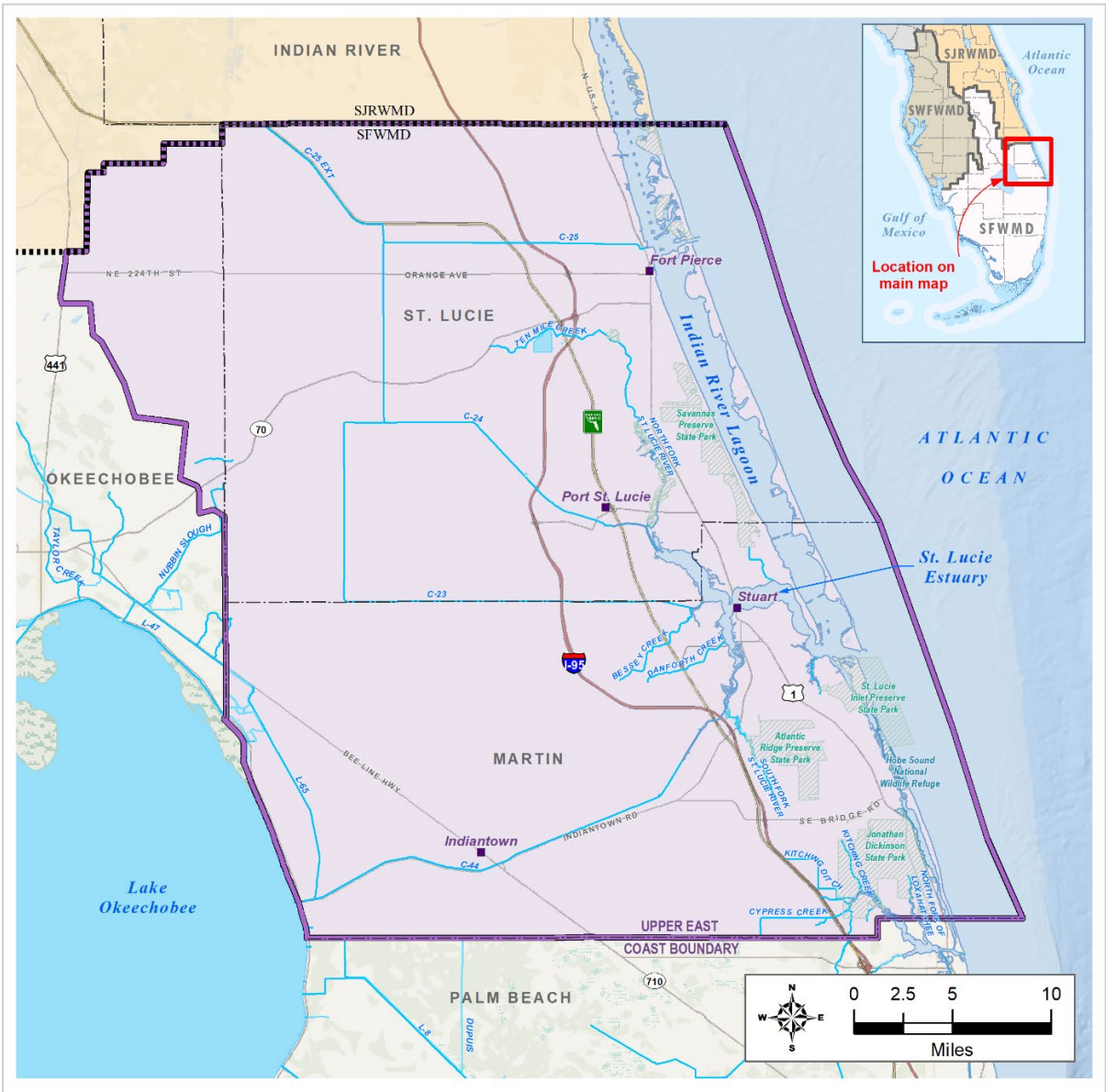


Figure 1-1. Upper East Coast Water Supply Planning Area.

Determining the availability of water needed to meet projected demands requires consideration of the area's water resources. The primary sources of fresh water throughout the UEC Planning Area are surface water and groundwater. To a much lesser extent, reclaimed water also is used. Major surface water resources for the UEC Planning Area include the C-23, C-24, C-25, and C-44 canals as well as Lake Okeechobee and its hydraulically connected water bodies. The availability of surface water in the planning area is limited, primarily due to water resource protection criteria (**Chapter 4**). Groundwater resources in the UEC Planning Area include the surficial and Floridan aquifer systems (SAS and FAS). Further information about water source options is provided in **Chapter 5**.

# 2021 UEC PLAN UPDATE

The 2021 UEC Plan Update reflects the changes experienced in the UEC Planning Area since 2016, and their effect on water use and projected water demands. The 2021 UEC Plan Update consists of two documents: the planning document with appendices, and the *Support Document for the 2021-2024 Water Supply Plan Updates* (2021-2024 Support Document; SFWMD 2021). The planning document and appendices focus on the UEC Planning Area. The 2021-2024 Support Document discusses aspects common to four of the SFWMD regional planning areas, including the legal authority and requirements for water supply planning. The Upper Kissimmee Basin is not included in the Support Document because it is part of the Central Florida Water Initiative, which has its own support documents.

# GOAL AND OBJECTIVES

The goal of the 2021 UEC Plan Update is to identify sufficient water supply sources and future projects to meet existing and future reasonable-beneficial uses during 1-in-10-year drought conditions through 2045 while sustaining water resources and natural systems. The objectives of the 2016 UEC Plan Update were reviewed and modified to develop the following objectives for this 2021 UEC Plan Update:

1. **Water Supply** – Quantify sufficient volumes of water and water supply projects to meet reasonable-beneficial consumptive uses projected through 2045 under 1-in-10-year drought conditions.

2. **Natural Systems** – Protect and enhance natural systems and water resources including the St. Lucie River and Estuary, the Indian River Lagoon, the Northwest Fork of the Loxahatchee River, and other federal, state, and locally identified natural areas.

3. **Water Conservation and Alternative Source Development** – Encourage water conservation measures to improve water use efficiency. Continue to encourage development of the FAS as an alternative water supply (AWS) and monitor the aquifers to enhance understanding of the relationships among water use, water levels, and water quality. Develop water storage options, including aquifer storage and recovery (ASR) systems and reservoirs, and promote projects that increase use of reclaimed water.

4. **Linkage with Local Governments** – Provide information to support local government Comprehensive Plans. Promote compatibility of the plan update with local government land use decisions.

5. **Compatibility and Linkage with Other Efforts** – Achieve compatibility and integration with the following planning-related activities:
    - Other state and federal water resource initiatives in the planning area;
    - Existing and proposed environmental projects;
    - Modifications to operating schedules for regional systems, including Lake Okeechobee; and
    - Water use permitting process, minimum flow and minimum water level (MFL) criteria, water reservations, and restricted allocation areas (RAAs).

# LEGAL AUTHORITY AND REQUIREMENTS

The legal authority and requirements for water supply planning are included in Chapters 163, 187, 373, and 403, 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.

In addition to water supply planning, the SFWMD is required by statute to provide updates for a variety of resource development, restoration, and monitoring programs implemented within the District's boundaries. Such updates are provided in the annual publication of the *South Florida Environmental Report*, which is referenced as needed in this plan update.

# REGIONAL AND LOCAL PLANNING LINKAGE

The SFWMD's regional water supply planning process is closely coordinated and linked to the local water supply planning of municipal/county governments and utilities. Coordination and collaboration among all water supply planning entities is needed throughout the regional water supply plan development and approval process.

While this 2021 UEC Plan Update addresses regional and Districtwide water supply issues, local governments are required to plan for their water and wastewater needs (as well as other infrastructure and public service elements) through their Comprehensive Plans. Local Comprehensive Plans also include Water Supply Facilities Work Plans (Work Plans), which are required by statute. In addition, local governments are required by statute to update their Work Plans and adopt revisions to their Comprehensive Plans within 18 months following approval of this 2021 UEC Plan Update. Revisions may include population projections, established planning periods, existing and future water resource projects, intergovernmental coordination activities, conservation and reuse measures, and the capital improvements element. More information on Comprehensive Plan and Work Plan requirement is provided in the 2021-2024 Support Document (SFWMD 2021).

To assist local governments in updating their Comprehensive Plans and Work Plans, the SFWMD has developed technical assistance tools and informational documents, which are available on the SFWMD website (https://www.sfwmd.gov/doing-business-with-us/work-plans). Additional information about developing a Work Plan is available from the Florida Department of Economic Opportunity website (www.floridajobs.org/community-planning-and-development/programs/community-planning-table-of-contents/water-supply-planning).

# PLAN DEVELOPMENT PROCESS

This 2021 UEC Plan Update describes how anticipated water supply needs will be met in the UEC Planning Area through 2045. The planning process used to develop this 2021 UEC Plan Update is outlined below.

## PLAN DEVELOPMENT PROCESS

### 1

**Planning and Assessment**

The process incorporated public participation and coordination with local stakeholders, including water supply utilities, agricultural operations, nongovernmental environmental groups, local governments, the Florida Department of Environmental Protection, the 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 2016 UEC Plan Update were key starting points.

### 2

**Data Collection, Analysis, and Issue Identification**

Using the 2016 UEC Plan Update as a foundation, developing this plan update involved collecting the latest information on: current and projected population and water demands (**Chapter 2**), water conservation (**Chapter 3**), water resource protections (**Chapter 4**), water supply source options (**Chapter 5**), and water resource issues (**Chapter 6**).

### 3

**Evaluation of Water Resources and Water Source Options**

This phase of the planning process involved reviewing existing monitoring data and updated regional modeling used for evaluation of water resources to identify issues. Where projected demand exceeds available supplies, water supply project options were identified, including alternative water supplies and water conservation.

### 4

**Identify Water Resource and Water Supply Development Projects**

Where resource conditions warranted, water resource development projects were identified (**Chapter 7**). Water supply development projects intended to meet water needs over the planning horizon were identified, compiled, and evaluated by the SFWMD with input from stakeholders, the public, and other agencies. Additionally, the projects were screened for permitting feasibility (**Chapter 8**).

## Public Participation

Public participation is a key component of the water supply plan development process to ensure the plan addresses the issues and concerns of stakeholders and that the direction and projects are appropriate for future water needs. Due to the COVID-19 pandemic, the SFWMD held virtual workshops for this water supply plan update. Stakeholders representing a variety of interests in the region, such as agriculture, industry, environment, utilities, local government planning departments, and state and federal agencies as well as the general public, were invited to attend the workshops. The workshops provided participants with an opportunity to review and comment on projected demands, water supply issues, the condition of regional water resources, water source options, groundwater modeling, and other key aspects of the water supply plan update.

Individual meetings were held throughout the planning process with public supply utilities, other planning agencies, local government planning departments, and agricultural representatives to discuss water demand projections and coordinate planning efforts. During meetings with the region's major utilities and local governments, population and demand estimates and projections were reviewed and verified, and the condition of regional water resources and AWS development efforts were discussed.

# PROGRESS SINCE THE 2016 UEC PLAN UPDATE

Since the 2016 UEC Plan Update, the following activities and programs in the UEC Planning Area are enhancing the region's water resources, water supply, and natural systems.

## Modeling and Hydrologic Studies

- **FAS Monitoring Network** – The SFWMD maintains and updates a network of more than 117 FAS monitor wells, 16 of which are within the UEC Planning Area. Water level data from the monitor wells are evaluated to help manage use of the FAS as a water supply source. In addition, water quality sampling and analyses are conducted periodically to observe any trends that might signal overuse of the resource.
- **East Coast Floridan Model** – The East Coast Floridan Model (Giddings et al. 2014) was updated and used to identify potential changes in water quality, flows, and water levels in the FAS for the 2019 and 2045 withdrawal scenarios (Billah et al. 2021). **Chapter 6** provides information about the modeling effort for this plan update.
- **Hydrogeologic Studies** – Between 2016 and 2020, the SFWMD and its partners completed the following hydrogeologic investigations:
  - Caulkins Water Farm Pilot Project, part of the SFWMD's Dispersed Water Management Program – water quality monitoring commenced in 2016 and is ongoing (Janzen et al. 2017).
  - Geochemistry of the Upper Floridan aquifer and Avon Park permeable zone (Geddes et al. 2018).
- **Updated Delineation of the Saltwater Interface in Martin and St. Lucie Counties** – The SFWMD reviewed water quality data from Martin and St. Lucie counties and updated maps to compare the 2009, 2014, and 2019 extent of saltwater intrusion within the SAS.

## Water Storage, Construction, and Restoration Projects

- **Herbert Hoover Dike/Lake Okeechobee** – In 2007, the United States Army Corps of Engineers (USACE) designated the Herbert Hoover Dike as a Class I risk, the highest risk for dam failure. Of the 32 culverts slated to be replaced, removed, or abandoned, 27 have been completed and the remaining 5 are under construction. The Dam Safety Modification Study identified 56.3 miles of the dam as needing improvement, of which 40 miles (71%) have been completed. Construction of all works are currently scheduled for completion by the end of 2022.

Herbert Hoover Dike

- **Lake Okeechobee Watershed Restoration Project** – Part of the Comprehensive Everglades Restoration Plan (CERP), the purpose of the Lake Okeechobee Watershed Restoration Project is to improve the ecology of Lake Okeechobee, decrease regulatory releases to the St. Lucie and Caloosahatchee estuaries, restore freshwater wetlands in the watershed, and improve water supply for existing legal users. The project team prepared a Final Integrated Project Implementation Report and Environmental Impact Statement that was released in August 2020 for public review. A Final Chief's Report and Congressional authorization is pending for the project. The recommended plan includes construction of up to 80 ASR wells located in clusters throughout the Lake Okeechobee watershed. The Florida State Legislature appropriated $100 million [$50 million in Fiscal Year (FY) 2020 and $50 million in FY2021] to the SFWMD for the design, engineering, and construction of the specific project components designed to achieve the greatest reductions in harmful discharges to the Caloosahatchee and St. Lucie estuaries.

- **Indian River Lagoon – South Project** – The Indian River Lagoon – South (IRL-S) project is part of CERP and was authorized by the Water Resource Development Act of 2007. The purpose of the IRL-S Project is to restore, preserve, and protect the Indian River Lagoon, St. Lucie Estuary, and associated watershed while maintaining the existing level of flood control and water supply. Structural project components for the IRL-S Project, such as reservoirs and stormwater treatment areas (STAs), will capture, store, and treat local runoff to the Indian River Lagoon and St. Lucie Estuary from the C-44, C-23, C-24, and C-25 basins. Since 2016, the C-44 reservoir and STA have been constructed and are in initial testing stages. The other structural components of the IRL-S Project (C-23 to C-44 Interconnect and the C-23/C-24 and C-25 STAs and reservoirs) are discussed in **Chapter 7**.

- **Ten Mile Creek Water Preserve Area** – The Ten Mile Creek Water Preserve Area consists of a 526-acre water storage area and 132-acre polishing cell that improves the quantity and timing of water discharged into the North Fork of the St. Lucie River. Originally constructed by the USACE, the project was transferred to the SFWMD in May 2016. Rehabilitation of the water preserve area was completed, and routine operation at a 4-foot maximum depth commenced in August 2017. See **Chapter 7** for more details.

- **Lakeside Ranch STA** – The Lakeside Ranch STA is a key component of the Northern Everglades and Estuaries Protection Program designed to reduce phosphorus loads to Lake Okeechobee. Located in northwestern Martin County, the Lakeside Ranch STA project consists of canals, levees, treatment cells, a central preserve area, and a southern preserve area on a 2,700-acre parcel of land adjacent to Lake Okeechobee. Phase II consisted of constructing STA-South (completed in January 2019) and the S-191A pump station (completed in August 2021). See **Chapter 7** for more details.

## Grant Funding Program

As part of the regional water supply plans' water resource development component (**Chapter 7**), and to assist local water users in implementation of the water supply development component (**Chapter 8**), the SFWMD periodically provides funding assistance to public water suppliers, local governments, special districts, homeowners' associations, water users, and other public and private organizations for AWS and water conservation projects that are consistent with the SFWMD's core mission. Water supply development projects are those that involve "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(26), F.S.] and are primarily the responsibility of local water providers. In 2019, the Florida Department of Environmental Protection and SFWMD initiated annual funding for the construction and implementation of AWS and water conservation projects to qualified applicants through the AWS Funding Program.

- **Alternative Water Supply** – From FY2016 through FY2021, the SFWMD provided AWS project funding for four projects that were completed or are under construction in the UEC Planning Area, generating 9.5 million gallons per day (mgd) of additional water capacity.
- **Water Conservation** – From FY2016 through FY2021, the SFWMD provided funding for eight water conservation projects that were completed or are being implemented in the UEC Planning Area. The projects are estimated to save 1.10 mgd.

# REFERENCES


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# 2

# Demand Estimates and Projections

This chapter summarizes the water demand estimates and projections for the Upper East Coast (UEC) Planning Area of the South Florida Water Management District (SFWMD or District) through the planning horizon (2019 to 2045). Estimates and projections are presented by water use category and were developed in coordination with various stakeholder groups, including agriculture, utilities, industry, local governments, and other interested parties. A detailed discussion of the data collection and analysis methodology is provided in **Appendix A**.

TOPICS

- Water Demand
- Water Use Categories
- Population Estimates and Projections
- Public Supply
- Domestic Self-Supply
- Agriculture
- Commercial/Industrial/ Institutional
- Landscape/Recreational
- Power Generation
- Summary of Demand Estimates
- Demand Projections in Perspective

Water demands in the UEC Planning Area are driven by agricultural irrigation, followed by potable water use provided by utilities. Due to greening disease (huanglongbing), citrus acreage and production continue to decrease. Water demand projections presented for citrus are based on the assumption that the number of active citrus groves will continue to decline through the planning horizon (2045). Acreages of all other crops are also projected to decrease. Starting in early 2020, the COVID-19 pandemic has had significant impacts to the economy, particularly to businesses and tourism. However, residential development has expanded at a robust rate in Martin and St. Lucie counties. The UEC Planning Area population continues to increase, and the average per capita use rate increased slightly between 2016 and 2019.

# WATER DEMAND

Water demands can be described and analyzed in two ways: gross demand and net demand. Gross demand is the volume of water withdrawn or diverted from a groundwater or surface water source. This definition serves as the basis for water allocations established through water use permits issued by the SFWMD. Further information on water use permitting is provided in the *Support Document for the 2021-2024 Water Supply Plan Updates* (2021-2024 Support Document; SFWMD 2021). Net demand refers to the volume of water delivered to end users after accounting for treatment losses and delivery system inefficiencies. For Public Supply (PS) and Domestic Self-Supply (DSS), demands commonly are referred to as raw and finished demands rather than gross and net demands, respectively. In this *2021 Upper East Coast Water Supply Plan Update* (2021 UEC Plan Update), net demand is equal to gross demand for all water use categories except PS.

This 2021 UEC Plan Update presents demands for average rainfall and 1-in-10-year drought conditions (**Appendix A**). Section 373.709, Florida Statutes (F.S.), states the level-of-certainty planning goal associated with identifying water demands contained in water supply plans shall be based on meeting demands during 1-in-10-year drought conditions for at least a 20-year period. Although not quantified in this plan, environmental demands are addressed through resource protection criteria (**Chapter 4**).

INFO

**Average Rainfall and 1-in-10-Year Drought**

An **average rainfall year** is defined as a year with a rainfall amount that has a 50% probability of being exceeded in any other year.

A **1-in-10-year drought** is defined as a year in which below normal rainfall occurs, with a 90% probability of being exceeded in any other year. It has an expected return frequency of once in 10 years.

# WATER USE CATEGORIES

Water demands for this 2021 UEC Plan Update are estimated in 5-year increments for the six water use categories listed below, which were established by the Florida Department of Environmental Protection (FDEP) in coordination with the state's water management districts. The water use category names and acronyms have been updated for this plan to align with other water supply planning efforts across the state.

- **Public Supply (PS)** – Potable water supplied by water treatment plants with a current allocation of 0.10 million gallons per day (mgd) or greater.
- **Domestic Self-Supply (DSS)** – Potable water used by households served by small utilities (less than 0.10 mgd) or self-supplied by private wells.
- **Agriculture (AG)** – Self-supplied water used for commercial crop irrigation, greenhouses, nurseries, livestock watering, pasture irrigation, and aquaculture.
- **Commercial/Industrial/Institutional (CII)** – Self-supplied water associated with the production of goods or provision of services by industrial, commercial, or institutional establishments.

- **Landscape/Recreational (L/R)** – Self-supplied and reclaimed water used to irrigate golf courses, sports fields, parks, cemeteries, and large common areas such as land managed by homeowners' associations and commercial developments.
- **Power Generation (PG)** – Self-supplied and reclaimed water used for cooling, potable, and process water by power generation facilities.

**Table 2-1** presents estimated (2019) and projected (2045) average gross water demands, by water use category, in the UEC Planning Area for this water supply plan update. AG accounts for the majority of current and projected demands, followed by PS, L/R, PG, DSS, and CII. A small decrease in total demand is projected through the planning horizon.

Table 2-1. Estimated (2019) and projected (2045) average gross water demands (in mgd) for the UEC Planning Area, by use category.

| Water Use Category | 2019 | 2045 |
|---|---|---|
| Public Supply | 56.26 | 81.62 |
| Domestic Self-Supply | 5.76 | 5.61 |
| Agriculture | 174.72 | 130.10 |
| Commercial/Industrial/Institutional | 4.43 | 5.74 |
| Landscape/Recreational | 32.03 | 40.64 |
| Power Generation | 17.91 | 17.47 |
| **UEC Planning Area Total** | **291.11** | **281.18** |

UEC = Upper East Coast; mgd = million gallons per day.

# POPULATION ESTIMATES AND PROJECTIONS

Population estimates and projections were used to develop demands for all water use categories except PG. Developing population estimates and projections required multiple sources of information, including county-level data from the Bureau of Economic and Business Research (BEBR), consistent with Section 373.709(2)(a), F.S., sub-county data from traffic analysis zones, and local data from local government Comprehensive Plans. **Appendix A** provides further details on the development of population estimates and projections. Draft results were presented to the region's larger PS utilities to ensure accuracy and obtain agreement with final 2045 population projections in the plan update.

NOTE

All population estimates and projections are for permanent residents, as defined by the United States Census. However, the per capita use rate, which is used to calculate water demands, reflects use by seasonal residents as well.

In 2019, the estimated population within the UEC Planning Area was 468,498 permanent residents (**Table 2-2**). BEBR projections indicate the UEC Planning Area population will grow to 686,409 permanent residents in 2045, an increase of approximately 47%. Nearly two-thirds of the UEC Planning Area population resides in St. Lucie County, while Martin County accounts for approximately one-third, and this trend is expected to continue. As explained in **Appendix A**, BEBR high projections were used for St. Lucie County and BEBR medium projections were used for Martin and northeastern Okeechobee counties. Only a small population that relies on DSS resides in the northeastern portion of Okeechobee County within the UEC Planning Area. Detailed population projections for PS utilities and county DSS areas are provided in **Appendix A**.

Table 2-2. Permanent resident population served by PS and DSS in the UEC Planning Area in 2019 and 2045.

| County | 2019 Population | | | 2045 Population | | |
|---|---|---|---|---|---|---|
| | PS | DSS | **Total** | PS | DSS | **Total** |
| Martin | 151,506 | 7,092 | **158,598** | 183,730 | 9,271 | **193,001** |
| St. Lucie | 272,297 | 37,060 | **309,357** | 459,716 | 33,085 | **492,801** |
| Okeechobee* | 0 | 544 | **544** | 0 | 607 | **607** |
| **UEC Planning Area Total** | **423,803** | **44,695** | **468,499** | **643,446** | **42,963** | **686,409** |

DSS = Domestic Self-Supply; PS = Public Supply; UEC = Upper East Coast.
* Values listed are only for the area within the UEC Planning Area boundary.

# PUBLIC SUPPLY

The PS category includes potable water supplied by water treatment plants with a current allocation of 0.10 mgd or greater. Developing PS demand projections in the UEC Planning Area was a multistep process that included determining PS utility service area and DSS populations, calculating per capita use rates (PCURs), and projecting future water needs.

NOTE

Perceived discrepancies in table totals are due to rounding.

## Per Capita Use Rates

For each PS utility, a net (finished) water PCUR was developed using past population estimates and finished water data reported to the FDEP. The PCUR for each utility is a 5-year (2015 through 2019) average, calculated by dividing annual net (finished) water volume by the corresponding service area population for each year. For PS demand projections, PCURs were assumed to remain constant through 2045. To calculate projected gross (raw) demands, the treatment efficiency for each utility, based on treatment process type(s) expected in 2045, was applied as a raw-to-finished ratio. Any demand reductions due to historical conservation practices are implicitly factored into the projections by using the 5-year average PCUR. Future water conservation savings (**Chapter 3**) were not factored into the demand projections used in this plan update due to water savings uncertainties. PS service area and water treatment plant maps are provided in **Appendix A**. Utility profiles containing population and finished water use data and projections as well as permitted allocations are provided in **Appendix B**.

## PS Demand Estimates and Projections

**Tables 2-3** and **2-4** present PS gross (raw) and net (finished) water demands, respectively, in 5-year increments by county. The results indicate PS gross (raw) water demands will increase approximately 50%, from 56.26 mgd in 2019 to 81.62 mgd in 2045 under average rainfall conditions. Calculation of 1-in-10-year demand is increased based only on the outdoor portion of PS use, and the methodology is explained in **Appendix A**.

Table 2-3. PS gross (raw) water demands in the UEC Planning Area, by county.

| County | Gross (Raw) Demand – Average Rainfall Conditions (mgd) | | | | | | | 2045 1-in-10-Year Demand |
|---|---|---|---|---|---|---|---|---|
| | 2019 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | |
| Martin | 22.26 | 22.54 | 23.89 | 25.00 | 25.92 | 26.61 | 27.23 | 31.76 |
| St. Lucie | 34.00 | 35.98 | 40.18 | 43.22 | 47.82 | 51.20 | 54.39 | 59.29 |
| Okeechobee* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **UEC Planning Area Total** | **56.26** | **58.52** | **64.07** | **68.22** | **73.74** | **77.81** | **81.62** | **91.05** |

mgd = million gallons per day; PS = Public Supply; UEC = Upper East Coast.

* Values listed are only for the area within the UEC Planning Area boundary. No PS utilities are located in the portion of Okeechobee County within the UEC Planning Area.

Table 2-4. PS net (finished) water demands in the UEC Planning Area, by county.

| County | Net (Finished) Demand – Average Rainfall Conditions (mgd) | | | | | | | 2045 1-in-10-Year Demand |
|---|---|---|---|---|---|---|---|---|
| | 2019 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | |
| Martin | 19.20 | 19.45 | 20.46 | 21.30 | 21.96 | 22.53 | 23.05 | 26.90 |
| St. Lucie | 28.17 | 29.83 | 33.30 | 35.64 | 39.37 | 42.15 | 44.78 | 48.83 |
| Okeechobee* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **UEC Planning Area Total** | **47.37** | **49.28** | **53.76** | **56.94** | **61.33** | **64.68** | **67.83** | **75.73** |

mgd = million gallons per day; PS = Public Supply; UEC = Upper East Coast.

* Values listed are only for the area within the UEC Planning Area boundary. No PS utilities are located in the portion of Okeechobee County within the UEC Planning Area.

# DOMESTIC SELF-SUPPLY

The DSS category includes potable water used by households that are served by small utilities with current allocations less than 0.10 mgd or that are self-supplied by private wells. Permanent resident populations within DSS areas were developed simultaneously with the PS population estimates and projections. All permanent residents outside of PS utility service area boundaries were considered DSS population. Population projection methodology and results are further described in **Appendix A**.

**Table 2-5** contains the UEC Planning Area's DSS demand estimates and projections under average rainfall conditions. The average PCUR of PS utilities in the county were used to calculate demands. For DSS demands, the raw to finished water ratio is assumed to be 1.00. Therefore, no distinction is made between gross (raw) and net (finished) water demands. Average DSS demands in 2019 were 5.76 mgd for 44,695 permanent residents (**Table 2-2**). DSS demands are expected to decrease 3%, to 5.61 mgd for 42,963 residents in 2045. This decrease can be attributed to low anticipated growth in DSS areas and expansion of PS utility service areas over the planning horizon.

Table 2-5. DSS gross (raw) water demands in the UEC Planning Area, by county.

| County | Demand – Average Rainfall Conditions (mgd) | | | | | | | 2045 1-in-10-Year Demand |
|---|---|---|---|---|---|---|---|---|
| | 2019 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | |
| Martin | 1.11 | 1.12 | 1.20 | 1.27 | 1.34 | 1.39 | 1.45 | 1.69 |
| St. Lucie | 4.60 | 4.79 | 4.97 | 5.15 | 3.96 | 4.03 | 4.10 | 4.47 |
| Okeechobee* | 0.05 | 0.05 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.07 |
| **UEC Planning Area Total** | **5.76** | **5.96** | **6.23** | **6.48** | **5.36** | **5.48** | **5.61** | **6.23** |

DSS = Domestic Self-Supply; mgd = million gallons per day; UEC = Upper East Coast.
* Values listed are only for the area within the UEC Planning Area boundary.

# AGRICULTURE

The AG category includes self-supplied water used for commercial crop irrigation, greenhouses, nurseries, livestock watering, pasture irrigation, and aquaculture. AG is the largest water use category in the UEC Planning Area, accounting for 174.72 mgd (60%) of the region's total estimated water demand in 2019. Agricultural production in the UEC Planning Area is of regional significance, with 107,383 acres under irrigation (**Figure 2-1**). In 2018, output from the crop, livestock, and fisheries sectors located within the UEC Planning Area contributed $558 million to the regional economy (Court and Ferreira 2020).

Agricultural acreage data published by the Florida Department of Agriculture and Consumer Services (FDACS 2020) were used to determine water demands for this 2021 UEC Plan Update. Pursuant to Section 373.709(2)(a), F.S., water management districts are required to consider FDACS water demand projections. Any adjustments or deviations from the projections published by FDACS, "…must be fully described, and the original data must be presented along with the adjusted data." A detailed description of the analyses and adjustments is provided in **Appendix A**.

Agricultural water demand was determined using the Agricultural Field-Scale Irrigation Requirements Simulation (AFSIRS) model (Smajstrla 1990). No distinction was made between net and gross water demands. The FDACS irrigated crop acres, soil types, growing seasons, and irrigation methods were used as input data for the AFSIRS model. AG demand estimates and projections are based on the commercially grown crop categories in **Table 2-6**, as generally developed by the FDEP and water management districts for use in water supply plans. Citrus and sugarcane are the predominant irrigated land use in the UEC Planning Area, encompassing 56,559 acres with an average demand of 87.23 mgd in 2019 (**Table 2-6**). Together, these two crop types account for approximately half of the irrigated acreage and demand under average rainfall conditions. Irrigated fresh market vegetables, hay, and greenhouse/nurseries are the next largest AG categories, with a combined 46,473 acres and 76.14 mgd of irrigation demand in 2019.

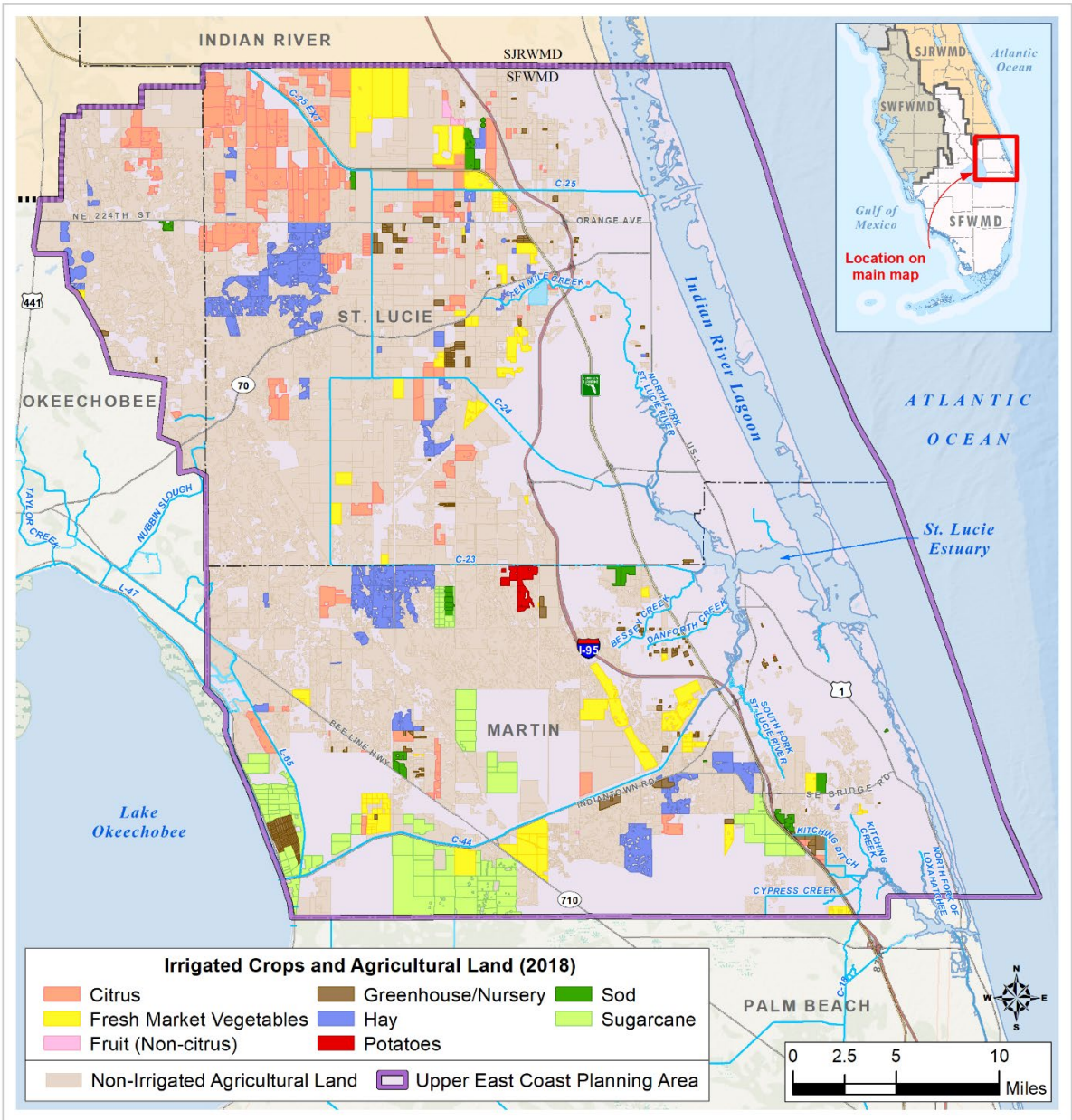


Figure 2-1. Agricultural irrigated land in the UEC Planning Area (Data from: FDACS 2020).

Table 2-6. Agricultural irrigated acres and gross water demands (in mgd) in the UEC Planning Area, by crop type.

| Crop | 2019 | | | 2045 | | |
|---|---|---|---|---|---|---|
| | Acres | Average Demand | 1-in-10-Year Demand | Acres | Average Demand | 1-in-10-Year Demand |
| Citrus | 32,478 | 37.20 | 46.92 | 20,109 | 22.70 | 28.89 |
| Sugarcane | 24,081 | 50.03 | 58.11 | 20,359 | 42.66 | 49.94 |
| Fresh Market Vegetables | 20,586 | 31.86 | 38.21 | 16,163 | 23.63 | 28.49 |
| Hay/Pasture | 20,493 | 29.54 | 34.33 | 15,486 | 22.03 | 25.53 |
| Greenhouse/Nursery | 5,394 | 14.74 | 16.25 | 3,753 | 9.95 | 11.03 |
| Sod | 2,900 | 5.56 | 6.63 | 1,856 | 3.71 | 4.53 |
| Potatoes | 1,101 | 3.10 | 3.60 | 1,080 | 3.04 | 3.53 |
| Fruit (Non-Citrus) | 350 | 0.71 | 0.82 | 198 | 0.40 | 0.47 |
| **Total** | **107,383** | **172.74** | **204.87** | **79,004** | **128.12** | **152.41** |

mgd = million gallons per day; UEC = Upper East Coast.
Note: The Florida Department of Agriculture and Consumer Services reports acreages and demands for a field crops category; however, there are no field crops in the UEC Planning Area.

Total irrigated acres in the UEC Planning Area are projected to decrease 26% by 2045. All crops are projected to decrease in acreage over the planning horizon. The largest change in irrigated acreage and demand is expected to occur in the citrus industry. By 2045, citrus is expected to decrease by 12,369 acres, and average demands are projected to decrease by 14.50 mgd.

Gross AG demands under average rainfall conditions in the UEC Planning Area are projected to decrease from 174.72 mgd in 2019 to 130.10 mgd in 2045 (**Table 2-7**). These totals include demands from livestock and aquaculture in addition to the demands for crop irrigation shown in **Table 2-6**. Demands for livestock and aquaculture in the UEC Planning Area in 2019 are estimated to be 1.91 mgd and 0.07 mgd, respectively, and are projected to remain constant over the planning horizon.

**INFO**

Examples of crop categories used in this report include the following:

**Fresh Market Vegetables**:
- Tomatoes
- Green beans
- Peppers
- Melons

**Fruits (Non-Citrus)**:
- Dragon fruit
- Strawberries

Table 2-7. AG gross water demands for all agricultural acreage, livestock, and aquaculture in the UEC Planning Area, by county.

| County | Demand – Average Rainfall Conditions (mgd) | | | | | | | 2045 1-in-10-Year Demand |
|---|---|---|---|---|---|---|---|---|
| | 2019 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | |
| Martin | 101.67 | 99.56 | 96.54 | 93.46 | 90.58 | 87.08 | 83.72 | 97.46 |
| St. Lucie | 67.56 | 64.93 | 60.42 | 55.61 | 50.57 | 46.14 | 41.29 | 50.96 |
| Okeechobee* | 5.49 | 5.49 | 5.49 | 5.09 | 5.09 | 5.09 | 5.09 | 5.97 |
| **UEC Planning Area Total** | **174.72** | **169.98** | **162.45** | **154.16** | **146.24** | **138.31** | **130.10** | **154.39** |

AG = Agriculture; mgd = million gallons per day; UEC = Upper East Coast.
* Values listed are only for the area within the UEC Planning Area boundary.

# COMMERCIAL/INDUSTRIAL/INSTITUTIONAL

The CII water use category includes water demands associated with industrial and commercial operations for processing, manufacturing, and technical needs such as concrete, citrus processing, and mining operations. CII demands only include self-supplied users and do not include industrial or commercial users that receive water from PS utilities; those users are included in the PS category. All CII demand estimates and projections are presumed to be the same for average rainfall and 1-in-10-year drought conditions, and withdrawal demand is assumed to be equal to user demand. Therefore, no distinction is made between net and gross water demands.

Estimated CII demands for 2019 were 4.43 mgd, with minimal projected growth resulting in demands of 5.74 mgd in 2045 (**Table 2-8**). Growth within the CII category is expected to be driven by regional population growth.

Table 2-8. CII gross water demands in the UEC Planning Area, by county.

| County | Demand (mgd) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2019 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 |
| Martin | 3.46 | 3.50 | 3.70 | 3.86 | 3.99 | 4.11 | 4.21 |
| St. Lucie | 0.92 | 0.97 | 1.08 | 1.19 | 1.29 | 1.38 | 1.47 |
| Okeechobee* | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.06 | 0.06 |
| **UEC Planning Area Total** | **4.43** | **4.52** | **4.83** | **5.10** | **5.33** | **5.55** | **5.74** |

CII = Commercial/Industrial/Institutional; mgd = million gallons per day; UEC = Upper East Coast.
* Values listed are only for the area within the UEC Planning Area boundary.

# LANDSCAPE/RECREATIONAL

L/R is the third largest water use category in the UEC Planning Area, encompassing irrigation of golf courses and other landscaped areas such as parks, sports fields, and common areas of residential developments. L/R demands include use of groundwater/surface water as well as reclaimed water. L/R acreages reflect only the acres under water use permits and do not include acres solely irrigated with reclaimed water that do not have backup water use permits. Details regarding development of the L/R demands are provided in **Appendix A**.

Within the L/R category, 9,881 permitted acres were attributed to landscape irrigation (**Table 2-9**). These landscaped areas are expected to grow 45%, which is approximately the same rate as the local population through 2045.

For the recreational part of the L/R category, there are 58 golf courses irrigating 5,406 acres under water use permits in the UEC Planning Area (**Table 2-9**). This does not include golf course acreage solely irrigated with reclaimed water. Under average rainfall conditions, this land use required an estimated 12.16 mgd in 2019. Golf course acres and demands are projected to remain steady through 2045.

Table 2-9. L/R permitted acreage and gross water demands (in mgd) in the UEC Planning Area.

| Land Use | 2019 | | | 2045 | | |
|---|---|---|---|---|---|---|
| | Acres | Average Demand | 1-in-10-Year Demand | Acres | Average Demand | 1-in-10-Year Demand |
| Landscape | 9,881 | 19.87 | 25.03 | 14,319 | 28.48 | 35.88 |
| Golf | 5,406 | 12.16 | 15.81 | 5,406 | 12.16 | 15.81 |
| **Total** | **15,287** | **32.03** | **40.84** | **19,725** | **40.64** | **51.69** |

UEC = Upper East Coast; mgd = million gallons per day; L/R = Landscape/Recreational.

Gross water demands for L/R are the combination of demands from the golf sector and other landscaped areas as well as estimated and projected reclaimed water use. No distinction is made between net and gross water demands. Under average rainfall conditions, total estimated L/R gross water demands are projected to increase from 32.03 mgd in 2019 to 40.64 mgd in 2045. **Table 2-10** shows that groundwater and surface water supply sources meet approximately 76% of the 2019 L/R water demands, with reclaimed water supplementing the remaining 24%. The ratio of reclaimed water to groundwater/surface water used to meet future L/R demands is assumed to remain constant. Demands for reclaimed water in each county are assumed to grow at the same rate as that county's L/R demands.

Table 2-10. L/R gross water demands in the UEC Planning Area, by county and source.

| Source | Demand – Average Rainfall Conditions (mgd) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2019 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 |
| Martin County | | | | | | | |
| Groundwater/Surface Water | 11.88 | 11.96 | 12.32 | 12.62 | 12.86 | 13.08 | 13.27 |
| Reclaimed Water | 3.66 | 3.69 | 3.80 | 3.89 | 3.97 | 4.03 | 4.09 |
| **Martin County Total** | **15.54** | **15.65** | **16.12** | **16.51** | **16.83** | **17.11** | **17.36** |
| St. Lucie County | | | | | | | |
| Groundwater/Surface Water | 12.51 | 13.02 | 14.06 | 15.11 | 16.02 | 16.87 | 17.67 |
| Reclaimed Water | 3.92 | 4.08 | 4.41 | 4.73 | 5.02 | 5.29 | 5.54 |
| **St. Lucie County Total** | **16.43** | **17.10** | **18.47** | **19.84** | **21.04** | **22.16** | **23.21** |
| Okeechobee County* | | | | | | | |
| Groundwater/Surface Water | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.07 | 0.07 |
| Reclaimed Water | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Okeechobee County Total** | **0.06** | **0.06** | **0.06** | **0.06** | **0.06** | **0.07** | **0.07** |
| UEC Planning Area | | | | | | | |
| Groundwater/Surface Water | 24.45 | 25.04 | 26.44 | 27.79 | 28.94 | 30.01 | 31.01 |
| Reclaimed Water | 7.58 | 7.77 | 8.21 | 8.63 | 8.99 | 9.32 | 9.63 |
| **UEC Planning Area Total** | **32.03** | **32.81** | **34.65** | **36.41** | **37.93** | **39.34** | **40.64** |

L/R = Landscape Recreational; mgd = million gallons per day; UEC = Upper East Coast.
* Values listed are only for the area within the UEC Planning Area boundary.

# POWER GENERATION

Demands under the PG category include use of groundwater, fresh surface water, or reclaimed water by thermoelectric power generation facilities. PG demands do not include the use of brackish surface water and cooling water returned to its withdrawal source, or seawater. Demands under average rainfall and 1-in-10-year drought conditions are assumed to be equal in the PG category; no distinction is made between net and gross water demands.

There are two power generation plants currently operating in the UEC Planning Area that are addressed in this plan update: Florida Power & Light (FPL) Martin Plant near Indiantown (Martin County) and the Treasure Coast Energy Center in Fort Pierce (St. Lucie County).

Also operating in the UEC Planning Area is the FPL St. Lucie Nuclear Plant on Hutchinson Island. However, the facility uses potable water (permitted separately) and seawater (which does not require a water use permit) for cooling; therefore, the facility is not addressed in this water supply plan update. The Indiantown Cogeneration Plant in Martin County is inactive and will be demolished by 2022.

The FPL Okeechobee Clean Energy Center, located in Okeechobee County, is within the St. Johns River Water Management District, approximately 6 miles outside the UEC Planning Area. Because the facility is beyond the planning area and SFWMD boundary, its demands are not included in this 2021 UEC Plan Update. However, the facility's demands were simulated in the groundwater modeling analysis because the influence of the withdrawals extends into the UEC Planning Area. The facility is estimated to need an average of 9.00 mgd (11.00 mgd peak) of water from the Floridan aquifer system for operation.

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 generation capacity will use fresh or alternative (brackish or reclaimed) water sources for cooling. The FPL Martin Plant uses cooling pond and tower technology that varies by unit and substantially decreases overall water supply demands at the facility because the cooling pond is the intake and release point. PG demands are expected to remain relatively stable from 2019 to 2045 (**Table 2-11**). More information on the development of PG estimates and projections is provided in **Appendix A**.

Table 2-11. Average gross water demand for PG in the UEC Planning Area between 2019 and 2045.

| County | Gross Water Demand (mgd) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2019 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 |
| Martin | 16.46 | 14.13 | 14.13 | 14.13 | 14.13 | 14.13 | 14.13 |
| St. Lucie | 1.45 | 3.34 | 3.34 | 3.34 | 3.34 | 3.34 | 3.34 |
| **UEC Planning Area Total** | **17.91** | **17.47** | **17.47** | **17.47** | **17.47** | **17.47** | **17.47** |

mgd = million gallons per day; PG = Power Generation; UEC = Upper East Coast.

# SUMMARY OF DEMAND ESTIMATES

Total gross water demands under average rainfall conditions in the UEC Planning Area are projected to be 281.18 mgd by 2045, a 3% decrease from 2019 demands (291.11 mgd). Demands under 1-in-10-year drought conditions are approximately 16% higher than those for average rainfall conditions.

**Table 2-12** provide 5-year incremental summaries of gross demands for all water use categories in the UEC Planning Area under average rainfall and 1-in-10-year drought conditions. Gross demands under average rainfall conditions are used to demonstrate projected trends, including the following key highlights:

- PS and DSS gross demands combined are expected to increase 41%, from 62.02 mgd in 2019 to 87.23 mgd in 2045. PS will remain the second largest water use category in the UEC Planning Area.
- AG gross demands are projected to decrease from 174.72 mgd in 2019 to 130.10 mgd in 2045. AG will remain the largest water use category in the UEC Planning Area.
- CII gross demand is projected to increase 1.31 mgd over the planning period. The projected demand growth is related to regional population growth.
- L/R gross demands are projected to increase by 8.61 mgd by 2045. L/R will remain the third largest water use category in the UEC Planning Area.
- PG gross demands are projected to remain relatively constant, with 17.47 mgd expected in 2045.

Table 2-12. Summary of gross water demands under average rainfall and 1-in-10-year drought conditions in the UEC Planning Area, by water use category.

| Water Use Category | 2019 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 |
|---|---|---|---|---|---|---|---|
| Demand – Average Rainfall Conditions (mgd) | | | | | | | |
| PS | 56.26 | 58.52 | 64.07 | 68.22 | 73.74 | 77.81 | 81.62 |
| DSS | 5.76 | 5.96 | 6.23 | 6.48 | 5.36 | 5.48 | 5.61 |
| AG | 174.72 | 169.98 | 162.45 | 154.16 | 146.24 | 138.31 | 130.10 |
| CII | 4.43 | 4.52 | 4.83 | 5.10 | 5.33 | 5.55 | 5.74 |
| L/R | 32.03 | 32.81 | 34.65 | 36.41 | 37.93 | 39.34 | 40.64 |
| PG | 17.91 | 17.47 | 17.47 | 17.47 | 17.47 | 17.47 | 17.47 |
| **Total** | **291.11** | **289.26** | **289.70** | **287.84** | **286.07** | **283.96** | **281.18** |
| Demand – 1-in-10-Year Drought Conditions (mgd) | | | | | | | |
| PS | 63.04 | 65.53 | 70.67 | 76.28 | 82.36 | 86.84 | 91.05 |
| DSS | 6.36 | 6.59 | 6.57 | 7.17 | 5.94 | 6.10 | 6.23 |
| AG | 206.85 | 201.21 | 192.17 | 182.27 | 173.33 | 163.74 | 154.39 |
| CII | 4.43 | 4.52 | 4.83 | 5.10 | 5.33 | 5.55 | 5.74 |
| L/R | 40.84 | 41.83 | 44.16 | 46.37 | 48.28 | 50.04 | 51.69 |
| PG | 17.91 | 17.47 | 17.47 | 17.47 | 17.47 | 17.47 | 17.47 |
| **Total** | **339.43** | **337.15** | **335.87** | **334.66** | **332.71** | **329.74** | **326.57** |

AG = Agriculture; CII = Commercial/Industrial/Institutional; DSS = Domestic Self-Supply; L/R =Landscape/Recreational; mgd = million gallons per day; PG = Power Generation; PS = Public Supply; UEC = Upper East Coast.

# DEMAND PROJECTIONS IN PERSPECTIVE

Demand projections presented in this 2021 UEC Plan Update are based on the best available information. **Table 2-13** shows the 2040 average gross demands projected in the 2016 UEC Plan Update compared to the 2045 demands projected in this 2021 UEC Plan Update. The total demand projection for 2045 in this 2021 UEC Plan Update is 21% lower than the estimated 2040 demand projected in the 2016 UEC Plan Update. The projections reflect trends, economic circumstances, and industry intentions that change over time. Like any predictive tool based on past assumptions, there is uncertainty and a margin for error. The differences can be primarily attributed to:

- AG, CII, and L/R projections presented in this plan update were developed using a different methodology than was used in the 2016 UEC Plan Update in order to improve accuracy and use the best available data.
- Projected 2045 citrus acreage is significantly less than projected in the 2016 UEC Plan Update for 2040.
- Projected water needs for PG in 2045 are less than in the 2016 UEC Plan Update for 2040 because the construction of additional fossil and/or nuclear generation plants is no longer anticipated.

Table 2-13. Comparison of gross water demands under average rainfall conditions at the end of respective planning horizons in the 2016 UEC Plan Update and this 2021 UEC Plan Update.

| Water Use Category | 2016 UEC Plan Update 2040 Demand (mgd) | 2021 UEC Plan Update 2045 Demand (mgd) | Percent Difference |
|---|---|---|---|
| Public Supply | 73.15 | 81.62 | 12% |
| Domestic Self-Supply* | 0.74 | 5.61 | 658% |
| Agriculture | 186.65 | 130.10 | -30% |
| Commercial/Industrial/Institutional | 5.00 | 5.74 | 15% |
| Landscape/Recreational | 33.94 | 40.64 | 20% |
| Power Generation | 55.20 | 17.47 | -68% |
| **Total** | **354.68** | **281.18** | **-21%** |

mgd = million gallons per day; UEC = Upper East Coast.
* Difference in demands is due to population projection methodology adjustments.

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# 3

# Demand Management: Water Conservation

Demand management through water conservation is an important element of water supply planning and entails reducing the quantity of water required to meet regional demands through water use efficiency improvements and the prevention or reduction of unnecessary uses or losses of water. Water conservation contributes to the sustainability of water supply resources. Section 373.709(2), Florida Statutes (F.S.), requires that water conservation be considered when determining if the total capacity of the water supply development project options included in a water supply plan (**Chapter 8**) exceed the increase in projected demands for the planning horizon (**Chapter 2**).

TOPICS

- Conservation Measures
- Conservation Programs
- Regulatory Initiatives
- Potential for Water Conservation Savings
- Summary of Water Conservation

All water sources are finite; therefore, conservation and efficiency measures should be maximized, regardless of the water source, before more costly development options are implemented. Water conservation can reduce, defer, or eliminate the need to develop new water supply sources to meet current or future demands, which has the same effect as expanding the existing water supply. Moreover, conservation and demand management have been shown to reduce costs to utilities and rate payers over the long term (Feinglas et al. 2013, Chesnutt et al. 2018). Improving water use efficiency can reduce operational costs for most other users as well.

This chapter describes water conservation measures and programs and provides an estimate of potential water savings (demand reduction) achievable by 2045 in the Upper East Coast (UEC) Planning Area of the South Florida Water Management District (SFWMD or District). Additional conservation information can be found in the *Support Document for the 2021-2024 Water Supply Plan Updates* (2021-2024 Support Document; SFWMD 2021a), in the Comprehensive Water Conservation Program (SFWMD 2008), and on the SFWMD website (www.sfwmd.gov/conserve).

# CONSERVATION MEASURES

The average per capita water use rate in the UEC Planning Area has decreased from 167 gallons per capita per day (gpcd) in 2000 to approximately 130 gpcd in 2019. This is partly due to passive water savings, which result from the introduction of water-efficient fixtures and appliances into the marketplace, replacing older devices with more water-efficient models. Federal, state, and local codes and standards foster the development and use of more efficient devices, increasing passive savings. However, relying on passive savings alone would delay or exclude substantial conservation savings potential. Therefore, many local governments, utilities, and state agencies have conservation measures and programs in place encouraging use of high-efficiency equipment or improved water use behaviors that yield water savings. Local governments, utilities, and large water users are encouraged to research which types of programs would be most appropriate and cost-effective for their residents and specific user groups, and develop goal-based water conservation plans. Cost-share funding and other collaborative opportunities may be available to help implement conservation strategies and programs. The following subsections include a brief description of conservation measures that can be implemented for indoor and outdoor water use applications.

## Outdoor Water Use (Irrigation)

A large proportion of water used outdoors in the UEC Planning Area is for irrigation. Irrigation of food and other commodity crops is practiced by agricultural water users, while lawns and landscapes are irrigated by residential and commercial property owners. Many irrigation efficiency principles are common across these user groups; however, use patterns, scales of use, system design, typical hardware and components used, and knowledgeability of system managers vary widely between them.

### *Agriculture*

There are many options for agricultural operations to improve irrigation efficiency and conserve water. Generally, agricultural water conservation measures fall under three categories: 1) converting from one irrigation method (or system type) to a more efficient one; 2) improving the precision management capabilities of the irrigation system; and 3) implementing best management practices. The efficiency of any system can be optimized if the operator has real-time information on soil moisture and weather conditions and if the irrigation systems are remotely operated to allow quick irrigation adjustments in response to changing weather conditions. Hardware and technology that can improve system management, reduce water needs, and minimize water losses include the following:

- Flowmeters
- Weather stations
- Soil moisture sensors
- Variable-frequency pump drives
- Automated control systems
- Best management practices (e.g., laser leveling, irrigation system maintenance)

### *Urban*

In Florida, where irrigation occurs year-round, the largest portion of water used by urban water users served by utilities often is for irrigation. Moreover, the United States Environmental Protection Agency estimates approximately 50% of water used outdoors is wasted due to inefficient watering methods and systems. Therefore, improvements to irrigation efficiency are considered a primary factor in conservation savings potential among urban water users.

Irrigation efficiency improvements can be achieved at single- and multi-family residences, commercial and institutional properties, recreational areas (e.g., parks, athletic fields, golf courses), and other landscaped areas (e.g., roadway medians) by replacing outdated irrigation system timers with newer, weather and soil moisture-based controllers. These controllers should be tested and shown to meet the United States Environmental Protection Agency's WaterSense program specifications for water efficiency and performance. More information on the WaterSense program and labeled irrigation controllers is available at www.epa.gov/watersense.

Non-hardware measures include proper irrigation system design, conducting irrigation system performance audits, and use of Florida-Friendly Landscaping™ Program principles (Boyer and Dukes 2014). On-site capture of stormwater in cisterns to reuse for irrigation can also reduce demand on traditional water sources.

Golf courses typically are irrigated with a high degree of efficiency. However, opportunities to improve efficiency may exist using many of the same types of hardware and technology as described above. Additional practices for efficient golf course water use can be found in the *Best Management Practices Planning Guide & Template* published by the Golf Course Superintendents Association of America (2007) for golf course managers.

## Indoor Water Use

Another area of potential conservation savings is indoor water use in single- and multi-family residences and commercial/institutional buildings (e.g., office buildings, restaurants, movie theaters, long-term care facilities, hospitals). Potential measures include detecting and repairing water leaks and replacing older, inefficient plumbing fixtures (e.g., toilets, urinals, faucets, showerheads) with models that have been tested and shown to meet the WaterSense program specifications for water efficiency and performance. Older, inefficient appliances can be replaced with water-efficient models that have received the ENERGY STAR label. For more information on the ENERGY STAR program and to find labeled products, visit www.energystar.gov.

Common water efficiency improvement measures for commercial and industrial users are outlined in the SFWMD's (2013) *Water Efficiency Audit Guide*, which is discussed in greater detail in the 2021-2024 Support Document (SFWMD 2021a). Measures for improving water efficiency in non-residential settings may be applicable to specific operations or facilities such as autoclaves in hospitals; pre-rinse spray valves, food steamers, and waste grinders in restaurants; heating, ventilation, and air conditioning (HVAC) system efficiency upgrades; converting water-based cooling devices to air based; and water reuse/recycling in industrial operations. Other applicable measures may exist for specific industrial processes.

# CONSERVATION PROGRAMS

Conservation programs help educate water users and facilitate adoption of effective water conservation measures (e.g., specific actions or hardware that improve water use efficiency). Utilities and local governments are the primary entities that develop and implement conservation programs. Other regional and state agencies may also assume a leadership role in promoting and providing cost-share funding for water conservation. Utilities and local governments are encouraged to analyze their service areas and jurisdictions to determine potential user groups and programs that may be most suitable for them. The following subsections contain brief descriptions of established conservation programs that may be applicable to different water use categories.

## Education, Outreach, and Marketing

Although water savings attributed to education, outreach, and marketing campaigns are difficult to quantify, such campaigns are essential to reducing water use and instilling a lasting conservation ethic in businesses and communities. Developing a conservation ethic and educating water users enable people to know why conservation is important and necessary, what conservation measures are available to them, and how they can implement them. Campaigns usually are conducted by regional/local agencies or utilities and are designed to reach specific user groups (e.g., residents, schools, commercial properties).

The SFWMD has conducted an annual Conservation Expo since 2009 to provide education, outreach, and marketing opportunities to a variety of user groups on technological advances in the water conservation field. Each expo focuses on specific water conservation applications (e.g., industrial use, public water supply, agricultural irrigation) or measures (e.g., outreach, education).

## Cost-Share Funding Programs

### *SFWMD Cooperative Funding Program*

The SFWMD Cooperative Funding Program (CFP) provides financial incentives to local governments and utilities, homeowners' associations, commercial entities, and agricultural operations to implement technology and hardware-based water conservation projects. Historically, funding for the CFP has come from both ad valorem taxes and the Florida Legislature through the Florida Department of Environmental Protection. CFP funding is considered annually during the SFWMD's budget development. Since the 2016 UEC Plan Update, the SFWMD has provided approximately $3 million in water conservation funding for 60 projects Districtwide. Over the same time period [Fiscal Year (FY) 2016 through FY2021], 8 water conservation projects were funded in the UEC Planning Area for a total of $433,000. Currently funded projects are listed in **Chapter 8**. The CFP is expected to continue, although future funding levels are uncertain. The District's Governing Board has instituted that beginning in FY2023, local governments must have an adopted year-round irrigation ordinance that fully comports with the SFWMD's Mandatory Year-Round Landscape

Irrigation Conservation Measures Rule [Chapter 40E-24, Florida Administrative Code (F.A.C.)] in order to be eligible for alternative water supply or water conservation funding through the CFP. Additional information regarding the CFP can be found on the SFWMD's website (www.sfwmd.gov; Search: Cooperative Funding Program).

### *Environmental Quality Incentives Program*

The Environmental Quality Incentives Program (EQIP), implemented through the United States Department of Agriculture – Natural Resources Conservation Service, promotes agricultural production and environmental quality. Financial and technical assistance is offered to participants to address natural resource concerns and deliver environmental benefits such as improved water and air quality, conserved groundwater and surface water, reduced soil erosion and sedimentation, and improved or created wildlife habitat. From FY2016 through FY2021, 21 irrigation efficiency projects were funded by EQIP in the UEC Planning Area. Two projects (837 acres) were in Martin County, 15 projects (976 acres) were in St. Lucie County, and 4 projects (240 acres) were in Okeechobee County. EQIP is expected to continue, although future funding levels are uncertain.

## Certification and Recognition Programs

There are several national and statewide certification and recognition programs that direct builders, property owners, and building managers toward meeting environmentally friendly standards. Such programs include the Florida Green Building Coalition's Green Certification Program, the Florida Green Lodging Program, Leadership in Energy and Environmental Design (LEED), and Green Globes. These holistic programs typically include criteria affecting water use, energy efficiency, climate-adaptive landscaping, sustainable building material, site selection, indoor environmental quality, and greenhouse gas emissions.

INFO ⓘ

Florida-Friendly Landscaping means using low-maintenance plants and environmentally sustainable landscaping practices to conserve water, reduce pollution and erosion, and create wildlife habitat.

With respect to growing development and finite water resources, there are single-focus programs that target water use efficiency. These programs often are less expensive for builders and property managers than holistic ones. Two single-focus programs endorsed by all Florida water management districts are Florida Water Star and Florida-Friendly Yard Recognition. The Florida Water Star program certifies buildings and associated outdoor spaces that have been designed or retrofitted to meet high water efficiency standards and offers training for landscape and irrigation professionals to obtain program accreditation. The Florida-Friendly Yard Recognition program promotes low-maintenance and drought-tolerant plants, environmentally sustainable landscaping, and high-efficiency irrigation practices by providing recognition to properties where Florida-Friendly Landscaping practices have been successfully implemented. More information on these programs can be found on their individual program webpages and on the SFWMD's water conservation webpage (www.sfwmd.gov/conserve).

## Other Programs

### *Agricultural Best Management Practices Program*

The Florida Department of Agriculture and Consumer Services (FDACS) develops and adopts agricultural best management practices (BMPs) by rule for different types of agricultural operations. These BMPs have been designed primarily to reduce negative impacts on water quality while maintaining or enhancing agricultural production. However, some BMPs also improve water use efficiency and could reduce the amount of water needed to meet crop demands in average to wet years. Enrollment in the FDACS BMP program is voluntary. Within the UEC Planning Area, there currently are 142,501 acres in Martin County, 163,374 acres in St. Lucie County, and 41,756 acres in the northeastern portion of Okeechobee County enrolled in the FDACS BMP program. In addition, the FDACS Agricultural-Environmental Leadership Award recognizes environmentally innovative farming practices of the state's growers and ranchers. All agricultural water users are encouraged to enroll in the FDACS BMP program and learn about the Agricultural-Environmental Leadership Award. Local governments and agencies should consider promoting these programs to agricultural operations.

### *Agricultural Mobile Irrigation Labs*

The FDACS Mobile Irrigation Lab (MIL) program performs free evaluations of irrigation system efficiency on agricultural lands and makes recommendations for physical and operational improvements. Such recommendations may include modification of irrigation systems and equipment, alteration of irrigation scheduling, and other aspects of system management. Of the eight MILs operating in Florida, one (the St. Lucie MIL) serves Martin, St. Lucie, and Okeechobee counties.

### *Florida Automated Weather Network*

The Florida Automated Weather Network (FAWN), operated by the University of Florida – Institute of Food and Agricultural Sciences (UF/IFAS), provides weather information throughout the state at 15-minute intervals. FAWN management tools provide decision support functions to growers using historical and real-time weather data and crop modeling technology to help with short- and long-term planning, thereby maximizing the efficiency of irrigation practices (UF/IFAS 2019). There currently is one FAWN station (St. Lucie West) supported by the SFWMD in the UEC Planning Area. It is located in western St. Lucie County, south of State Road 70 and west of I-95. Additional information for this station is available at http://www.fawn.ifas.ufl.edu.

# REGULATORY INITIATIVES

Regulations or mandates can be used to accelerate improved practices or devices into mainstream use. 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 Florida Green Building Coalition. Ordinances and codes can be adopted wholly or partially, depending on conditions within a service area. Water efficiency measures are required statewide by statute, regionally by water management district rule, or locally by local government ordinance. In addition, utilities may be able to require builders meet efficiency codes in new construction as a condition of service.

The SFWMD promotes water conservation practices through water use permitting. In order for a proposed use of water to be considered reasonable-beneficial, the applicant must include water conservation practices in the permit application. Section 2.3.2 of the *Applicant's Handbook for Water Use Permit Applications within the South Florida Water Management District* (SFWMD 2021b) includes specific water conservation requirements for various water use categories.

The SFWMD's Mandatory Year-Round Landscape Irrigation Conservation Measures Rule (Chapter 40E-24, F.A.C.) was adopted to help protect South Florida's water resources by addressing the largest area of residential water use and greatest potential for viable water use reduction. In short, the rule limits landscape irrigation to 2 or 3 days per week, depending on location and local circumstances, and contains provisions for new landscaping and other situations that require a deviation from the rule requirements. Adoption of local ordinances that fully comport with Chapter 40E-24, F.A.C., is crucial to reducing landscape irrigation water use. When local governments implement irrigation ordinances, it demonstrates a commitment to water resource protection through conservation.

To assist local governments in adopting such an ordinance, the SFWMD has created a model ordinance, a model code, and several customizable outreach materials designed to educate residents on their local irrigation ordinance. As of May 2021, 4 of 11 local governments within the UEC Planning Area had adopted a year-round irrigation ordinance. The remaining seven were either in the process of adopting one or were reviewing the SFWMD's examples. Additional information and example documents for local implementation are available on the SFWMD's webpage (https://www.sfwmd.gov/doing-business-with-us/local-government-model-ordinances-and-codes).

# POTENTIAL FOR WATER CONSERVATION SAVINGS

Potential water savings for the UEC Planning Area were estimated for the following water use categories (**Table 3-1**): Agriculture (AG), Public Supply (PS), Domestic Self-Supply (DSS), and Landscape/Recreational (L/R). For the Commercial/Industrial/Institutional (CII) and Power Generation (PG) water use categories, potential water savings were estimated only for potable indoor water use, which was assumed to be provided by a PS utility. Therefore, those potential savings are accounted for under PS.

For this 2021 UEC Plan Update, eight frequently implemented measures were selected and quantified to generate the potential water savings for PS and DSS. Greater conservation savings may be possible in all water use categories if additional measures are implemented or if increased participation rates are realized. For example, the Central Florida Water Initiative (2015) identified 80 conservation programs and measures applicable to non-AG users and 47 programs and measures directly applicable to AG users.

Table 3-1. Potential water saved (in mgd) in the UEC Planning Area based on demand reduction estimates achievable by 2045.

| Use Category | County | | | Total by Sector |
|---|---|---|---|---|
| | Martin | St. Lucie | Okeechobee[1] | |
| Agriculture | 3.67 | 2.31 | 0.15 | **6.13** |
| Public Supply[2] | 1.39 | 1.98 | -- | **3.37** |
| Domestic Self-Supply[2] | 0.08 | 0.30 | -- | **0.38** |
| Landscape/Recreational | 1.02 | 1.71 | 0.01 | **2.74** |
| **Total** | **6.16** | **6.30** | **0.16** | **12.62** |

mgd = million gallons per day; UEC = Upper East Coast.

[1] Values listed are only for the area within the UEC Planning Area boundary. There are no Public Supply utilities or golf courses located in the portion of Okeechobee County within the UEC Planning Area. The permanent resident population in the Domestic Self-Supply category is too small to realize potential water savings.

[2] Includes passive savings.

## Agriculture

AG is the largest water use category in the UEC Planning Area, accounting for 60% [174.72 million gallons per day (mgd)] of the total demand in 2019. Although AG demands are projected to decline to 130.10 mgd in 2045, AG is projected to remain the largest water use category. As discussed in **Chapter 2** and **Appendix A**, the annual Florida Statewide Agricultural Irrigation Demand (FSAID) report published by FDACS includes 20-year estimates and projections of agricultural acreage and water demands. Estimated efficiency improvement (i.e., conservation estimate) is one of the parameters calculated by the FSAID model, and the spatially based data that contribute to the water demand estimates and projections are available by water management district planning area. The potential AG conservation savings within the UEC Planning Area were determined using the FSAID geodatabase (https://www.fdacs.gov/Agriculture-Industry/Water/Agricultural-Water-Supply-Planning). The methodology for calculating the potential AG conservation savings is more fully described in Appendix E of the FSAID VII report (FDACS 2020), but generally is based on estimated historical use determined from the United States Department of Agriculture's Farm and Ranch Irrigation Surveys and actual water savings data from MILs. The projected conservation savings are based primarily on irrigation system changes, changes in scheduling, and sensor-based automation.

The total savings calculated by the FSAID model for any given year depends on the crops produced, the acreage of each crop, and the irrigation systems employed, as projected to exist in that year. Because these variables change over the planning horizon (2019 to 2045), projected savings also change and may be nonlinear. The estimated conservation potential for the AG water use category in the UEC Planning Area in 2045 is 6.13 mgd (**Table 3-1**).

Irrigated AG acreage in the UEC Planning Area is projected to decline approximately 26% (from 107,383 acres in 2019 to 79,004 acres in 2045). Some of this abandoned acreage likely will consist of older irrigation systems, which may have been available for efficiency upgrades (i.e., conservation savings). Additionally, any new AG projects likely will be installed with efficient irrigation systems. Therefore, the availability of efficiency upgrades overall will decrease.

## Public Supply and Domestic Self-Supply

PS is the second largest water use category in the UEC Planning Area and is projected to increase through the planning horizon. PS accounted for an estimated 47.37 mgd of finished water demand in 2019 and 67.83 mgd in projected 2045 demands (**Chapter 2**). Historical conservation efforts in PS are reflected in the per capita use rate, which has declined approximately 22% between 2000 and 2019. This decline likely is the result of new construction using higher-efficiency fixtures and/or designed for more efficient water use, the SFWMD's Mandatory Year-Round Landscape Irrigation Conservation Measures Rule (Chapter 40E-24, F.A.C.), conservation rate structures, public education, and other conservation factors.

Estimates of active and passive water conservation potential for each county in the UEC Planning Area were made for residential and non-residential users (in both PS service areas and DSS areas) using the AWE Conservation Tracking Tool (Ver. 3) (AWE Tool). The AWE Tool calculates active water savings for user-selected conservation measures based on the number of measures implemented annually over the planning horizon, and the per unit savings and service lives of each measure. Passive savings are generated by the AWE Tool based on natural replacement of toilets, showerheads, and water-using appliances at the end of their service lives, whose current or future minimum efficiency is dictated by national, state, or local code requirements. Baseline data include Florida Department of Revenue parcel information, Bureau of Economic and Business Research household data and population projections, and Florida Department of Environmental Protection finished water monthly operating reports (as used in this plan update for demand projections; **Appendix A**). Conservation potential for DSS was analyzed with PS users and extracted in proportion to its percentage of the total population in each county.

Conservation measures included in the estimates for residential users supplied by PS utilities were limited to the following measures: high-efficiency toilets, showerheads, and clothes washers; irrigation and landscape evaluations; and advanced irrigation controllers. For many types of permit holders, including CII and PG, indoor potable water use often is provided by a PS utility. Conservation measures for non-residential users served by PS utilities included high-efficiency toilets and urinals as well as HVAC efficiency improvements.

For all measures except HVAC water use, the conservation (demand reduction) estimate assumes a participation rate of 30% of the total annual potential implementations for each applicable measure. This assumption means 30% of all possible implementations would be accomplished over the planning horizon (2019 to 2045), which is thought to be an achievable participation rate for most conservation measures. For HVAC efficiency improvements, a flat rate of five implementations per year was used to represent an achievable participation level, based on land use parcel data for the UEC Planning Area.

The AWE Tool estimates passive savings for PS will reach 1.00 mgd in Martin County and 1.60 mgd in St. Lucie County by 2045. The portion of Okeechobee County included in the UEC Planning Area currently has no PS users, and the DSS community consists of fewer than 200 homes. Therefore, conservation potential for those user groups was not analyzed. The combined estimated conservation potential by PS and DSS users (active and passive savings) in the UEC Planning Area in 2045 is 3.75 mgd (**Table 3-1**).

## Landscape/Recreational

The L/R use category includes irrigation of landscaped areas such as parks, athletic fields, roadway medians, commercial spaces, large private residential properties, and golf courses. Because their demands are estimated in different ways, golf course potential water savings are discussed separately from other permitted landscape irrigation. The total conservation potential for the L/R use category in 2045 is 2.74 mgd (**Table 3-1**).

There are approximately 1,650 active landscape irrigation water use permits in the UEC Planning Area. Landscape irrigation is projected to use a total of 28.48 mgd in 2045. To estimate the potential water conservation savings for landscaped areas, a variety of irrigation efficiency measures were applied to 30% of the permits over the planning horizon, yielding a 30% savings. Assuming an average per permit use for each county, the estimated conservation potential for landscape irrigation in 2045 is 2.57 mgd.

### *Golf Courses*

There are 41 active water use permits in the UEC Planning Area for golf course irrigation. These golf courses are projected to use 12.16 mgd of water in 2045. Indoor potable water use at golf courses is assumed to be provided by a PS utility.

Most golf courses are irrigated with a high degree of efficiency. According to a 2019 statewide survey of Florida Golf Course Superintendents Association members, 55% of golf courses use advanced irrigation controllers (Irwin and Wanvestraut 2020). A conservation program would therefore aim to affect the golf courses not yet using advanced irrigation controllers.

To estimate the potential water conservation savings for golf courses, a variety of irrigation efficiency measures were applied to 30% of the 41 permitted golf courses over the planning horizon, yielding a 10% savings. Assuming an average per permit use for each county, the estimated conservation potential for golf courses in 2045 is 0.17 mgd. There are no active golf course permits in the portion of Okeechobee County within the UEC Planning Area boundary.

In addition to the 41 active, permitted golf courses in the UEC Planning Area, there are an additional 17 courses that use reclaimed water for irrigation and do not have a permit for backup supply (or supplementation). While all water should be used efficiently regardless of its source and the same measures applicable to other courses could increase water use efficiency on courses using (or supplementing with) reclaimed water, the SFWMD does not have water use data for the golf courses without water use permits. Therefore, potential water savings for those courses were not calculated.

## Commercial/Industrial/Institutional

For CII permit holders, indoor potable water use is assumed to be provided by a PS utility. Therefore, conservation savings estimates were captured during the PS analysis by the measures targeting non-residential users (i.e., high-efficiency restroom fixtures and HVAC efficiency improvement measures). CII permitted water use was not analyzed for conservation potential as those uses were assumed to be process specific and, therefore, difficult to estimate within the scope of a regional analysis.

## Power Generation

PG facilities use large quantities of water for cooling, but most of the water is returned to the source from which it was obtained. As a result, there are minimal efficiency gains to be had from the cooling process. Potential savings for PG were not estimated as part of this analysis. As with the CII use category, indoor potable water use at PG facilities is assumed to be provided by a PS utility. Therefore, conservation savings estimates were captured during the PS analysis in the AWE Tool by the measures specifically targeting non-residential users (i.e., high-efficiency restroom fixtures and HVAC efficiency measures).

# SUMMARY OF WATER CONSERVATION

Conservation programs that achieve increased water savings through education, rebates, and new technologies are much less expensive than alternative water supply projects, which typically involve construction of new treatment plants, groundwater wells, reservoirs, or other costly infrastructure. In addition, decreased per capita water use resulting from conservation helps utilities avoid or reduce supply and treatment costs as populations increase and potentially reduces the necessity and overall magnitude of rate increases for customers. Therefore, regardless of the water source(s) used, conservation should be maximized before more costly development options are implemented.

Potential water savings achievable by 2045 for the AG, PS, DSS, and L/R (including golf) water use categories are estimated to be 12.62 mgd (**Table 3-1**). These savings would be achieved if the measures and programs discussed in this chapter are implemented at reasonable levels over the planning horizon. Greater conservation savings would be possible by all user groups if additional measures are implemented or if increased participation rates are realized. Utilities and local governments should conduct potential water conservation savings and cost analyses for their service areas and jurisdictions. Such analyses can inform the decision-making process regarding investment in alternative water supply projects.

Local, regional, and state government agencies as well as PS utilities in the UEC Planning Area can develop conservation strategies to encourage and assist water users in improving their water use efficiency. Because PS utilities typically promote conservation only within their service areas, government agencies should consider conducting educational outreach to promote and incentivize conservation among DSS and L/R users. Cost-share funding may be available to local governments (and in some cases, directly to large users) to foster the adoption of conservation measures. Agricultural operations are encouraged to take advantage of the FDACS BMP program as well as funding opportunities (through EQIP or CFP), site audits via MILs, and FAWN to make weather-based irrigation decisions. Individual users are encouraged to seek out resources to improve water use efficiency and reduce expenses.

SFWMD staff are available to assist conservation program developers in the UEC Planning Area with technical support, collaborative program implementation, ordinance review, long-term demand management planning, and funding assistance via the District's CFP. In addition to the programs and strategies discussed in this chapter, conservation program resources are discussed further in the 2021-2024 Support Document (SFWMD 2021a).

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# 4

# Water Resource Protection

This chapter provides an overview and update of protections afforded to water resources within the Upper East Coast (UEC) Planning Area through statutory and regulatory criteria. The ability to meet the water demands described in **Chapter 2** largely depends on the future availability of water resources. Understanding the relationship among projected water demands, water sources, and limitations imposed on withdrawals is critical to water supply planning.

**TOPICS**

- Water Resource Protection Standards
- Regulatory Protection of Water Resources
- Summary of Water Resource Protection

Stakeholders in the UEC Planning Area rely on surface water and groundwater to meet demands. The primary surface water sources are 1) the C-44 Canal, which receives water from Lake Okeechobee, and 2) the C-23, C-24, and C-25 canals, which were constructed to provide drainage for a large agricultural area. The C-23, C-24, and C-25 canal system is not hydraulically connected to Lake Okeechobee; the system receives recharge from rainfall and local basin runoff only. Fresh groundwater from the surficial aquifer system and brackish groundwater from the Floridan aquifer system (FAS) are the primary water sources for public supply, landscape/recreational, and commercial/industrial/institutional uses. New or increased allocations beyond existing volumes are limited for Lake Okeechobee and the C-23, C-24, and C-25 canals. Therefore, many water users in the region have constructed wells to use groundwater as a supplemental water supply.

**NOTE**

MFLs and recovery strategies for Lake Okeechobee and the Northwest Fork of the Loxahatchee River affect portions of the UEC Planning Area but are included in the Lower East Coast water supply plan updates.

The South Florida Water Management District (SFWMD or District) implements a water use permitting program and adopts minimum flows and minimum water levels (MFLs), water reservations, and restricted allocation areas (RAAs) to protect water supplies for natural systems (**Figure 4-1**). This chapter discusses water use permitting criteria as well as MFLs, water reservations, and RAAs adopted in the UEC Planning Area. Further information about permitting and other resource protections, including those related to Comprehensive Everglades Restoration Plan (CERP) projects, is provided in the *Support Document for the 2021-2024 Water Supply Plan Updates* (2021-2024 Support Document; SFWMD 2021a). Water resource development projects that can provide additional water, including projects supporting MFLs, water reservations, and RAAs, are discussed in **Chapter 7**.

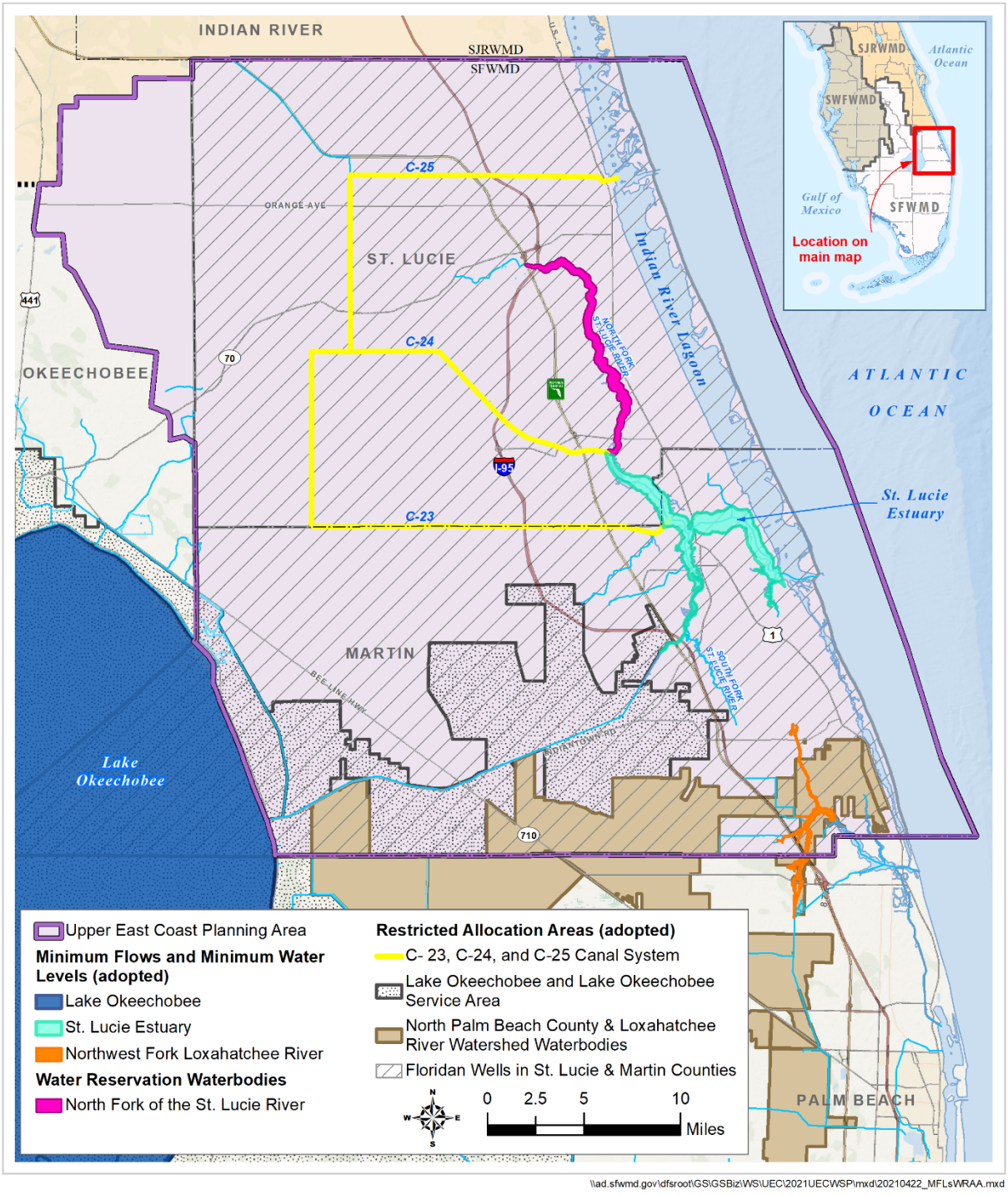


Figure 4-1. Adopted minimum flows and minimum water levels, water reservations, and restricted allocation areas in or affecting portions of the UEC Planning Area.

# WATER RESOURCE PROTECTION STANDARDS

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 to prevent various levels of harm (no harm, harm, significant harm, and serious harm). Each standard plays a role in achieving sustainable water resources. For instance, programs regulating surface water management and water use permitting must prevent harm to water resources, including related natural systems. **Figure 4-2** represents the conceptual relationship among water resource protection tools and standards, observed impacts, and water shortage severity. A more detailed discussion of resource protection tools, including water use permitting and water shortage rules, and definitions of the protection standards can be found in the 2021-2024 Support Document (SFWMD 2021a).

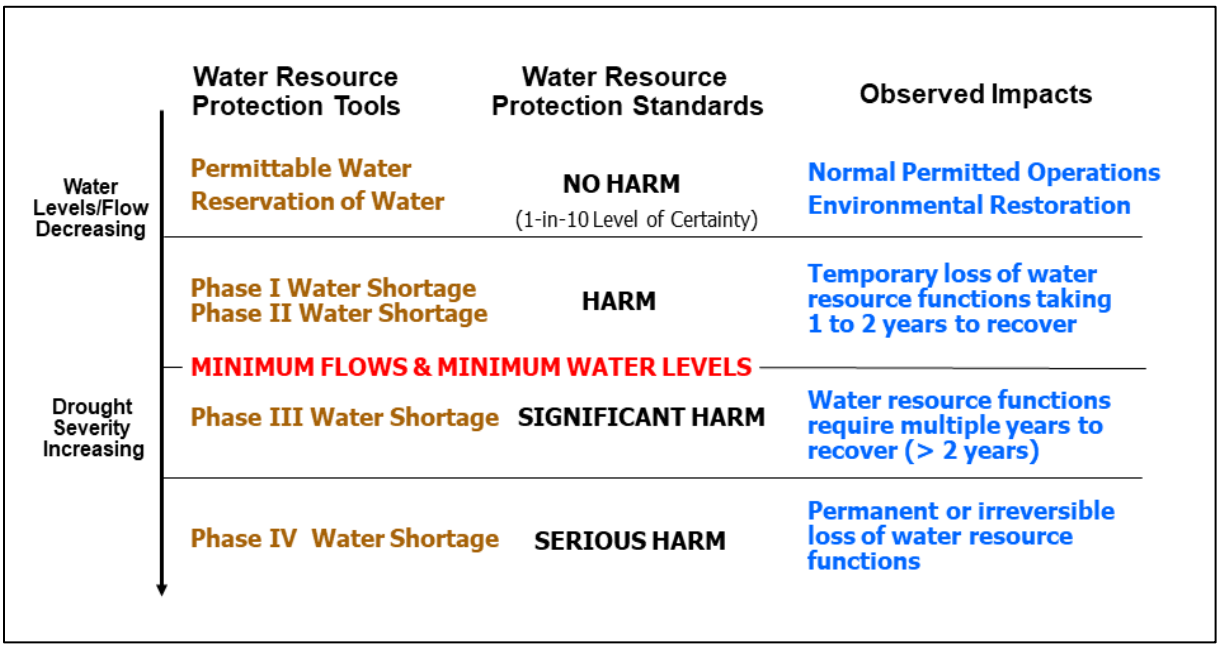


Figure 4-2. Conceptual relationship among water resource protection standards at various levels of water resource harm (Modified from: Rule 40E-8.421, F.A.C.).

# REGULATORY PROTECTION OF WATER RESOURCES

## Water Use Permitting

Unless exempt by statute or identified in the Water Rights Compact of 1987, 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. 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 [Section 373.223(1), F.S.]. The proposed water use must comply with the water resource protection criteria [see Rule 40E-2.301, 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 2021b)], including 1) implementation criteria for regulatory components of an adopted MFL prevention or recovery strategy, 2) implementation criteria for water reservations, and 3) RAA criteria. Additional information about water use permitting can be found in the 2021-2024 Support Document (SFWMD 2021a).

## Minimum Flows and Minimum Water Levels

MFL criteria are minimum flows or minimum water levels at which water resources, or the ecology of the area, would experience significant harm from further withdrawals. MFL criteria are applied individually to affected water bodies and define the minimum flow or minimum water level for surface water bodies, or minimum water level for groundwater in aquifers. Adopted MFLs in the SFWMD are contained in Chapter 40E-8, F.A.C. The SFWMD adopts a prevention or recovery strategy when an MFL is initially adopted (Rule 40E-8.421, F.A.C.) and, if needed, when an MFL is re-evaluated or revised. The SFWMD fulfills its statutory obligation to identify key water bodies for which MFLs should be developed or re-evaluated by providing a Priority Water Body List and Schedule in Chapter 3 of the annual updates to the *South Florida Environmental Report – Volume II* [Section 373.042(3), F.S.]. Detailed information about MFLs, including descriptions of recovery and prevention strategies, is provided in the 2021-2024 Support Document (SFWMD 2021a).

In the UEC Planning Area, an MFL and prevention strategy has been adopted for the St. Lucie Estuary (Rule 40E-8.341, F.A.C.) (**Figure 4-1**). The MFLs and recovery strategies for Lake Okeechobee and the Northwest Fork of the Loxahatchee River affect portions of the UEC Planning Area but are included in the Lower East Coast water supply plan updates.

The St. Lucie Estuary MFL and prevention strategy were adopted by the SFWMD in 2002 to protect the estuary's oligohaline zone and the organisms that inhabit it (submerged aquatic vegetation, phytoplankton, zooplankton, macroinvertebrates, and larval and juvenile fish and shellfish) from significant harm (as defined in Rule 40E-8.021, F.A.C.). The MFL criteria for the St. Lucie Estuary are based on the determination that significant harm occurs to the oligohaline zone of the estuary when net freshwater flows to the estuary are reduced. This can occur when freshwater deliveries to the North Fork of the St. Lucie River decline substantially. A minimum mean monthly flow criterion of 28 cubic feet per second (cfs) at the Gordy Road structure was adopted as the MFL. Additional information about the MFL and a description of the prevention strategy are provided in **Appendix C**.

## Water Reservations

Water reservations in the SFWMD are adopted by rule in Chapter 40E-10, F.A.C. A water reservation sets aside a volume of water for the protection of fish and wildlife or public health and safety (Section 373.223, F.S.). Reserved volumes of water are unavailable for allocation to consumptive uses. However, any unreserved volumes of water may be certified by the District's Governing Board as available and allocated to consumptive uses. Water reservations do not 1) prevent the use of unreserved water or water allocated in consumptive use permits, 2) establish operating regimes, 3) drought-proof natural systems, 4) ensure wildlife proliferation, or 5) improve water quality.

Water reservations are developed based on existing water availability or in consideration of future water supplies made available by water resource development projects (**Chapter 7**). Regional water supply plans must list water resource development projects that support water supply development for existing and future uses and natural systems, including those in adopted water reservations (Section 373.709, F.S.). Additionally, 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.

Water reservations may be used to protect water for CERP projects prior their construction, as required by the Water Resources Development Act of 2000 and Section 373.470(3)(c), F.S., and as parts of MFL recovery and prevention strategies. Additionally, water reservations may be a component of an MFL recovery or prevention strategy. Further information about water reservations, including their role in CERP implementation, is provided in the 2021-2024 Support Document (SFWMD 2021a).

One water reservation has been adopted in the UEC Planning Area for the protection of fish and wildlife in the North Fork of the St. Lucie River (Subsection 40E-10.051, F.A.C.) and downstream estuaries (**Figure 4-3**).

### *North Fork of the St. Lucie River*

The CERP Indian River Lagoon – South (IRL-S) Project was authorized by Congress in the Water Resources Development Act of 2007. To initiate this federal project as part of CERP, the State of Florida, and ultimately the SFWMD, was required to reserve or allocate water for the natural systems associated with the project prior to project construction and implementation. A prospective water reservation was adopted by the SFWMD in 2010 for the North Fork of the St. Lucie River (Subsection 40E-10.051, F.A.C.)—a tributary to the St. Lucie Estuary and southern Indian River Lagoon—to fulfill the legal requirement to protect water for fish and wildlife and to ensure the CERP IRL-S Project provides the intended benefits for the natural system. The water reservation criterion is a mean monthly flow of 130 cubic feet per second over the Gordy Road structure from November 1 through May 31 of each year (**Figure 4-3**).

INFO

A prospective water reservation legally reserves the water anticipated to be made available by a project, prior to the project being constructed.

The SFWMD used a resource-based approach to develop the water reservation for the North Fork of the St. Lucie River. Technical evaluations, including review of available literature and empirical data as well as development of watershed and hydrodynamic models, were conducted to 1) define hydrologic targets for the river, and 2) quantify the volume of available water produced by the CERP IRL-S Project (**Chapter 7**). Relationships were identified among freshwater flows discharged from the watershed, salinity, and downstream estuarine ecological responses. These evaluations were documented in the supporting technical report for the water reservation (SFWMD 2009). An independent, expert peer-review panel reviewed the technical document and related reports and determined that the SFWMD's analysis of the best available information supported the linkages between the hydrologic conditions in the river and the habitat requirements needed for fish and wildlife. The technical document and other supporting information for the water reservation are available on the SFWMD's website at http://www.sfwmd.gov/reservations.


Figure 4-3. North Fork of St. Lucie River water reservation water body.

## Restricted Allocation Areas

RAAs are defined geographic areas where use of specific water supply sources (e.g., lakes, wetlands, canals, aquifers) is restricted due to concerns regarding water availability. RAAs are listed in Section 3.2.1 of the Applicant's Handbook (SFWMD 2021b), which is incorporated by reference in Rule 40E-2.091, F.A.C. Water allocations beyond the criteria listed in the Applicant's Handbook are restricted or prohibited. RAAs are adopted for a variety of reasons, including 1) where there is insufficient water to meet the projected needs of a region, 2) to protect water for natural systems and future restoration projects (e.g., CERP), or 3) as part of MFL recovery or prevention strategies. **Figure 4-1** shows the locations of adopted RAAs wholly or partially in the UEC Planning Area, which include the following areas:

- C-23, C-24, and C-25 Canal System
- North Palm Beach County/Loxahatchee River Watershed Waterbodies
- Lake Okeechobee and Lake Okeechobee Service Area
- Floridan Aquifer Wells in Martin and St. Lucie Counties

### *C-23, C-24, and C-25 Canal System*

Due to limited surface water availability and canal bank instability at low stages, an RAA was adopted for the C-23, C-24, and C-25 canal system in 1981 (Subsection 3.2.1.B of the Applicant's Handbook [SFWMD 2021b]). The RAA criteria for the C-23, C-24, and C-25 canal system state that no additional surface water will be allocated from the C-23, C-24, and C-25 canals or any connected canal systems that derive water supply from these canals, above existing allocations. No increase in surface water pump capacity will be recommended. Because these canals have permitted withdrawals that are reduced or terminated based on water levels (14 feet National Geodetic Vertical Datum of 1929), 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-year level of certainty unless additional water sources are used.

### *North Palm Beach County/Loxahatchee River Watershed Waterbodies*

An RAA was adopted in 2007 for the North Palm Beach County/Loxahatchee River Watershed Waterbodies, which are defined in Subsection 1.1 of the Applicant's Handbook (SFWMD 2021b), to ensure that water necessary for Everglades and Loxahatchee River watershed restoration activities is not allocated for consumptive uses [Subsection 3.2.1.E of the Applicant's Handbook (SFWMD 2021b)]. 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. The RAA is a component of the MFL recovery strategies for the Everglades and the Northwest Fork of the Loxahatchee River. Additional information on this RAA can be found in the Lower East Coast water supply plan updates.

### *Lake Okeechobee and Lake Okeechobee Service Area*

An RAA was adopted in 2008 for Lake Okeechobee and the Lake Okeechobee Service Area, which comprise the Lake Okeechobee basin, per Subsection 3.2.1.F of the Applicant's Handbook (SFWMD 2021b). The area covers more than 1.8 million acres, including Lake Okeechobee and the integrated conveyance systems that are hydraulically connected to, and receive water from, Lake Okeechobee, such as the Caloosahatchee River, the St. Lucie Canal, and secondary canal systems that receive Lake Okeechobee water for water supply purposes via gravity flow or pump [defined in Subsections 3.2.1.F.1.a and 3.2.1.F.1.b of the Applicant's Handbook (SFWMD 2021b) as the Lake Okeechobee Waterbody]. Net increases in the volume of surface water withdrawn from the RAA are prohibited over that resulting from base condition water uses occurring from April 1, 2001 to January 1, 2008. Allocations over the base condition water use are only allowed through sources detailed in Subsection 3.2.1.F.3.c of the Applicant's Handbook (SFWMD 2021b), such as certified project water, implementation of offsets, alternative water supply, available and unassigned base condition water use, or base condition water use that was terminated or reduced after January 1, 2008. The RAA is part of the MFL recovery strategy for Lake Okeechobee. Additional information on this RAA can be found in the Lower East Coast water supply plan updates.

### *Floridan Aquifer Wells in Martin and St. Lucie Counties*

An RAA was adopted in the 1980s that restricts pumps on FAS wells in Martin and St. Lucie counties due to concerns regarding water availability and water quality. RAA criteria in Subsection 3.2.1.D of the Applicant's Handbook (SFWMD 2021b) prohibit the use of pumps on flowing FAS wells in Martin and 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) an analysis shows the withdrawals will not interfere with existing legal uses; 4) the pump is installed temporarily for freeze protection; or 5) the pump is installed temporarily during a declared water shortage.

## SUMMARY OF WATER RESOURCE PROTECTION

- The UEC Planning Area has the following resource protections in place:
  - Water use permitting criteria
  - An MFL for the St. Lucie Estuary
  - A water reservation for the North Fork of the St. Lucie River
  - RAAs for the C-23, C-24, and C-25 Canal System; North Palm Beach County/Loxahatchee River Watershed Waterbodies; Lake Okeechobee and Lake Okeechobee Service Area; and Floridan Aquifer Wells in Martin and St. Lucie Counties
- MFL, water reservation, and RAA criteria continue to be implemented in the UEC Planning Area and have not been modified since the 2016 UEC Plan Update.
- Water shortage and water use permitting rules and criteria have not changed for the UEC Planning Area since the 2016 UEC Plan Update. Further information on water shortage management and water use permitting is available in the 2021-2024 Support Document (SFWMD 2021a).

NAVIGATE

Detailed information about MFLs is available on the SFWMD website at http://www.sfwmd.gov/mfls.

Detailed information about water reservations is available on the SFWMD website at http://www.sfwmd.gov/reservations.

Detailed information about RAAs is available in the Applicant's Handbook (SFWMD 2021b).

MFL, water reservation, and RAA status updates are provided annually in Chapter 3 of the *South Florida Environmental Report – Volume II*, available at http://www.sfwmd.gov/sfer.

Further information can be found in the 2021-2024 Support Document (SFWMD 2021a) and **Appendix C**.

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# 5

# Water Source Options

This chapter presents water source options that could be available through 2045 to accommodate urban and agricultural demands in the Upper East Coast (UEC) Planning Area while still meeting the needs of the natural system. Descriptions of the sources, current and projected uses, and factors that affect availability for water supply purposes are provided. **Chapter 6** presents the South Florida Water Management District's (SFWMD or District) analyses of the surface water and groundwater conditions in the region. Information about water treatment technologies and their related costs is provided in the *Support Document for the 2021-2024 Water Supply Plan Updates* (2021-2024 Support Document; SFWMD 2021).

TOPICS

- Surface Water
- Groundwater
- Reclaimed Water
- Water Storage
- Seawater
- Summary of Water Source Options

In the UEC Planning Area, fresh groundwater from the surficial aquifer system (SAS) and surface water from canals and lakes are considered traditional water sources; whereas, alternative water supply (AWS) or nontraditional water source options include brackish groundwater from the Floridan aquifer system (FAS), reclaimed water, water stored in aquifer storage and recovery (ASR) wells or in aboveground reservoirs, and seawater.

To meet water supply needs, water users primarily rely on the SAS and surface water (**Figure 5-1**). However, withdrawals from these sources have approached sustainable limits because of aquifer productivity, environmental concerns, and resource protection criteria and regulatory limitations (**Chapter 4**). As a result, brackish groundwater from the FAS and reclaimed water are being developed to meet increased demands. Use of such AWS sources is an integral part of current and future water supply strategies in the UEC Planning Area.

Surface water and fresh groundwater currently supply 91% of water needs for Agriculture (AG) in the UEC Planning Area, with agricultural operations primarily relying on surface water (**Figure 5-2**). A combination of fresh and brackish groundwater supplies 100% of Public Supply (PS) demands. Of the 15 PS utilities in the UEC Planning Area, 8 utilities use fresh groundwater to meet all their potable water demand, and the remaining 7 utilities use brackish groundwater for a portion of or all their current demands. Currently, the City of Stuart and St. Lucie County Utilities use only fresh groundwater from the SAS. However, the City of Stuart anticipates using the FAS to meet a portion of its demand beginning in 2023, and St. Lucie County Utilities anticipates using the FAS beginning in 2028. Existing allocations and infrastructure appear to be sufficient to meet 2045 water demands for AG and PS. New surface water withdrawals are limited by restricted allocation area (RAA) criteria (**Chapter 4**), and fresh groundwater withdrawals are limited by resource constraints.

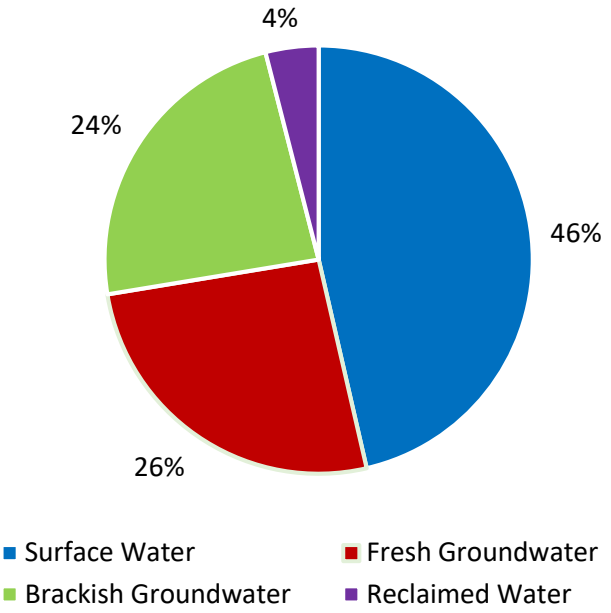


Figure 5-1. Water use in the UEC Planning Area in 2019, by source (From: SFWMD 2020).

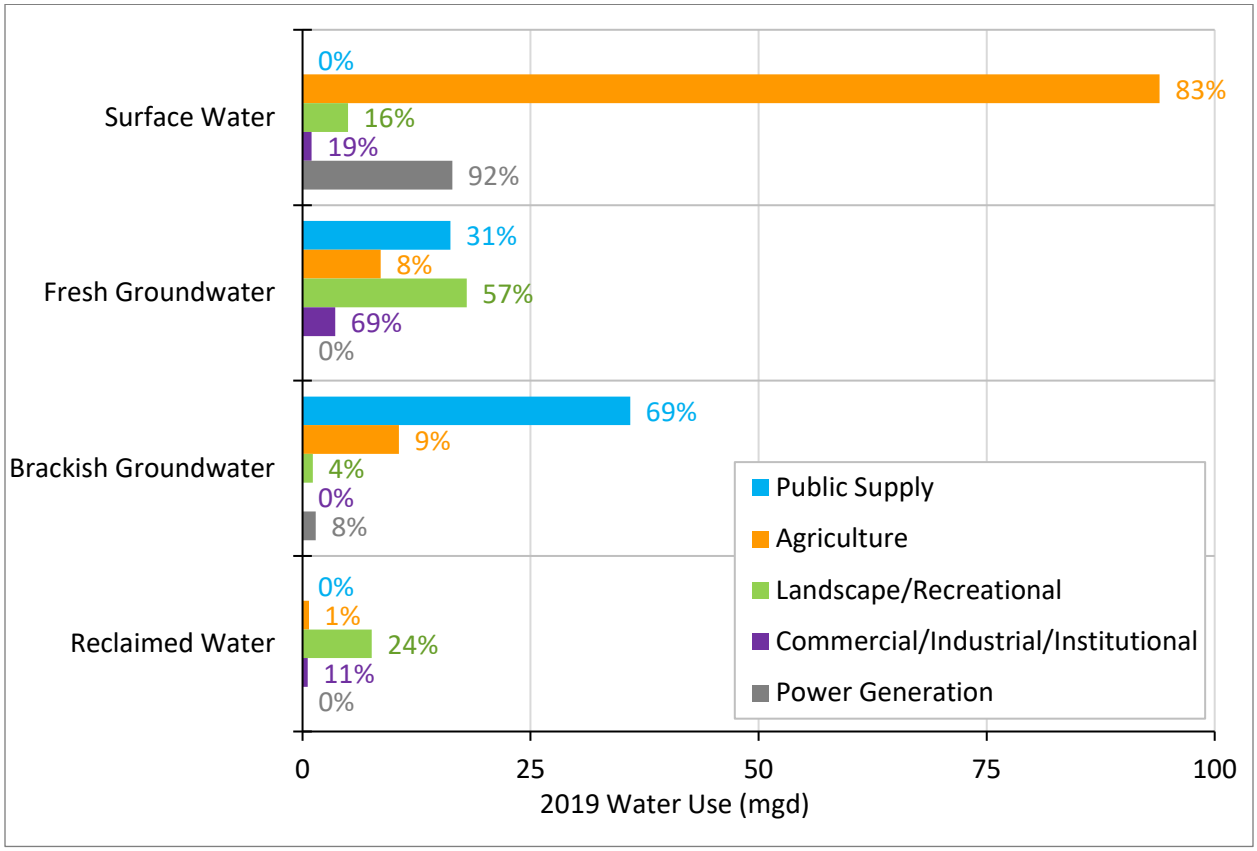


Figure 5-2. Water use in the UEC Planning Area in 2019, by source and use type. (Notes: Fresh groundwater supplies 100% of Domestic Self-Supply demand. Percentages may not equal 100% due to rounding.)

# SURFACE WATER

Surface water is water that has not penetrated much below the surface of the ground and is a major source of water supply in the UEC Planning Area. Surface water sources, primarily used for agricultural and urban irrigation, include canals, lakes, and reservoirs. The C-23, C-24, C-25, and C-44 canals are operated and maintained by the SFWMD. There also are smaller canals for local uses, as described below. Lake Okeechobee, which is operated and maintained by the United States Army Corps of Engineers, provides water to some AG users in the region via the C-44 Canal. Although the UEC Planning Area has multiple surface water sources, most are limited by regulatory protections (**Chapter 4**).

## C-23, C-24, and C-25 Canals

The C-23, C-24, and C-25 canals are the most widely used surface water sources in the UEC Planning Area. Although these canals are not directly connected to Lake Okeechobee or the SFWMD's regional system, they are used to provide water to secondary local canals and to recharge the SAS. AG is the predominant user of surface water from these canals. RAA criteria have been established for the C-23, C-24, and C-25 canals and their directly connected canals that prohibit additional surface water allocations from these water bodies above existing allocations (**Chapter 4**).

## C-44 Canal

The C-44 Canal was constructed as a navigable waterway and flood control outlet for Lake Okeechobee and is the only canal in the UEC Planning Area to receive inflow from outside the basin. AG is the predominant user of the C-44 Canal.

The recently completed C-44 reservoir and stormwater treatment area in Martin County are intended to capture, store, and treat runoff from the C-44 basin prior to its discharge back to the C-44 Canal and, ultimately, the St. Lucie Estuary (**Chapter 7**). The reservoir has 50,600 acre-feet of storage and delivers water to the 6,400-acre stormwater treatment area, which is divided into six independently operating cells for water quality treatment as a component of the CERP Indian River Lagoon – South Project. Construction of the C-44 reservoir was completed in June 2021. The reservoir is now in operational testing and monitoring for 2 years, after which the SFWMD will evaluate water availability associated with the reservoir. The District's Governing Board may certify additional water from the C-44 reservoir as available for consumptive use after project testing is complete.

## Local Surface Water Sources

There are several water control districts, established under Chapter 298, Florida Statutes (F.S.), that are operated for flood control and water supply in the UEC Planning Area (**Figure 5-3**). Stormwater from the interconnected lakes and canals can be held in the water control district canal systems for irrigation. Some water control districts divert water from SFWMD canals (e.g., C-24, C-25, C-44) to maintain specific water levels within their boundaries. Water diversions into local canal networks are used primarily for AG irrigation purposes and, to a lesser extent, Landscape/Recreational (L/R) irrigation.

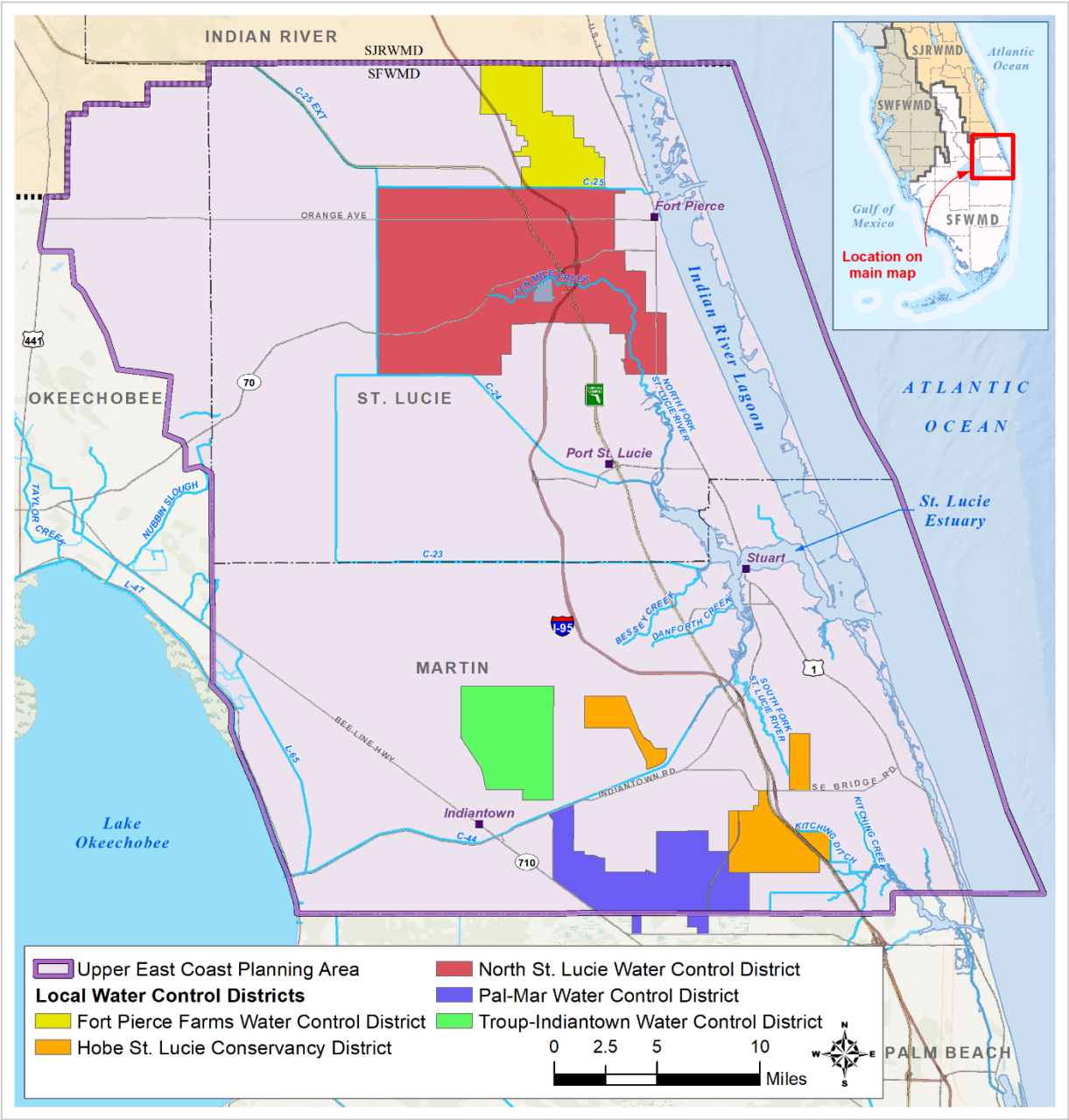


Figure 5-3. Water control districts in the UEC Planning Area.

## Existing and Future Use

In 2019, approximately 83% of AG demands in the UEC Planning Area was met with surface water, and this percentage is expected to remain the same through 2045. However, irrigated agricultural acreage and associated demands are projected to decrease approximately 25% from 2019 to 2045 (**Chapter 2**). The locations of permitted AG surface water withdrawals are shown in **Figure 5-4**.

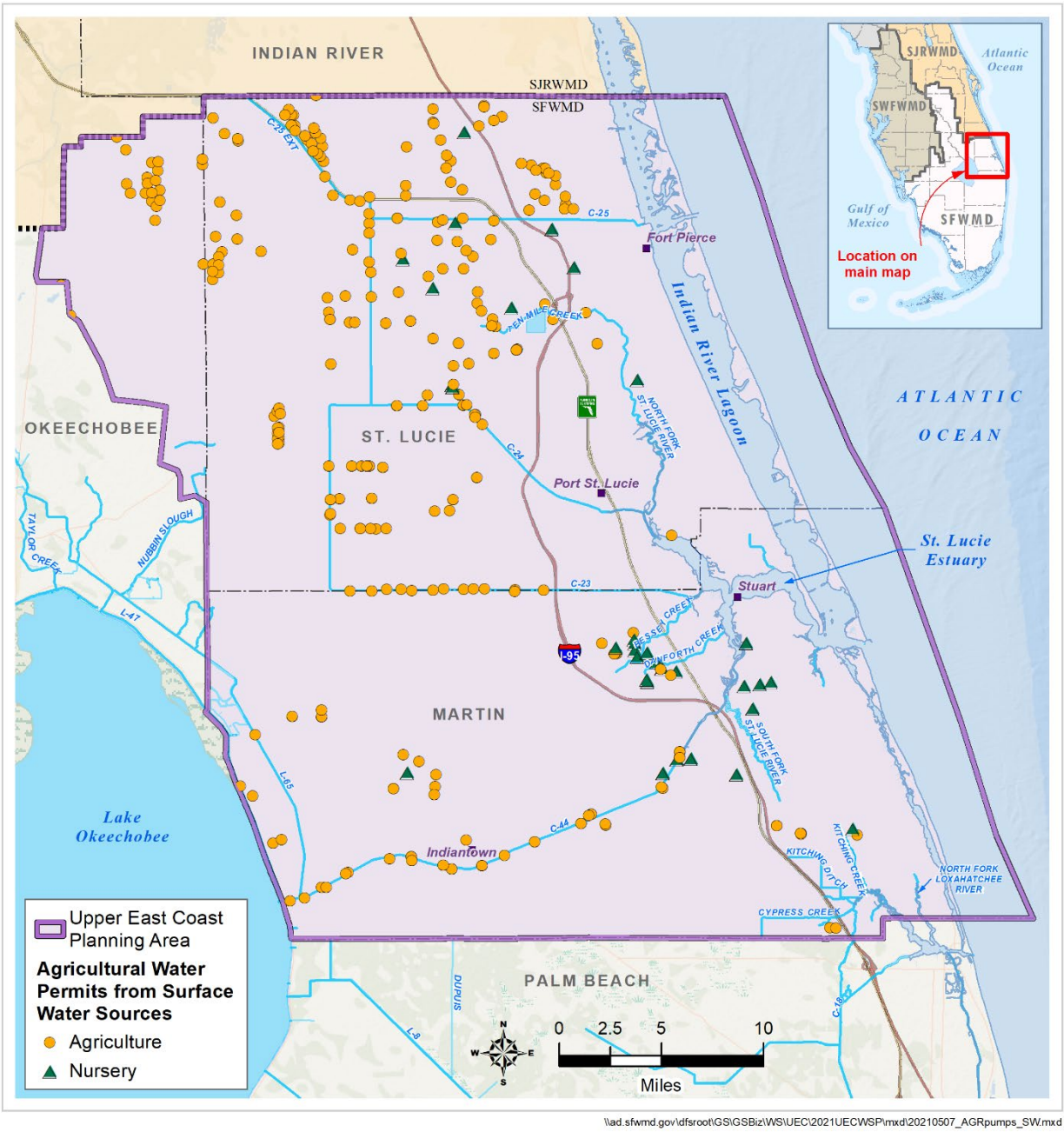


Figure 5-4. Permitted surface water withdrawal locations for agricultural irrigation within the UEC Planning Area.

Approximately 16% of L/R demands in the UEC Planning Area, including golf courses, was met with surface water in 2019. Withdrawals primarily are from on-site ponds or adjacent local canals. L/R use is expected to increase 27% by 2045; however, surface water withdrawals may decrease as new demands, and some existing demands, are met with reclaimed water. Permitted L/R surface water withdrawal locations are shown in **Figure 5-5**.

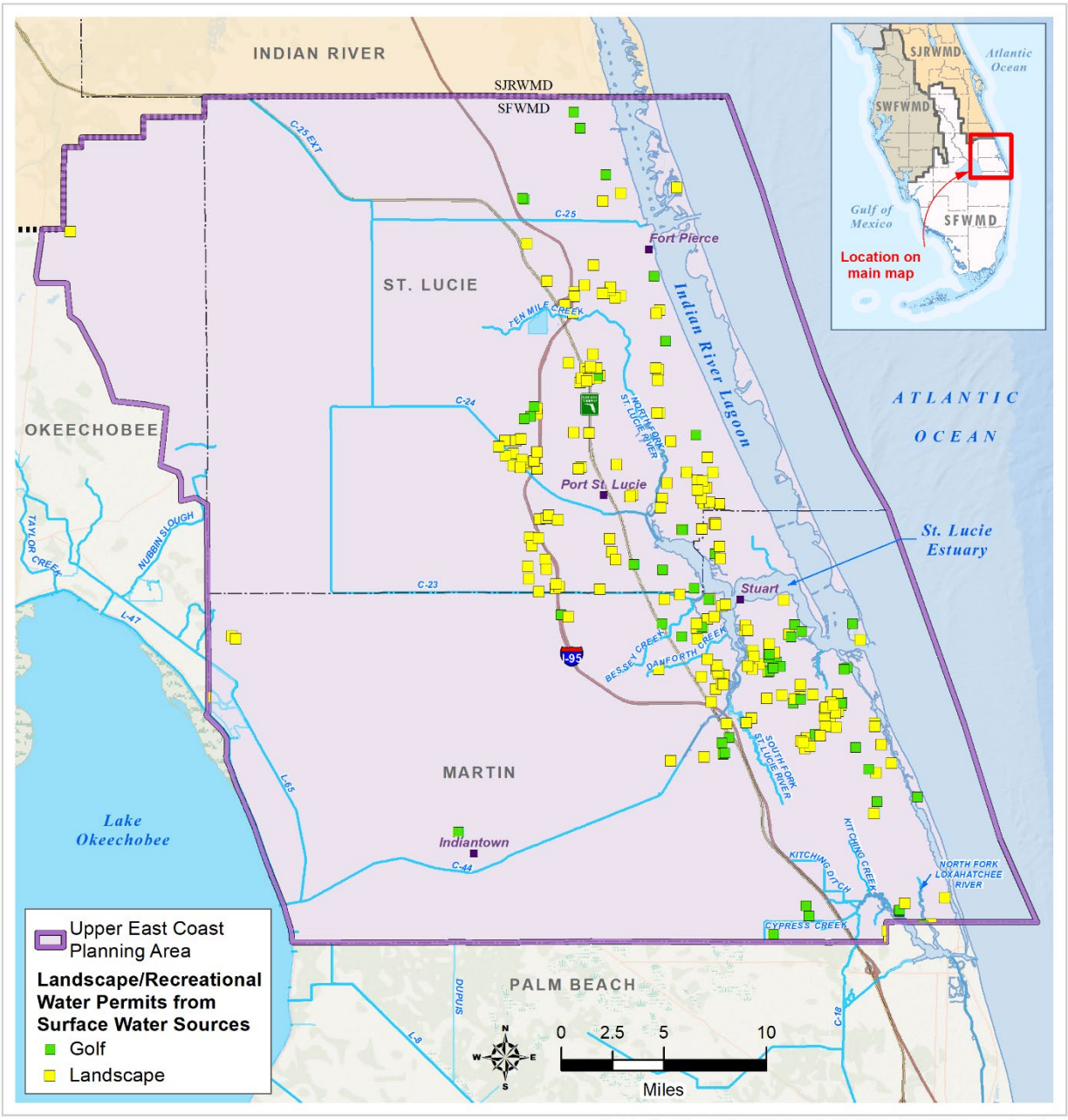


Figure 5-5. Permitted surface water withdrawal locations for golf course and landscape irrigation within the UEC Planning Area.

In 2019, surface water was used to meet 19% of Commercial/Industrial/Institutional (CII) demands in the UEC Planning Area. CII demands will increase slightly by 2045, and the same proportion presumably will be met with surface water.

The Florida Power & Light (FPL) Martin Plant in Indiantown withdraws water from the C-44 Canal and is the only Power Generation (PG) facility using fresh surface water for once-through cooling pond makeup water. No increase in surface water withdrawals for the PG use category is projected through 2045.

Surface water is used primarily for AG and to a lesser extent L/R, CII, and PG uses. Based on demand projections, surface water sources supplemented with groundwater appear sufficient to meet the projected 2045 demands.

# GROUNDWATER

The SAS and FAS are the major groundwater sources in the UEC Planning Area (**Figure 5-6**). The SAS provides fresh groundwater, and the FAS provides brackish groundwater.

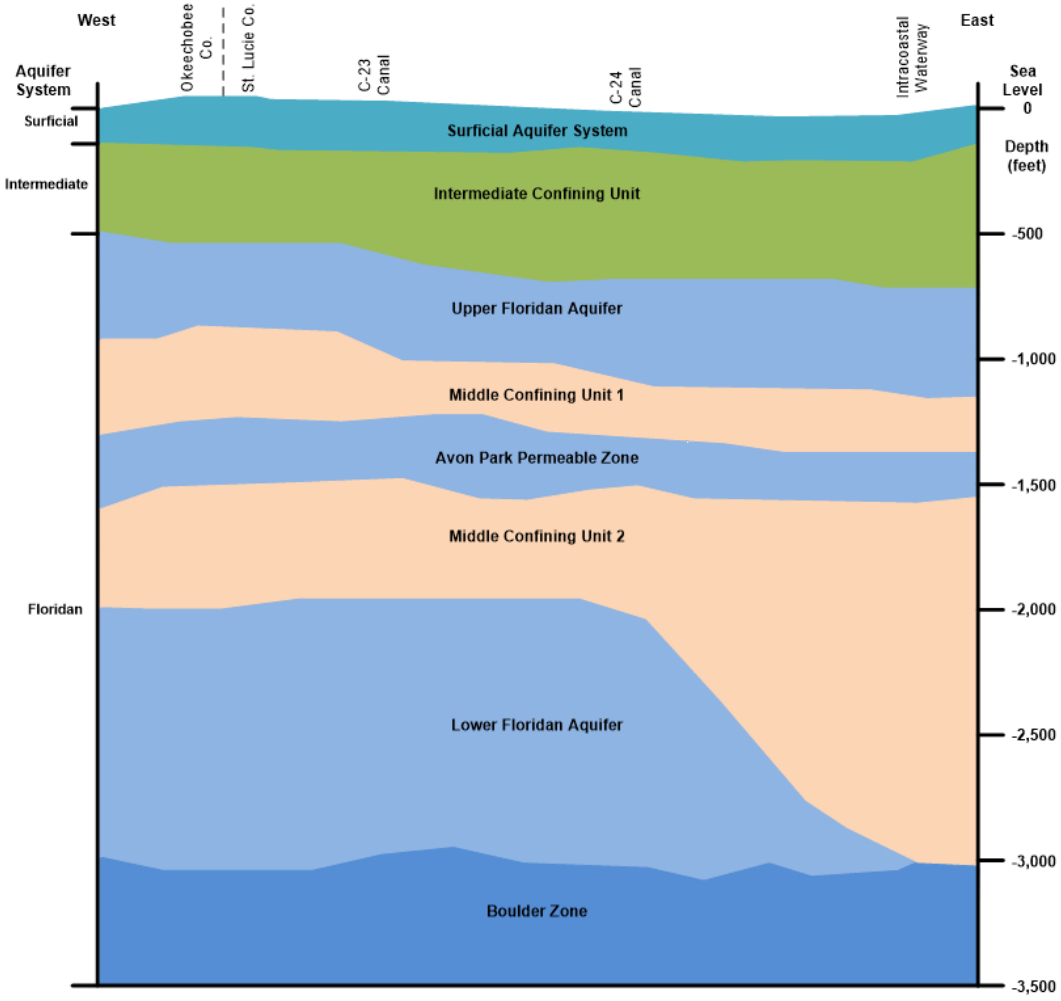


Figure 5-6. Generalized hydrogeologic cross-section of the UEC Planning Area.

PS is the largest user of groundwater in the UEC Planning Area, and total groundwater withdrawals have slightly increased over the past 14 years (**Figure 5-7**). PS use of the FAS has increased in volume since 2006, while the volume withdrawn from the SAS has remained steady. In 2006, the SAS provided approximately 49% of the water for PS, and the FAS provided approximately 51%. By 2019, only about 31% of PS demand was met with water from the SAS due to increased use of water from the FAS (69%). The percentage of SAS use for PS is projected to continue decreasing over time as the use of AWS sources (e.g., brackish water, reclaimed water) increases.

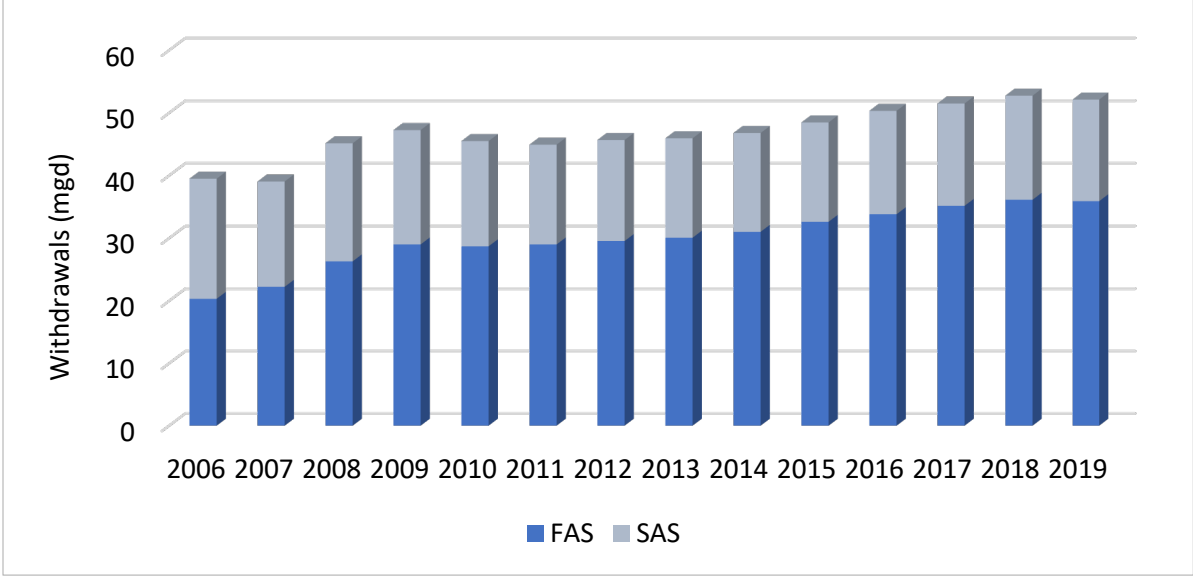


Figure 5-7. Public Supply withdrawals from the surficial and Floridan aquifer systems in the UEC Planning Area (2006 to 2019).

## Fresh Groundwater – Surficial Aquifer System

The SAS produces fresh water from relatively shallow wells in most of the UEC Planning Area. Fresh groundwater has a chloride concentration less than 250 milligrams per liter (mg/L), which is a secondary drinking water standard (United States Environmental Protection Agency 2021). All water use categories in the UEC Planning Area, except PG, rely on fresh groundwater from the SAS, although AG predominantly uses surface water. Development of new SAS groundwater sources may be feasible in some areas; however, permitting new water supplies will depend on local resource conditions. Based on demand projections in this plan update, a combination of fresh and brackish groundwater (supplemented with surface water as described earlier) appears to be adequate to meet projected 2045 demands.

The SAS is an unconfined to semi-confined aquifer system composed of solutioned limestone, sandstone, sand, shell, and clayey sand and is recharged by local rainfall and regional canals. Water availability from the SAS is limited by the rate of groundwater recharge, aquifer productivity, potential wetland impacts, proximity to contamination sources, saltwater intrusion, and other existing legal users in the area. During droughts, low regional groundwater levels may cause inland movement of the saltwater interface in the SAS. In this case, water shortage restrictions may be declared by the District's Governing Board to conserve freshwater supplies and reduce the risk of saltwater intrusion. Water availability from the SAS is further discussed in **Chapter 6**.

### *Existing and Future Use*

PS is the largest user of fresh groundwater in the UEC Planning Area (**Figure 5-2**). In 2019, 25.79 million gallons per day (mgd) of the region's PS demand was met with fresh groundwater from the SAS. Use of the SAS is projected to increase only slightly by 2045 (28.82 mgd) as increased PS demands are expected to be met with water from the FAS.

In 2019, fresh groundwater from the SAS supplied 100% of the estimated demand for Domestic Self-Supply (DSS). By 2045, DSS demand is expected to decrease to 5.61 mgd due to low anticipated growth in DSS areas and the expansion of potable water distribution lines in PS service areas.

AG primarily depends on surface water and uses fresh groundwater to a much lesser extent due to the low productivity of the SAS in the region. In 2019, agricultural operations withdrew approximately 9.00 mgd of fresh groundwater from the SAS. Although AG demand is expected to decrease 25% over the planning period (from 174.42 to 130.10 mgd), no decrease in the use of fresh groundwater is anticipated. Permitted AG groundwater withdrawal locations in the UEC Planning Area are shown in **Figure 5-8**.

In 2019, approximately 57% of L/R demand, including golf courses, and 69% of CII demand was met with fresh groundwater from the SAS (**Figure 5-2**). L/R and CII demands are expected to increase 43%, based on population growth. Fresh groundwater is expected to meet approximately half of the increased demand, depending on availability at specific locations. For the L/R category, some SAS withdrawals may be replaced with reclaimed water if available. Permitted L/R groundwater withdrawals in the UEC Planning Area are shown in **Figure 5-9**.

In 2019, a combination of surface water, fresh groundwater, and brackish groundwater was used to meet PG demands. Surface water is used by one PG facility for cooling pond makeup water only, which accounts for 92% of PG demands. PG demands are expected to remain the same through 2045, and the same proportion of surface water, SAS, and FAS use is expected. However, some withdrawals may be replaced with reclaimed water as it becomes available.

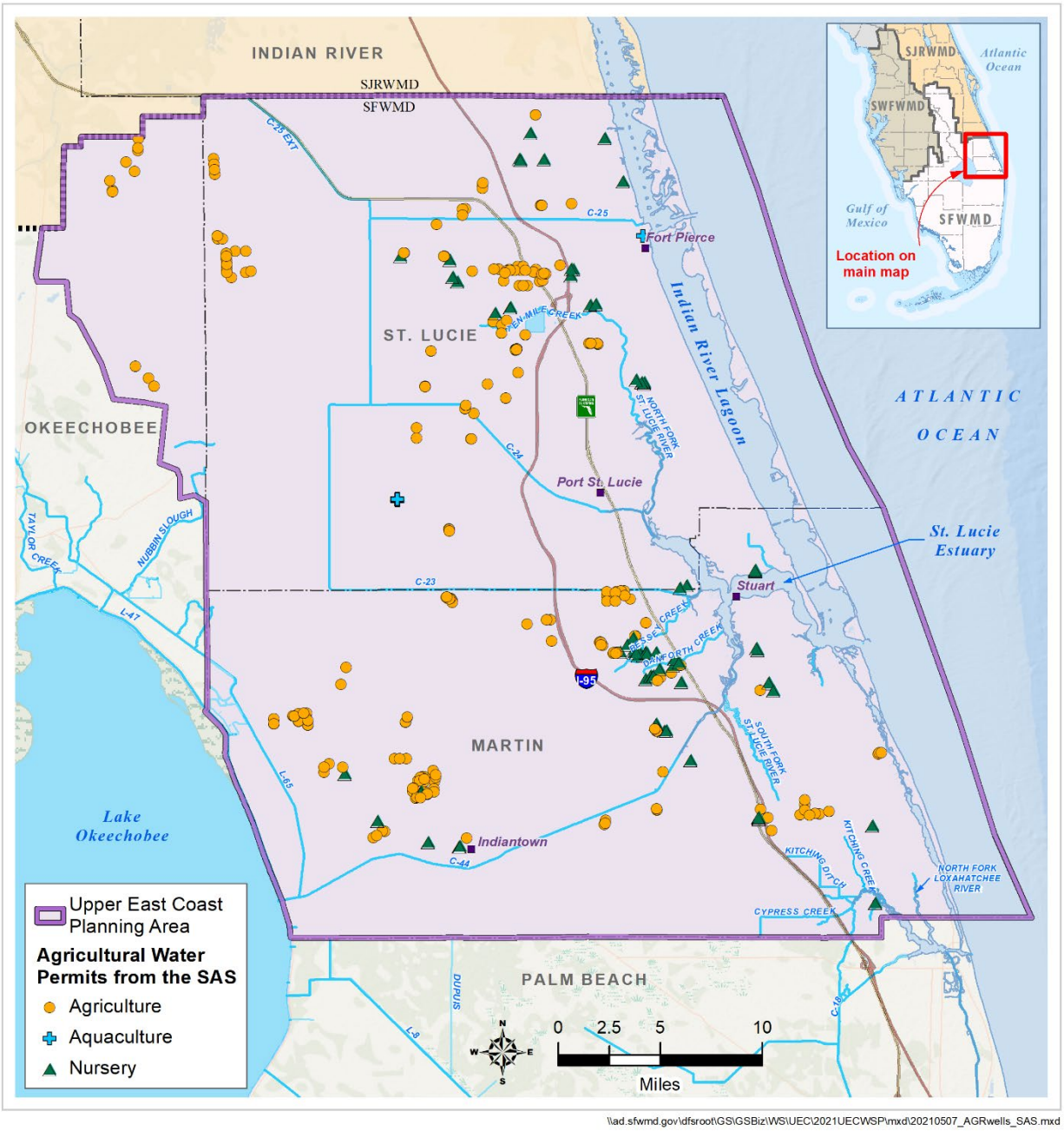


Figure 5-8. Permitted surficial aquifer system withdrawal locations for agricultural irrigation within the UEC Planning Area.

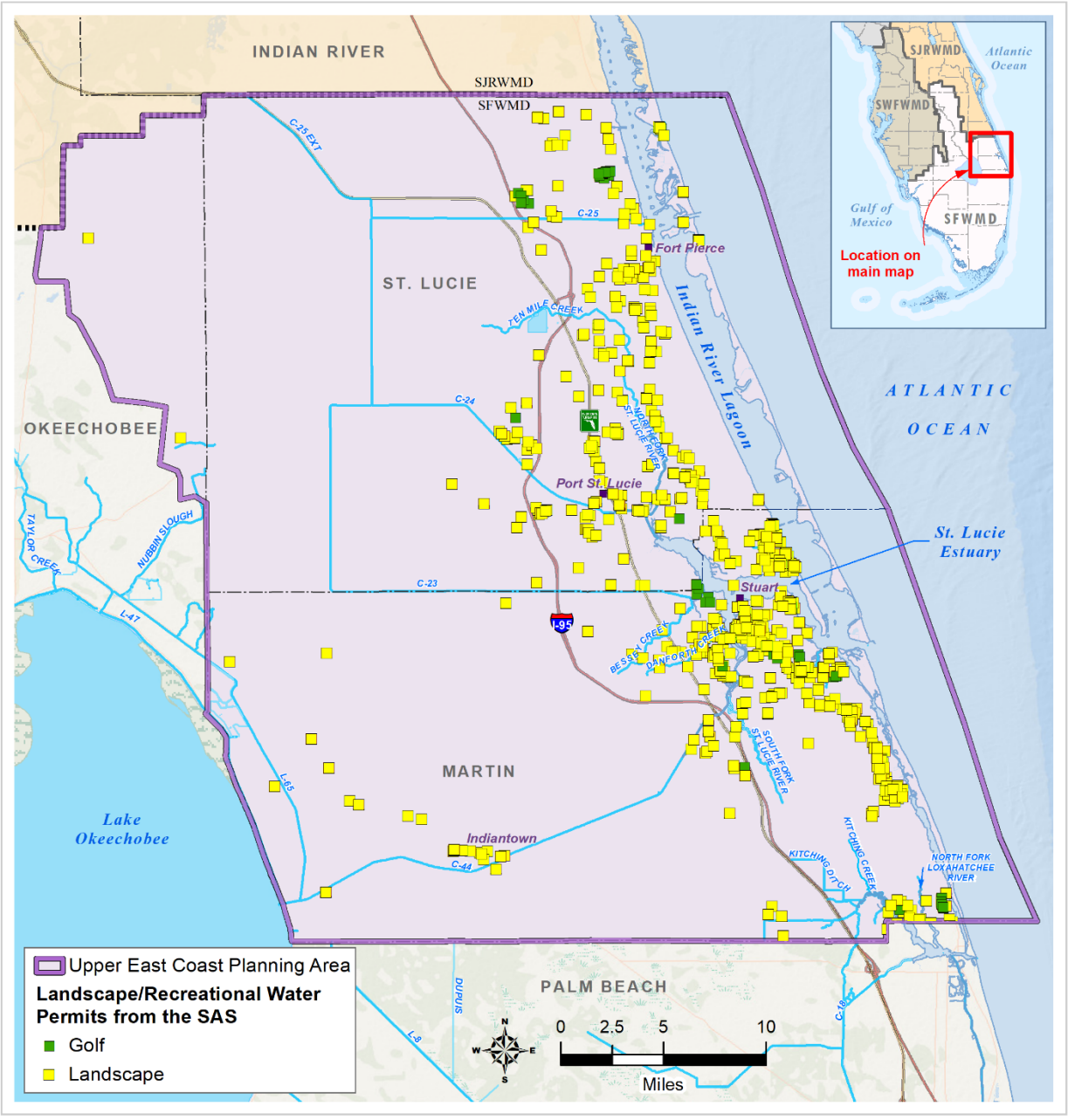


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Figure 5-9. Permitted surficial aquifer system withdrawal locations for golf course and landscape irrigation within the UEC Planning Area.

## Brackish Groundwater – Floridan Aquifer System

Brackish water has a chloride concentration between 250 and 19,000 mg/L (seawater). In the UEC Planning Area, water from the FAS typically has chloride concentrations greater than 1,000 mg/L and is considered brackish. Desalination or blending with fresh water is required before this water supply source is suitable for most uses, including irrigation and human consumption. Water quality in the FAS decreases substantially from central to southern Florida, with increasing hardness, chlorides, and salinity. Salinity also increases with depth, making the deeper producing zones less desirable for development than shallower parts of the system. The FAS is productive in the UEC Planning Area; however, use of this brackish water source is limited by water quality concerns (**Chapter 6**) and regulatory protections (**Chapter 4**).

The FAS is a confined, high-yield aquifer system that provides substantial volumes of water. Overall, the productivity of the FAS is considerably greater than that of the SAS in the region. The top of the FAS is separated from the SAS by the low-permeability sediments of the intermediate confining unit. Within the UEC Planning Area, the FAS is composed of a carbonate rock (limestones and dolostones) sequence more than 2,700 feet thick. The FAS has several discrete aquifers separated by low-permeability confining units, including the Upper Floridan aquifer (UFA), Avon Park permeable zone (APPZ), and Lower Floridan aquifer (LFA) (**Figure 5-6**).

In the UEC Planning Area, the top of the FAS (coincident with the top of the UFA) is approximately 800 to 1,100 feet below land surface. The UFA is under artesian pressure (i.e., wells flow naturally at land surface without the need for a pump) throughout most of the District. The potentiometric heads (water levels) ranging from 30 to 55 feet above mean sea level. Although the potentiometric surface of the UFA is above land surface, the intermediate confining unit prevents upward migration of water into shallower aquifers. The UFA is composed of limestones from the Suwannee, Ocala, and Upper Avon Park formations.

The top of the APPZ varies but typically is 1,200 to 1,500 feet below mean sea level and consists of thick beds of dolostone with interbedded limestones (Reese and Richardson 2008). It is approximately 600 feet thick and separated from the UFA (above) and LFA (below) by confining units (**Figure 5-6**, middle confining units 1 and 2). Heads (water levels) in the UFA and APPZ are similar, but productivity and salinity vary considerably.

The LFA comprises the limestones and dolostones of the Lower Avon Park, Oldsmar, and Upper Cedar Keys formations. The total dissolved solids concentration (a measure of salinity) within the LFA is greater than 10,000 mg/L, which is the threshold for an underground source of drinking water. Though generally not considered useful as a water supply source in the UEC Planning Area, the LFA includes the Boulder Zone (approximately 2,100 to 3,500 feet below mean sea level), a cavernous and highly transmissive interval used for disposal of wastewater effluent and concentrate from reverse osmosis (RO) treatment facilities through the use of deep injection wells.

The SFWMD partners with other agencies (e.g., the United States Geological Survey) to monitor the FAS through regional monitor well networks and through permittees as part of reporting requirements for water use (SFWMD) and deep injection wells (Florida Department of Environmental Protection). Data from these wells indicate some seasonal variations in water levels, but overall, levels have remained stable over the period of record.

Nearly all PS utilities in the UEC Planning Area that use the UFA have had one or more production wells experience degraded water quality. However, regional water quality in the FAS has remained relatively stable. **Chapter 6** contains monitor well location information and data from the regional FAS network as well as water quality graphs from PS utility data.

### *Existing and Future Use*

The FAS provides brackish groundwater for PS, AG, L/R, and PG demands in the UEC Planning Area. PS utilities extensively use the FAS as a water supply source. PS withdrawals from the FAS increased from approximately 20 to 36 mgd between 2006 and 2019 (**Figure 5-10**) and are expected to increase to 56 mgd by 2045. In the UEC Planning Area, seven PS utilities have FAS permit allocations, totaling 89.37 mgd. The FAS is not used for PS in the portion of Okeechobee County within the UEC Planning Area.

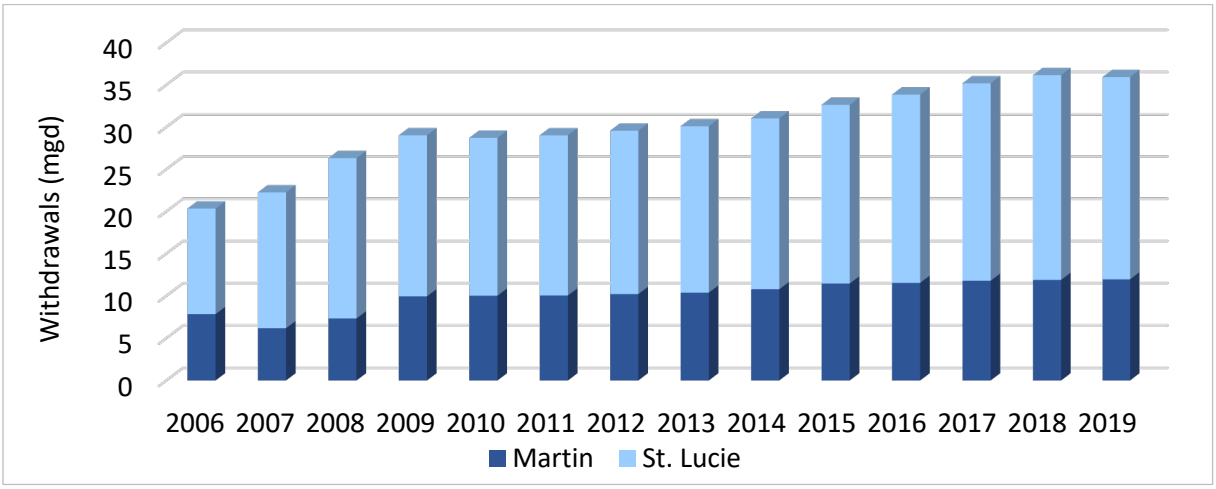


Figure 5-10. Public Supply withdrawals from the Floridan aquifer system in the UEC Planning Area (2006 to 2019).

PS utilities use RO treatment to remove excess salinity and reach acceptable drinking water quality. The approximate production efficiency, or recovery, for brackish water RO facilities Districtwide is between 75% and 85%, depending on the membrane technology employed and the salinity of the source water (Carollo Engineers, Inc. 2009). There currently are eight RO water treatment plants in Martin and St. Lucie counties, with a combined treatment capacity of 59.04 mgd. To some extent, FAS water can be blended with fresh water from the SAS and treated with lime softening or nanofiltration technology to meet chloride drinking water standards. The ability to use blending depends on the water quality of the FAS water and other treated water produced by the utility.

Additional permitted FAS users in the UEC Planning Area include numerous AG users, six golf courses—Sailfish Point Golf Club, Jupiter Island Club, Indianwood Golf and Country Club, and Martin County Golf and Country Club in Martin County, and Island Pines Golf and Country Club and Island Dunes Country Club in St. Lucie County—and one PG facility: the Treasure Coast Energy Center in St. Lucie County. AG permit holders use the UFA as a supplemental source when surface water availability is limited. AG and L/R FAS demands are not expected to increase between 2019 and 2045. FAS demands for PG increased from 1.45 mgd in 2019 to 3.34 mgd in 2020 but are not expected to increase again before 2045. FAS well locations are shown in **Figure 5-11**.

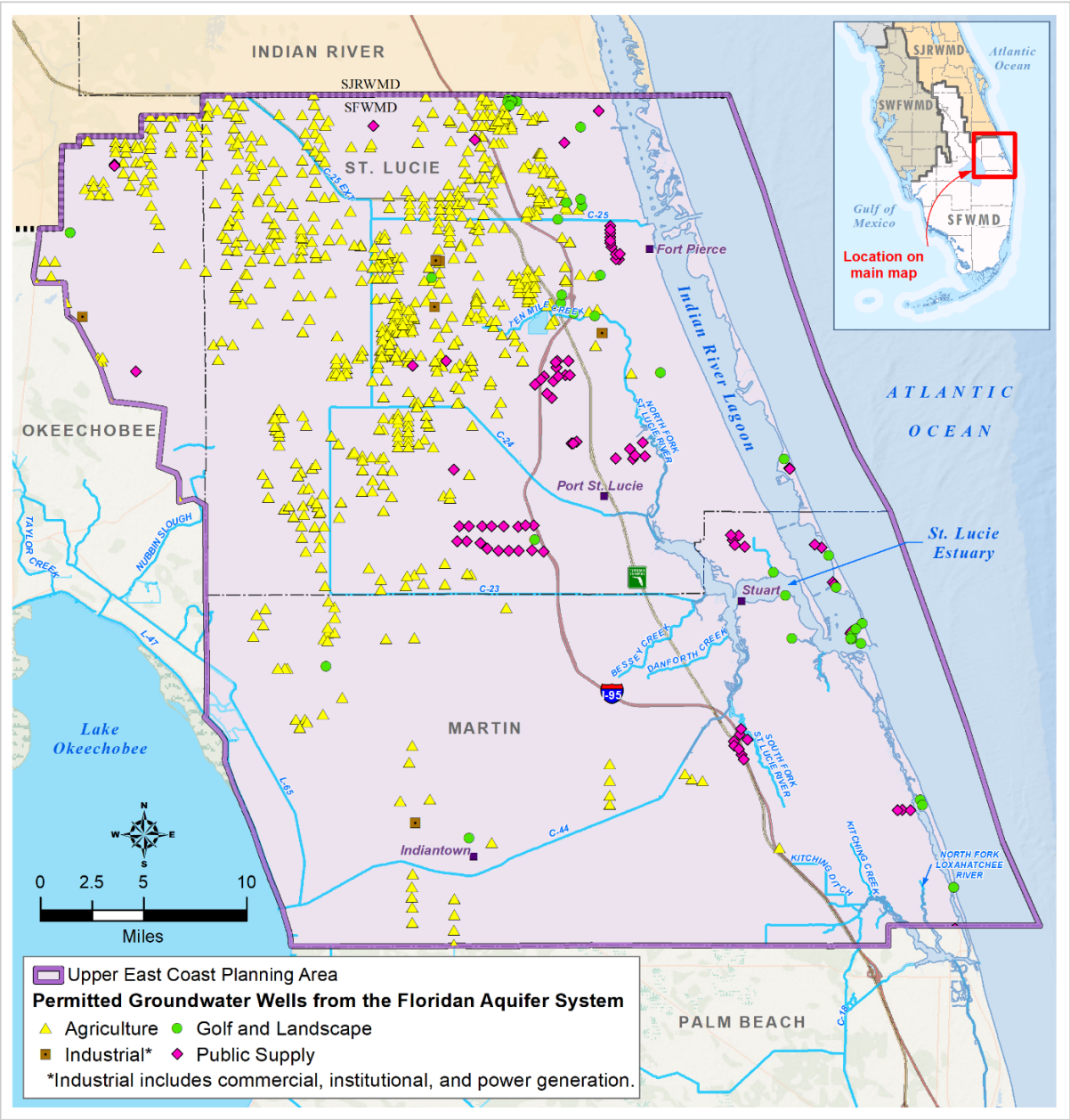


Figure 5-11. Floridan aquifer system wells in the UEC Planning Area.

The SFWMD used the East Coast Floridan Model (ECFM) to simulate 2019 and 2045 demands from the FAS in the UEC Planning Area. Review of historical chloride data and the ECFM results concluded that with properly designed and managed wellfields, the FAS appears able to meet projected demands through 2045. The ECFM simulations and analyses conducted to support this plan update are considered conservative and provide insight to potential water level and water quality changes that may occur in the FAS over time if no wellfield design or operations plan is implemented to minimize the movement of poor-quality water. The model results identified potential areas that may require further evaluation. Water quality should remain adequate for all users, with RO treatment as needed. A discussion of the model results, conclusions, and recommendations is provided in **Chapter 6** and **Appendix D**.

# RECLAIMED WATER

Reclaimed water is wastewater that has received at least secondary treatment and basic disinfection and is reused after flowing out of a domestic wastewater treatment facility (WWTF) [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 Water Resource Implementation Rule (Chapter 62-40, F.A.C.) requires the Florida Department of Environmental Protection and water management districts to advocate and direct the use of reclaimed water as an integral part of water management programs, rules, and plans. The SFWMD requires all water use permit applicants proposing to use more than 0.10 mgd of water and applicants within a mandatory reuse zone, as designated by local governments through ordinance, to use reclaimed water if feasible. In addition, substitution credits and impact offsets, resulting from use of reclaimed water, may be included in a water use permit. A substitution credit is the use of reclaimed water to replace a portion or all of an existing permitted use of a limited surface water or groundwater resource, allowing a different user to initiate or increase withdrawals from the resource. Impact offsets are derived from the use of reclaimed water to reduce or eliminate a harmful impact that has occurred or would occur as a result of a surface water or groundwater withdrawal.

## Existing Reuse

Wastewater reuse conserves water resources by reducing reliance on traditional freshwater sources and is an environmentally sound alternative to deep well injection and other traditional disposal methods. Although disposal methods will be needed during wet periods, the use of reclaimed water during normal to dry periods minimizes wasteful disposal of water resources. In addition, reclaimed water provides an acceptable alternative to potable water for uses like irrigation, often at a lower cost. The volume of reclaimed water used in the UEC Planning Area for a beneficial purpose (e.g., landscape irrigation, golf course irrigation, cooling water) increased from 5.80 mgd in 1994 to 8.80 mgd in 2019 (**Figure 5-12**). Annual fluctuations in the volume of reclaimed water used are due to the addition of new users and variable amounts of rainfall.

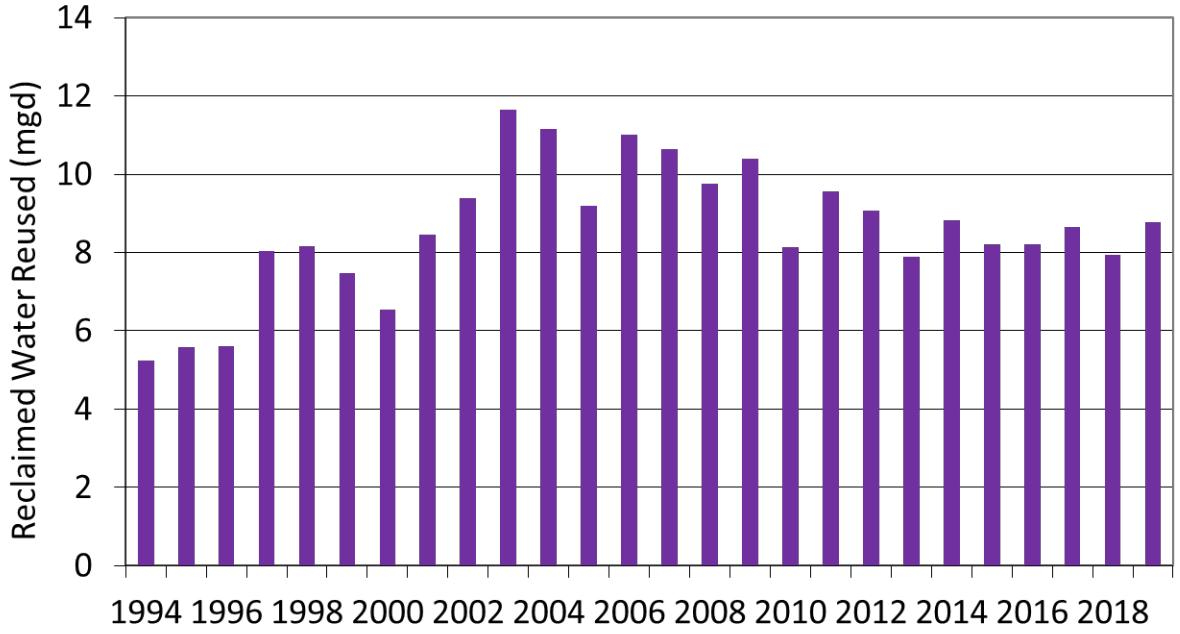


Figure 5-12. Annual average reclaimed water use in the UEC Planning Area from 1994 to 2019.

As of 2020, there are 20 domestic WWTFs in the UEC Planning Area with a capacity of 0.10 mgd or greater (**Appendix E**). In 2019, those facilities treated a total of 24.22 mgd and 36% was reused. The *2019 Reuse Inventory* (Florida Department of Environmental Protection 2020) indicated 27% of wastewater generated in St. Lucie County and 53% generated in Martin County is reused. Reuse was primarily for irrigation of golf courses, parks, schools, and residential lots (7.73 mgd of the 8.77 mgd reused). The remainder was reused for groundwater recharge through percolation ponds (0.36 mgd) and other uses such as processes at the treatment facility, cooling water, toilet flushing, and absorption fields (0.68 mgd). However, 16.01 mgd of potentially reusable water was disposed of through deep well injection and surface water discharge in 2019.

### *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. In the UEC Planning Area, 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

Wastewater flows are projected to increase from 24.22 mgd in 2019 to 46.13 mgd by 2045, a 21.91 mgd increase. As stated previously, 16.01 mgd of potentially reusable wastewater effluent was disposed of in the UEC Planning Area in 2019. Combined, this represents 37.92 mgd of potential AWS. Utilities currently distributing reclaimed water to customers intend to continue and expand their reuse systems as additional reclaimed water and users

become available. Most major utilities in the region are planning to provide more reclaimed water by 2045. In many cases, future reuse will occur in new residential developments.

Many utilities have constructed the required treatment facilities to produce reclaimed water for public access irrigation in anticipation of increased reclaimed water demand in the future. In many areas, local government development approval includes use of reclaimed water and extension of reclaimed water pipelines, substantially increasing the volume of reuse by 2045. Applying the current reuse rate of 36% to projected wastewater flows results in 16.61 mgd of additional reuse by 2045.

The following planned activities by utilities could increase reuse in the UEC Planning Area:

- Development in western sections of the City of Port St. Lucie Utility Systems Department's service area is expected to increase water reuse from the Glades WWTF. New service to existing developments is also expected to increase reuse in the area.
- Construction of a mainland water reclamation facility by the Fort Pierce Utilities Authority is expected to increase opportunities for water reuse. The existing Island WWTF, which is expected to be replaced by the Mainland WWTF, has limited reuse potential due to a lack of demand in the vicinity.
- Construction of a regional WWTF in northeastern St. Lucie County will make reclaimed water available for new development and expand other reuse distribution systems.
- The reclaimed water interconnect between the City of Stuart and Martin County Utilities allows for expanded reuse of the city's reclaimed water and allows Martin County Utilities to expand their reclaimed water distribution network.

Many utilities are proposing to use reclaimed water for irrigation in new residential developments. This could replace the use of potable water for irrigation in those developments and reduce PS demands from the FAS compared to current projections.

## Supplemental Sources to Meet Reuse Demand

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 stormwater 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.

As of 2020, St. Lucie West Services District is the only utility in the UEC Planning Area that supplements its reclaimed water. In 2019, the utility supplemented its reclaimed water supply primarily with water from its stormwater management lakes (0.45 mgd) and a small amount of SAS groundwater (0.03 mgd). South Martin Regional Utility historically has supplemented its reclaimed water with SAS groundwater but did not report supplemental flows in 2019.

# WATER STORAGE

Storage is an essential component of any supply system that experiences fluctuation in supply and demand. Capturing excess surface water and groundwater during wet conditions for use during dry conditions increases the amount of available water. Approximately two-thirds of South Florida's annual rainfall occurs during the wet season. Without sufficient storage capacity, much of this water discharges to the ocean through surface water management systems and natural drainage. In the UEC Planning Area, potential water storage options include ASR systems and reservoirs, both of which are considered AWS options.

## Aquifer Storage and Recovery

ASR involves storing stormwater, surface water, fresh groundwater, drinking water, or reclaimed water in an aquifer that has appropriate attributes (e.g., modest transmissivity, intergranular porosity, overlain by a competent confining unit, low ambient water salinity) and subsequently recovering the water. In this process, an aquifer acts as an underground reservoir for injected water. The injected 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 (i.e., stored). The water is pumped back out (i.e., recovered) at a later date for use. The amount of water recovered depends on subsurface conditions, storage time, and water quality. The level of treatment required during recovery, if any, depends on the intended use of the water (e.g., public consumption, irrigation, surface water augmentation, wetlands enhancement).

The volume of water made available through ASR depends on several factors, including well yield, water availability, aquifer characteristics, variability in water supply and demand, and use type. There are uncertainties that need to be addressed with the implementation of ASR systems, but this storage option has the potential to retain substantial quantities of water that otherwise would be lost to the ocean, deep well injection, or evaporation.

Most of the ASR systems in the District have been built by PS utilities to store potable water during periods of low seasonal demand for subsequent recovery during periods of high demand. To date, one ASR exploratory well and an associated monitor well have been constructed (Port Mayaca) within the UEC Planning Area. The SFWMD has conducted aquifer performance testing on this exploratory well. Ten ASR wells are proposed (by the City of Port St. Lucie Utility Systems Department) at the McCarty Ranch Preserve and Water Treatment Plant site (expected start date of December 2032). The SFWMD, in cooperation with the United States Army Corps of Engineers, is pursuing regional ASR systems as part of the Comprehensive Everglades Restoration Plan (CERP). Further information about these projects is provided in **Chapter 7**.

## Local and Regional Reservoirs

Surface water reservoirs store water primarily captured during wet weather conditions for use during the dry season and are considered an AWS source. Water typically is captured from rivers or canals and stored in aboveground or in-ground reservoirs, which are referred to as off-stream reservoirs. Small-scale (local) reservoirs are used by agricultural operations to store recycled irrigation water or collect stormwater runoff. These reservoirs also may

provide water quality treatment before off-site discharge. Large-scale (regional) reservoirs are used for stormwater attenuation, water quality treatment in conjunction with stormwater treatment areas, and storage of seasonally available water. Regional storage projects, such as those related to the CERP Indian River Lagoon – South Project (**Chapter 7**), may enhance surface water availability. The recently completed C-44 reservoir and the proposed McCarty Ranch and Grove Land reservoirs are examples of off-stream regional reservoirs in the UEC Planning Area. Water supply development projects designed to capture, treat, and store water are discussed in **Chapter 8**.

## SEAWATER

The use of desalinated seawater from the Atlantic Ocean is an AWS option. The SFWMD does not require water use permits for the use of seawater. One PG facility in the UEC Planning Area uses seawater for cooling purposes (FPL St. Lucie Nuclear Plant). The ocean is an abundant source of water; however, desalination is required before seawater can be used for most water supply purposes. There are no PS utilities currently using or proposing to use seawater by 2045.

Major advances in seawater desalination treatment and efficiencies have occurred over the past decade. As a result, desalination costs are declining; however, the cost of standalone seawater desalination facilities remains higher than brackish water desalination. Co-locating seawater desalination facilities with coastal power plants results in cost savings, decreasing the cost difference compared to other AWS options. Additional information regarding seawater desalination is provided in the 2021-2024 Support Document (SFWMD 2021).

## SUMMARY OF WATER SOURCE OPTIONS

Water users in the UEC Planning Area rely on fresh groundwater and surface water as well as brackish water from the FAS and reclaimed water for urban, agricultural, and industrial uses. Total gross water demands under average rainfall conditions are projected to decrease 3% between 2019 and 2045. Additionally, the total demand projection for 2045 in this 2021 UEC Plan Update is 21% lower than the estimated 2040 demand projected in the 2016 UEC Plan Update. As concluded in previous UEC water supply plan updates, traditional freshwater sources alone are not sufficient to meet projected 2045 water demands; therefore, continued development of AWS sources is needed.

The SAS historically has served as the primary source of water to meet PS demands in the UEC Planning Area. Large-scale expansion of SAS withdrawals is limited due to resource constraints, impacts to existing legal users, potential environmental impacts to natural systems, and possible saltwater intrusion. Therefore, the FAS will continue to provide an increasing portion of the water needed to meet 2045 PS demands. The ECFM results indicate the FAS will be able to meet demands, in terms of volume and water quality.

Surface water and the SAS will remain the primary sources for AG and L/R irrigation. As urban growth occurs, some agricultural land is expected to transition to urban uses. Many existing agricultural areas have water use permits to use fresh groundwater for crop irrigation. While water use permits cannot be directly transferred from one land use type to another, conversion of agricultural lands to another use may result in available fresh

groundwater, consistent with regulatory criteria. In addition, most utilities are proposing to expand reclaimed water distribution systems to new developments for irrigation.

The UEC Planning Area receives an average of 55 inches of rainfall annually; nearly two-thirds of this rainfall occurs during the wet season. Without sufficient storage capacity, much of this water discharges to tide. ASR systems and reservoirs under development as part of CERP will increase storage capacity, and in addition to meeting environmental water needs, will enhance water availability for other uses.

Water source options depend on location, use type, demand, regulatory requirements, and cost. As competition for limited water resources increases, development of AWS sources will also increase. The conclusions of previous plan updates continue to represent the issues considered to meet the 2045 projected water demands within the UEC Planning Area.

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# 6

# Water Resource Analyses

This chapter provides historical data and analyzes the current and future status of water resources in the Upper East Coast (UEC) Planning Area of the South Florida Water Management District (SFWMD or District) as well as their limitations and ability to meet the projected demands described in **Chapter 2**. The issues identified in this chapter may affect the use of existing water resources and the development of new supplies to meet projected water demands for 2045. **Appendix D** provides additional details about climate change, saltwater intrusion, and regional Floridan aquifer system (FAS) modeling. Understanding the effects of meeting water demands through withdrawals from water resources is critical to water supply planning.

TOPICS

- Summary of Issues Identified for 2045
- Evaluation and Analysis
- Surface Water Availability
- Groundwater Availability
- Climate Change and Sea Level Rise
- Summary of Water Resource Analyses

## SUMMARY OF ISSUES IDENTIFIED FOR 2045

Fresh groundwater, in conjunction with currently permitted surface water, is not adequate to meet the growing needs of the UEC Planning Area during 1-in-10-year drought conditions. As a result, water users from several use categories are expanding their use of alternative water supply (AWS) sources. Most Public Supply (PS) utilities are using the FAS to meet a portion of their current demands and to meet increases in demands through 2045. To meet greenspace irrigation demands, the use of reclaimed water is projected to increase in the UEC Planning Area. In addition, continued decreases in irrigated agricultural acreage and associated demands have resulted in reduced demands on surface water sources. Finally, the C-44 reservoir and stormwater treatment area (STA) are nearing completion and Indian River Lagoon South (IRL-S) Project components will capture excess surface water discharges for later release, which will enhance water availability for water supply purposes (**Chapter 7**).

The issues identified in this 2021 UEC Plan Update are consistent with those in previous plan updates. The following issues continue to influence water supply planning efforts in UEC Planning Area:

- Increased withdrawals from the surficial aquifer system (SAS) are limited by low aquifer productivity, potential impacts on wetlands and existing legal water uses and the potential for saltwater intrusion. New or increased allocations will be evaluated on an application-by-application basis to determine if a project meets water use permitting criteria.
- Peak discharges of surface water during the wet season are affecting the ecological health of the St. Lucie River and Indian River Lagoon.
- Regulatory limitations prohibit additional surface water allocations from the C-23, C-24, and C-25 canals and from Lake Okeechobee and the Lake Okeechobee Service Area (LOSA).
- Withdrawals from the FAS are expected to increase to meet future demands. Monitoring water levels and water quality in the FAS will be needed to ensure long-term sustainability of the resource.
- Climate change and sea level rise could impact the UEC Planning Area.

Previous water supply plan updates identified a variety of AWS projects to prevent water resource impacts, avoid competition among water users, and provide a sustainable supply of water. AWS projects include the use of reclaimed water, storage of water using aquifer storage and recovery (ASR) wells and reservoirs, and development and use of brackish water sources.

While development of fresh groundwater is limited in many areas of the UEC Planning Area, it may be available in some places. As urban growth occurs, some agricultural land is expected to transition to urban community uses. While water use permits cannot be directly transferred from one land use type to another, conversion of agricultural lands to another use may result in available fresh groundwater and surface water.

# EVALUATION AND ANALYSIS

When developing this water supply plan update, data and information from many sources were considered. The following information sources were used to evaluate water resources in the UEC Planning Area, including their availability and ability to meet projected demands considering the issues listed above:

- Water use permits and permit applications
- Water supply demand projections for 2045
- Hydrologic data for the SAS and FAS from monitor wells
- Updated results from the East Coast Floridan Model (ECFM) using 2019 and 2045 demands
- Updated saltwater interface maps for Martin and St. Lucie counties
- Input from planning area stakeholders and the public
- Water Supply Facilities Work Plans and capital improvement elements from local governments
- Activities and progress since the 2016 UEC Plan Update, including water supply diversification
- Data and information from the Comprehensive Everglades Restoration Plan (CERP), including status of CERP projects

Based on information from the aforementioned sources, issues identified in the 2016 UEC Plan Update were determined to be applicable for this 5-year plan update. The projected 2045 gross water demands for all water use categories in this plan update are 21% less than the projected 2040 demands in the 2016 UEC Plan Update (**Chapter 2**). The decrease in total projected demand is due to decreases in Agriculture (AG) demands. As a result, the findings and conclusions of previous plan updates are considered conservative but still representative of current and projected scenarios.

# SURFACE WATER AVAILABILITY

In the UEC Planning Area, surface water is primarily used for agricultural and urban irrigation. Notable surface water sources for the region include the C-23, C-24, and C-25 canals, and the C-44 Canal, which is part of the Lake Okeechobee Service Area (LOSA). Resource protection criteria (**Chapter 4**) must be considered when determining the availability of water sources. Surface water use is limited by restricted allocation area (RAA) criteria adopted for Lake Okeechobee and LOSA and for the C-23, C-24, and C-25 canals (**Chapter 4**). The RAA for Lake Okeechobee and LOSA restricts additional allocations from Lake Okeechobee and the integrated conveyance systems that are hydraulically connected to and receive water from Lake Okeechobee, including the C-44 Canal. The RAA for the C-23, C-24, and C-25 canals limits withdrawals to the existing allocations; therefore, these canals cannot be relied on to meet additional future demands. However, use of these surface water bodies has decreased with the decline in agricultural acreage. In the future, some surface water use may be replaced with AWS sources, such as reclaimed water if it becomes available.

In addition to water supply, canals and other surface water bodies are used for flood control, groundwater recharge, and preventing saltwater intrusion, among other uses. Depending on location, water elevations in canals are controlled to meet one or more objectives. Water level monitoring is a key component in managing surface water sources and is performed for a variety of reasons, including the following:

- Freshwater head is measured at coastal canal structures to evaluate potential saltwater intrusion.
- Surface water staff gauges are used to monitor hydroperiods in natural and man-made water bodies (i.e., wetlands).
- Surface water levels in lakes, reservoirs, and canals are measured to guide operations for water supply.
- Surface water levels are used to establish minimum flow and minimum water level (MFL) criteria and monitor compliance with those criteria to protect natural systems.

Several factors were considered when evaluating surface water availability to meet current and future demands in the UEC Planning Area. Based on monitoring data and resource protection criteria (i.e., RAAs, MFLs), surface water use for water supply is limited and is expected to remain so through the planning horizon. Increased future demands in the region likely will be met using groundwater sources.

# GROUNDWATER AVAILABILITY

The SAS and FAS are the major groundwater sources in the UEC Planning Area (**Chapter 5**). The following sections provide data and analyses of water levels and water quality in the SAS and FAS within the UEC Planning Area. The analyses focus on Martin and St. Lucie counties because the portion of Okeechobee County within the planning area lacks continuous long-term monitoring data. Hydrographs for selected SAS and FAS monitor wells are presented to show changes in water levels, using data from the District's DBHYDRO database, which contains historical and current hydrologic, meteorologic, hydrogeologic, and water quality data. In DBHYDRO, monitor wells are identified by a unique DBKey, as shown in the hydrographs below. In addition to the hydrographs, time series plots of chloride concentrations are provided as indicators of water quality. Water quality data in these time series plots are provided by PS utilities as part of their water use permit monitoring requirements. Additional information about PS utilities, including permitted allocations, treatment facilities, and proposed projects, is available in **Appendix B**.

## Surficial Aquifer System Analysis

Water availability from the SAS is affected by the rate of groundwater recharge, low aquifer productivity, potential wetland impacts from groundwater withdrawals, proximity to contamination sources, proximity to saltwater sources, and other existing legal users. Additional limited supplies may be developed and permitted from the SAS depending on local resource conditions, changing land use, and the viability of other supply options. Future strategies to address limits on availability are provided in **Chapter 9**.

### *Surficial Aquifer System Water Levels*

Historically, the SAS has been the primary source of potable water and urban irrigation in the UEC Planning Area. PS utilities use both the SAS and FAS but are meeting increased demands with water from the FAS. SAS monitor well locations in the UEC Planning Area are shown in **Figure 6-1**. For water supply planning purposes, nine SAS monitor wells were chosen as representative of trends in regional water levels (**Table 6-1**). Of these nine wells, four are discussed in this chapter; supplemental hydrographs are presented in **Appendix D**.

The SAS is recharged by infiltration from rainfall and local surface water bodies. Seasonal variations in water levels between the wet and dry seasons are typical in rain-driven shallow aquifers. While the magnitude of these fluctuations may vary from year to year (**Figures 6-2** to **6-5**), overall SAS water levels in the UEC Planning Area appear to be stable.

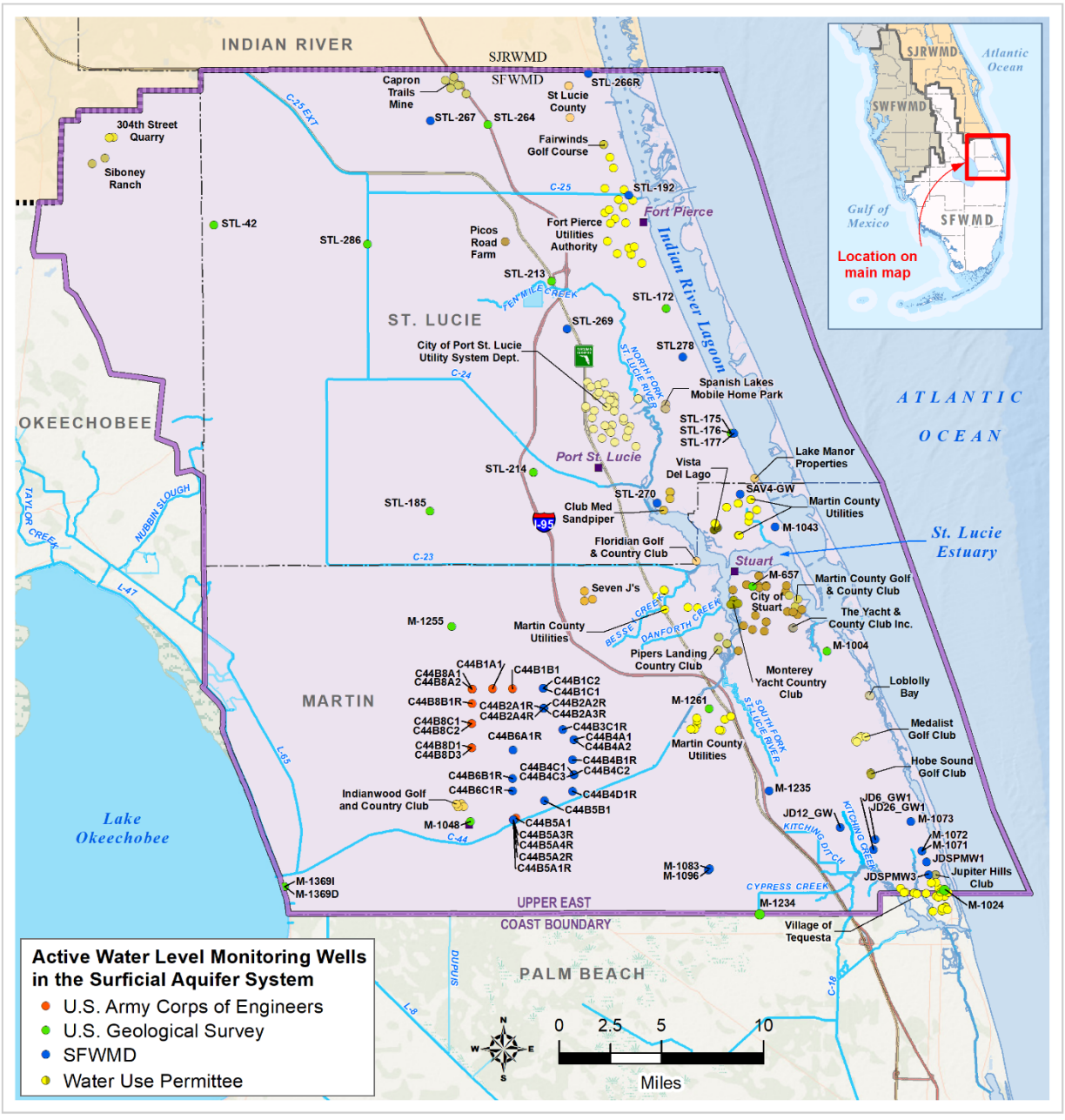



Figure 6-1. Active surficial aquifer system water level monitor wells in the UEC Planning Area.

Table 6-1. Minimum, maximum, and average groundwater levels for select surficial aquifer system wells in the UEC Planning Area.

| Well Name* | Total Depth (ft bls) | Minimum Level (ft NGVD29) | Maximum Level (ft NGVD29) | Average Level (ft NGVD29) | Period of Record |
|---|---|---|---|---|---|
| Martin | | | | | |
| **M-1024** | **83.0** | **0.24** | **10.14** | **2.94** | **01/01/1993 to 03/01/2020** |
| **M-1048** | **80.0** | **24.16** | **34.05** | **29.07** | **09/25/1974 to 01/28/2021** |
| M-1255 | 39.0 | 22.81 | 28.72 | 25.06 | 01/13/1993 to 12/08/2020 |
| SAV4-GW | 22.5 | 7.14 | 15.65 | 11.95 | 01/01/1997 to 01/28/2021 |
| St. Lucie | | | | | |
| STL-42 | 13.0 | 23.72 | 29.74 | 25.46 | 01/01/1993 to 12/15/2020 |
| STL-176 | 30.0 | 10.33 | 18.94 | 14.18 | 01/01/1993 to 12/07/2020 |
| **STL-185** | **118.0** | **20.48** | **27.91** | **24.60** | **01/15/1993 to 08/26/2020** |
| STL-214 | 70.0 | 17.52 | 26.44 | 21.18 | 02/09/1993 to 11/01/2020 |
| **STL-264** | **90.0** | **17.68** | **21.79** | **19.18** | **01/21/1993 to 08/16/2020** |

bls = below land surface; ft = foot; NGVD29 = National Geodetic Vertical Datum of 1929.
* Bolded wells are discussed in this chapter. Hydrographs for the remaining wells are presented in **Appendix D**.

**Figures 6-2** and **6-3** show long-term groundwater levels in monitor wells M-1024 and M-1048, respectively. Both wells show an approximately 10-foot maximum variation in water levels between the annual wet and dry seasons. There also is a subtle increase in dry season water levels over the past 5 years at the coastal M-1024 well, in response to recent wet conditions in the UEC Planning Area.

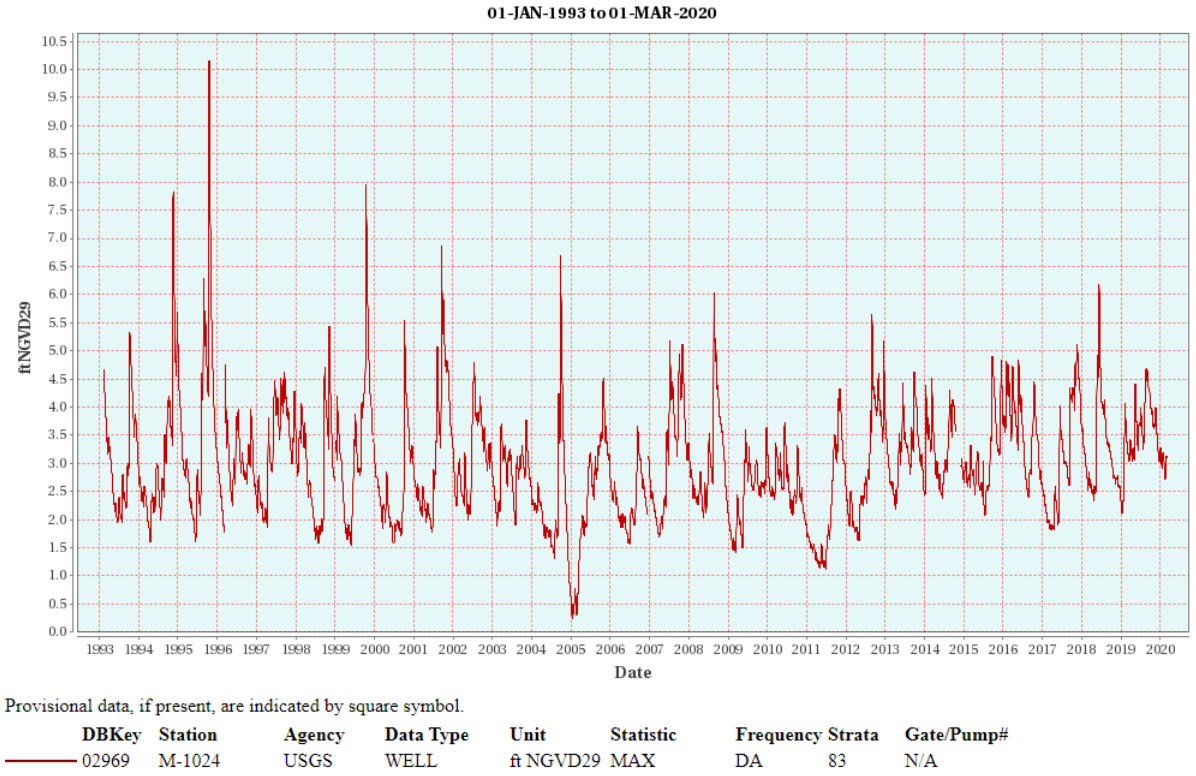



Figure 6-2. Water levels in surficial aquifer system monitor well M-1024, southern coastal Martin County.

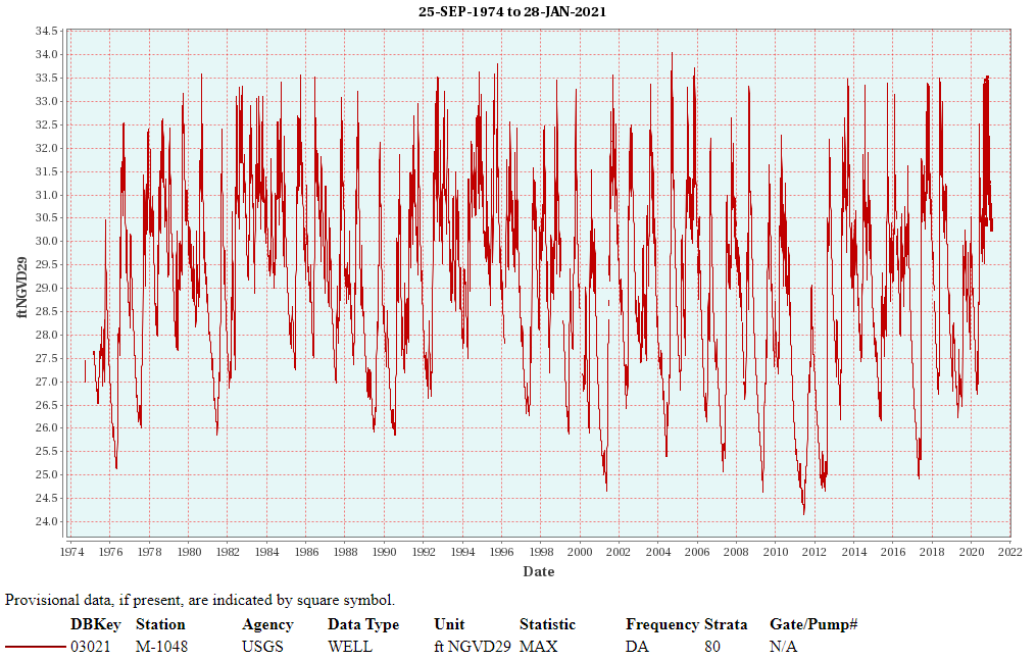



Figure 6-3. Water levels in surficial aquifer system monitor well M-1048, central Martin County.

**Figures 6-4** and **6-5** show long-term groundwater levels in monitor wells STL-185 and STL-264. STL-185 exhibited its lowest water elevation in 2007 (a drought year), and then rebounded to a normal pattern with a maximum fluctuation of nearly 7.5 feet. STL-264 shows seasonal fluctuations as well as decreased water levels during the 2007 drought. The maximum water level fluctuation for the well's period of record is only 4 feet.

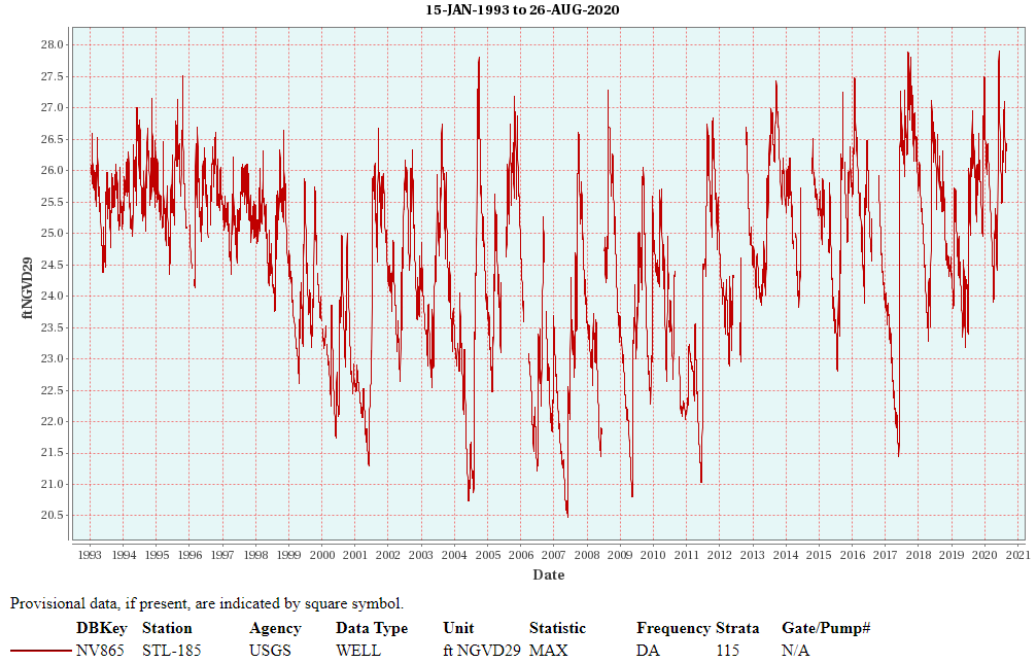



Figure 6-4. Water levels in surficial aquifer system monitor well STL-185, south central St. Lucie County.

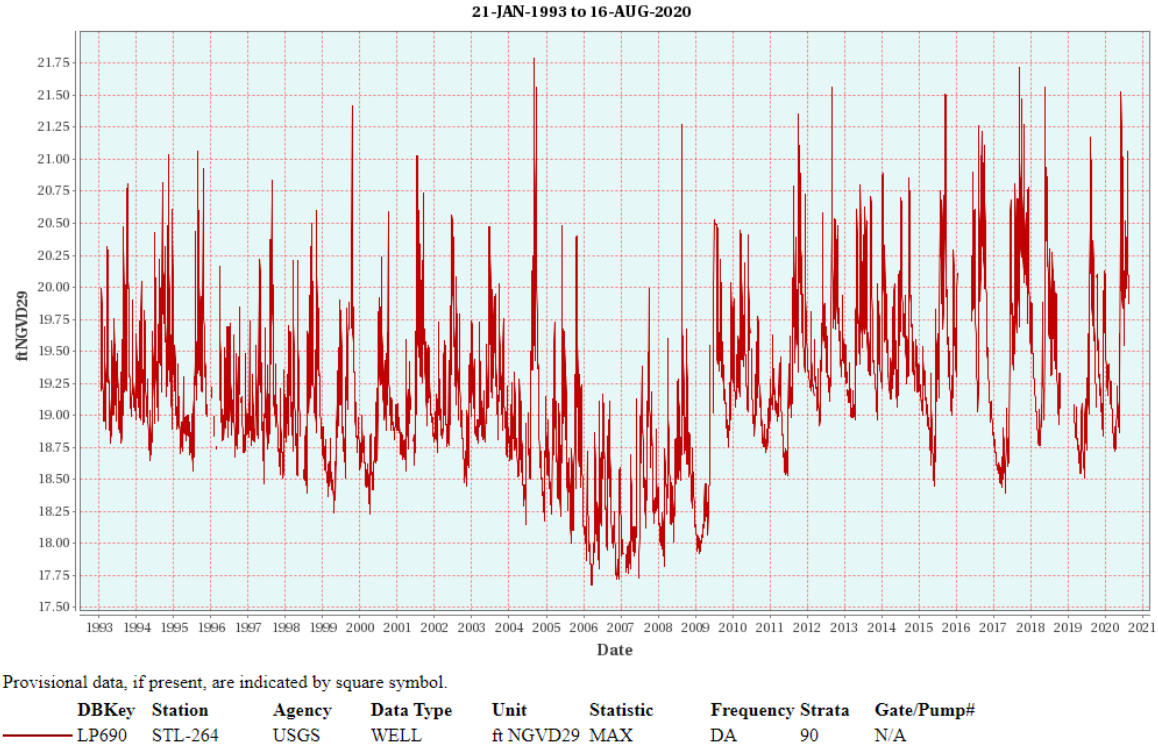



Figure 6-5. Water levels in surficial aquifer system monitor well STL-264, north central St. Lucie County.

## *Surficial Aquifer System Water Quality*

Water quality monitoring is crucial to managing and protecting fresh groundwater sources such as the SAS. Chloride concentration data are used to monitor saltwater intrusion, which can occur from the inland movement of the saltwater interface or the sustained upward movement of deeper saline groundwater (upconing). Chloride concentrations must be below 250 milligrams per liter (mg/L) to meet the drinking water standard (United States Environmental Protection Agency 2021). In the UEC Planning Area, several PS utilities withdraw water from the SAS (**Table 6-2**), and some wellfields are near the coast. Coastal wellfields have the potential to experience lateral saltwater intrusion, and monitor wells are purposely installed to the east as sentinel wells.

Table 6-2. Major Public Supply utilities withdrawing water from the surficial aquifer system.

| Utility | Permit Number | Number of Existing Permitted SAS Production Wells | SAS Allocation (mgd) |
|---|---|---|---|
| Martin County | | | |
| Martin County Utilities | 43-00102-W | 26 | 5.91 |
| South Martin Regional Utility | 43-00066-W | 16 | 4.83 |
| Stuart, City of | 43-00053-W | 23 | 3.67 |
| St. Lucie County | | | |
| Fort Pierce Utilities Authority | 56-00085-W | 42 | 8.00 |
| Port St. Lucie Utility Systems Dept., City of | 56-00142-W | 29 | 5.00 |

mgd = million gallons per day; SAS = surficial aquifer system.

## Martin County Utilities

Martin County Utilities has withdrawn water from the SAS since the 1980s. Most of the utility's SAS monitor wells have reported chloride concentrations of less than 200 mg/L; therefore, only a representative sample is shown in **Figure 6-6**. Overall, chloride concentrations have remained stable since 2009, with chloride concentrations below 250 mg/L. Well B21-SW-2 has shown elevated chloride concentrations, but they have been declining since 2016. Chloride concentrations at well TF-1 have been steadily increasing but remain below 200 mg/L. The utility's other monitor wells show no notable long-term increases in chloride concentrations.

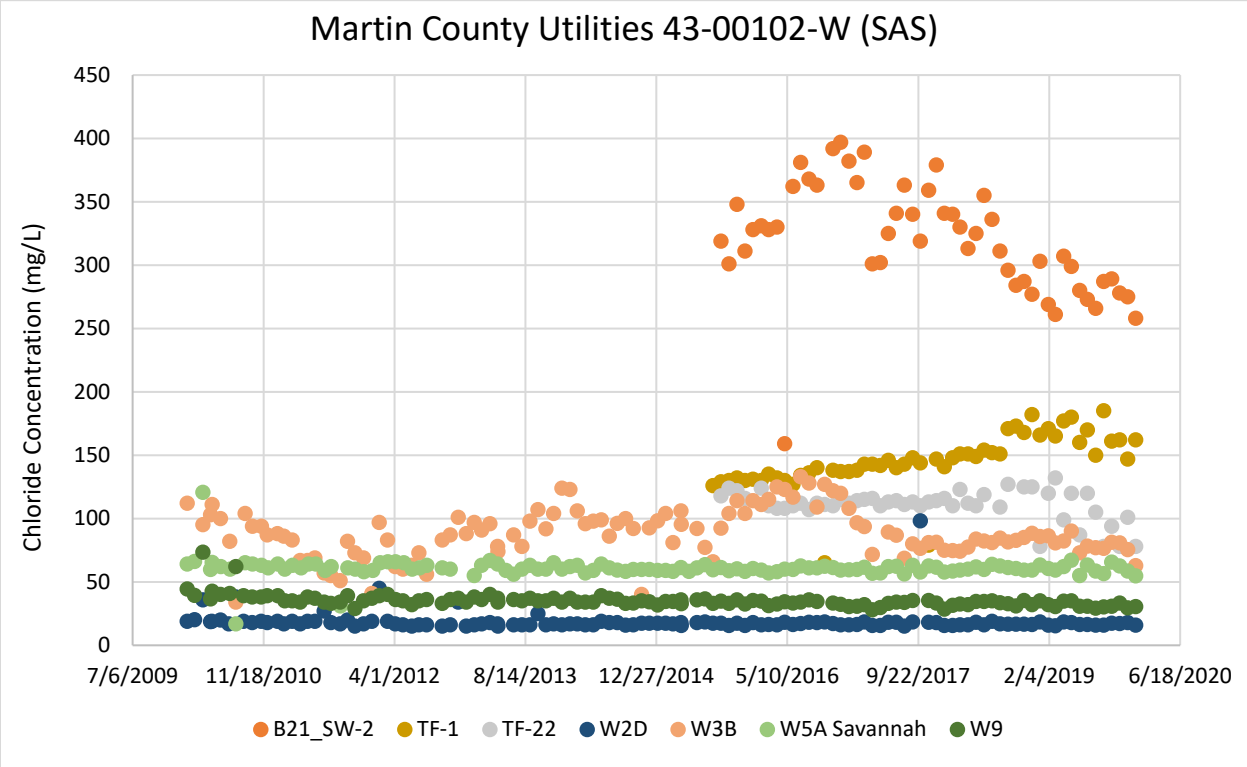



Figure 6-6. Chloride concentration trends at surficial aquifer system wells monitored by Martin County Utilities.

## South Martin Regional Utility

South Martin Regional Utility (previously known as Hobe Sound Water Company and Hydratech Utilities) has used the SAS for water supply since the 1970s. Most of the utility's SAS monitor wells have reported chloride concentrations of less than 200 mg/L; therefore, only a representative sample is shown in **Figure 6-7**. Overall, chloride concentrations have been stable since 2009 and remained below 200 mg/L, except for well SW-3DR. However, well SW-3DR has not shown an increasing trend in chloride concentrations and has remained below 200 mg/L since 2015.

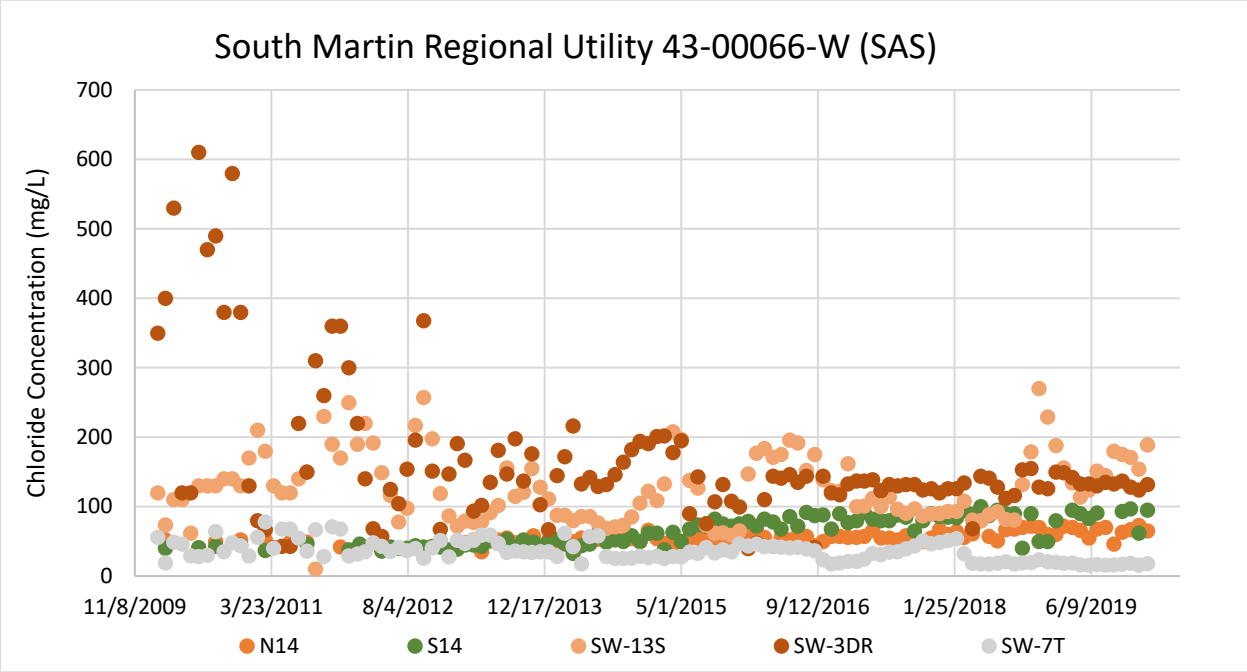



Figure 6-7. Chloride concentration trends at surficial aquifer system wells monitored by South Martin Regional Utility.

## City of Stuart

City of Stuart has obtained its water supply from the SAS since the 1950s. Most of the utility's SAS monitor wells have reported chloride concentrations less than 200 mg/L; therefore, only a representative sample is shown in **Figure 6-8**. Overall, chloride concentrations have remained stable since 2009, with seasonal fluctuations and no notable increases. Wells M-1158 and M-1147 had chloride concentrations greater than 200 mg/L from 2012 to 2018. However, no increasing trend has occurred at either well over the period of record.

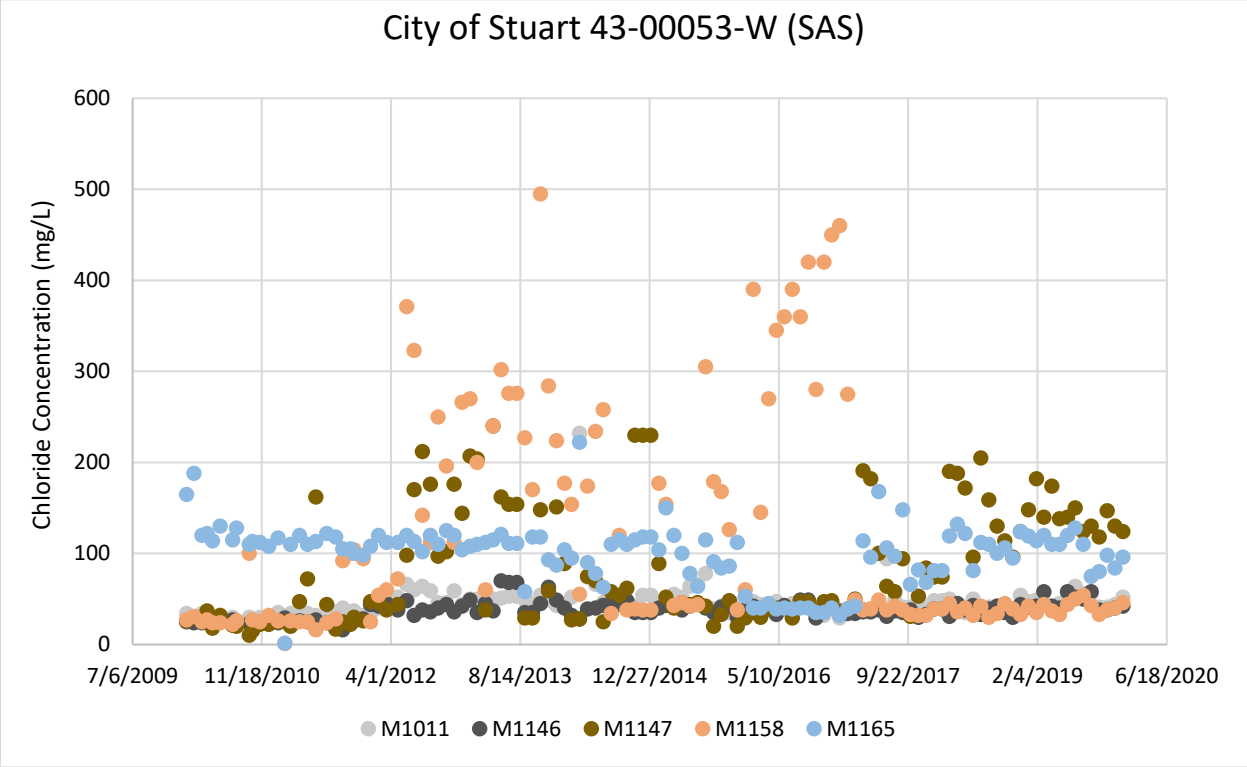



Figure 6-8. Chloride concentration trends at surficial aquifer system wells monitored by City of Stuart.

## Fort Pierce Utilities Authority

Fort Pierce Utilities Authority has obtained a portion of its water supply from the SAS since the 1960s. Most of the utility's SAS wells have reported chloride concentrations less than 100 mg/L; therefore, only a representative sample is shown in **Figure 6-9**. Overall, chloride concentrations have remained stable since 2009. Since 2009, wells FPSW-2 and FPSW-3 have shown large fluctuations in chloride concentrations, from less than 100 mg/L to more than 600 mg/L. However, no increasing trend has occurred at either well over the period of record.

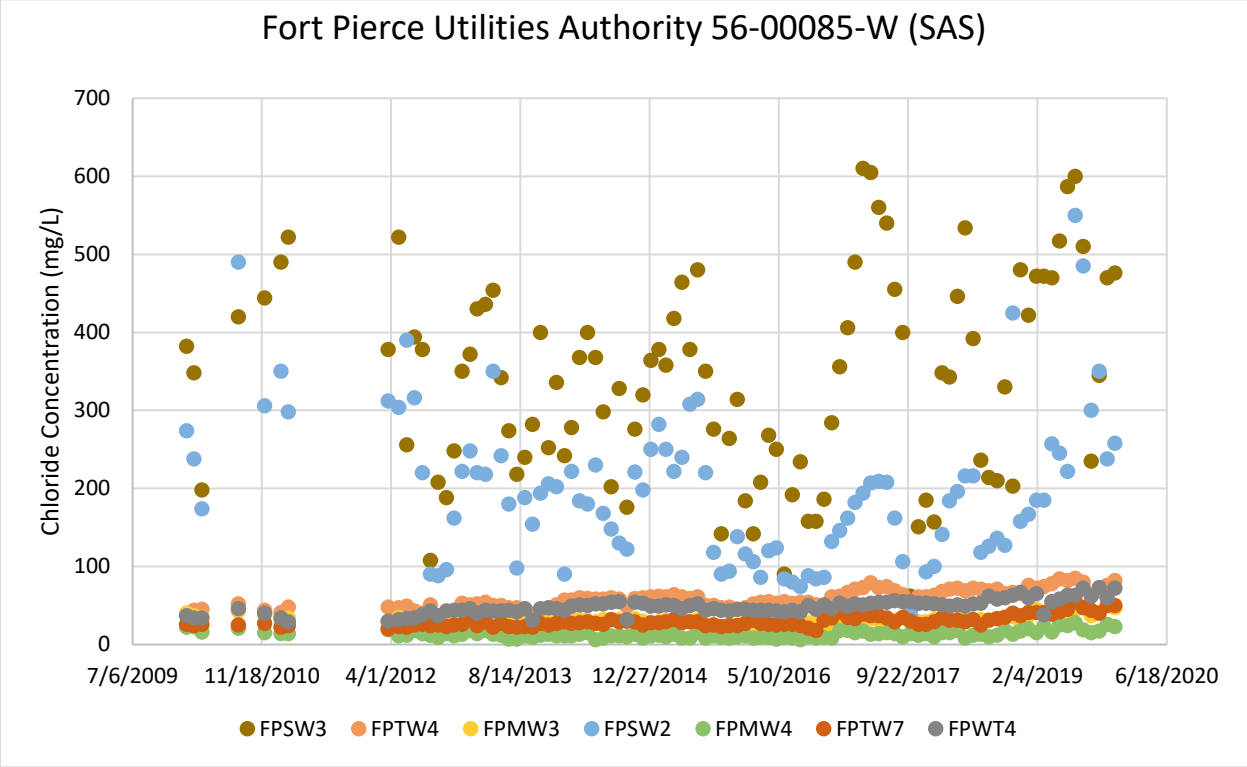



Figure 6-9. Chloride concentration trends at surficial aquifer system wells monitored by Fort Pierce Utilities Authority.

### City of Port St. Lucie Utility Systems Department

The City of Port St. Lucie Utility Systems Department has obtained a portion of its water supply from the SAS since the 1960s. Most of the utility's SAS wells have reported chloride concentrations less than 250 mg/L; therefore, only a representative sample is shown in **Figure 6-10**. In 2019, one well (well 24) had chloride concentrations greater than 250 mg/L, but concentrations have since decreased. Overall, chloride concentrations have remained stable over the period of record.

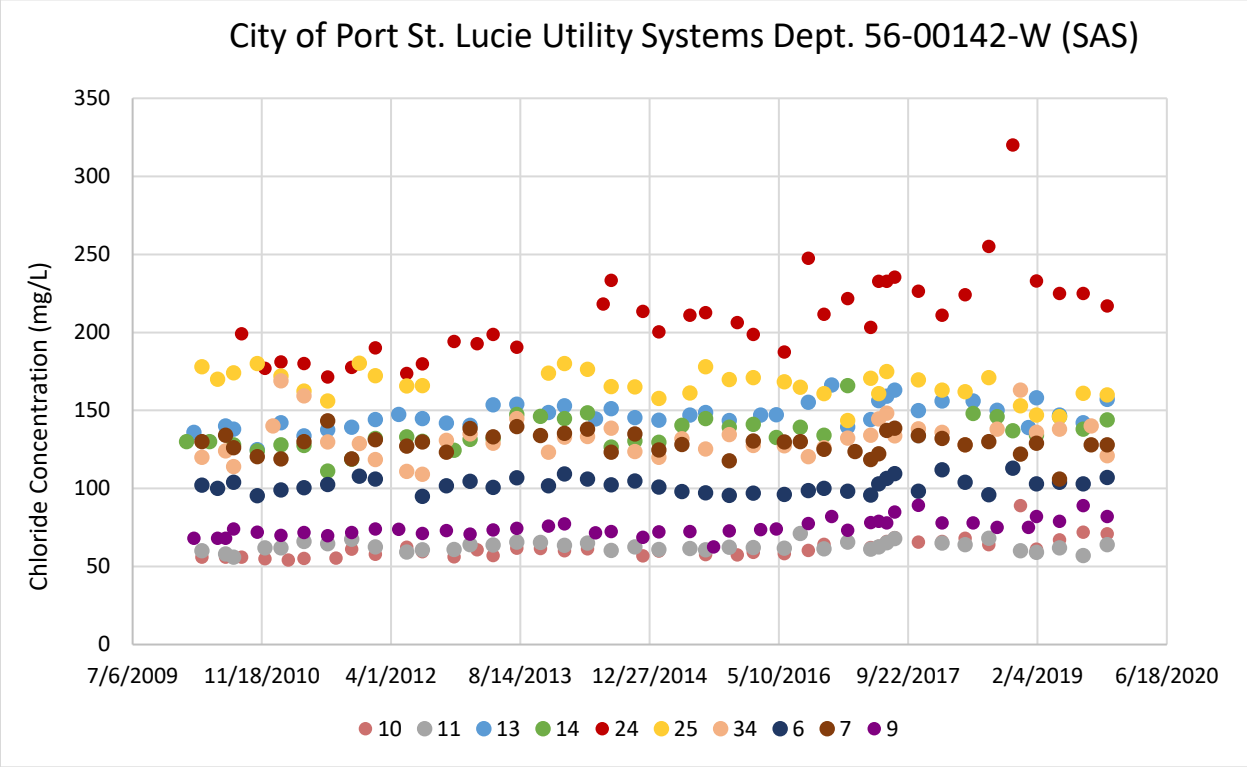



Figure 6-10. Chloride concentration trends at surficial aquifer system wells monitored by the City of Port St. Lucie Utility Systems Department.

## *Surficial Aquifer System Conclusions*

Past and present analyses of the SAS indicate it is a limited water resource in many areas and cannot be the primary source for all projected water demands in the UEC Planning Area without harming the environment or the resource. Water levels and water quality in the SAS appear to be stable at current withdrawal rates. However, AWS sources, such as the FAS, will need to be developed to meet increases in demand.

## Floridan Aquifer System Analysis

The FAS is a productive and important source of water for the PS and AG water use categories in the UEC Planning Area. The FAS is brackish and flows naturally at land surface without the need for pumps (i.e., artesian wells) throughout most of the planning area. There are two water-producing zones in the FAS that are used in this region: Upper Floridan aquifer (UFA) and Avon Park permeable zone (APPZ). Currently, the Lower Floridan aquifer is not used as a water source in the UEC Planning Area due to high chloride concentrations.

Use of the FAS is limited by water quality concerns and regulatory protections. Water availability from the FAS is affected primarily by water quality degradation, which can be managed through appropriate wellfield design and operating protocols. PS utilities can increase well spacing to minimize interference effects, rotate the operation of individual wells to reduce pumping stress, reduce pumping rates, and plug and abandon wells that have shown an increase in chloride concentrations. Most PS utilities are required to monitor water quality at their wellfields as part of their water use permit. Future strategies to address limits on availability are provided in **Chapter 9**. In addition, an RAA was adopted prohibiting pumps on flowing FAS wells in Martin and St. Lucie counties that increase the flow above the natural flow from the well, with some exceptions (**Chapter 4**).

Monitoring provides a better understanding of the hydrogeologic system through long-term systematic data collection, which is needed to evaluate current conditions, detect temporal trends, and develop and calibrate groundwater models. The SFWMD's Regional Floridan Groundwater (RFGW) monitoring program consists of a network of monitor wells completed in the various producing zones (i.e., UFA, APPZ) that track conditions in the FAS, including water levels and water quality, which are crucial to evaluating the water supply potential of the FAS. The RFGW wells are intended to collect background data and thus are located in areas where they are not directly influenced by withdrawals for consumptive use.

### *Floridan Aquifer System Water Levels*

PS utilities are expanding their use of the FAS to meet increased water demands. Due to this increased use, it is important to monitor water levels to identify any impacts to the resource. FAS monitor well locations in the UEC Planning Area are shown in **Figure 6-11**. For water supply planning purposes, nine FAS monitor wells were chosen as representative of trends in regional water levels (**Table 6-3**). Of these wells, seven are co-located wells at three locations and are discussed in this chapter; supplemental hydrographs are presented in **Appendix D**.

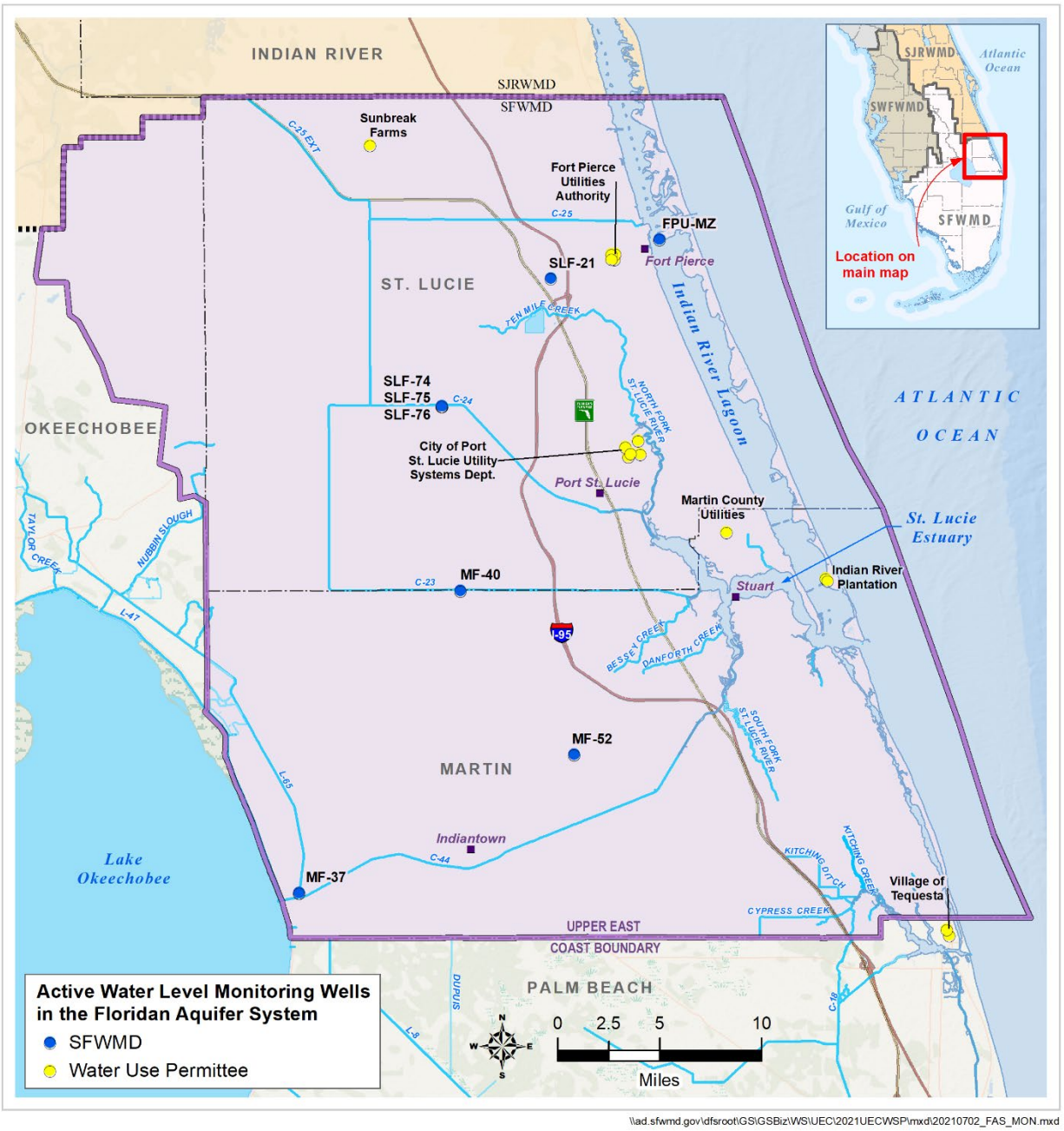



Figure 6-11. Active Floridan aquifer system monitor wells in the UEC Planning Area.

Table 6-3. Floridan aquifer system monitor wells with long-term water level data.

| Well Name | Open Hole Depth Interval (ft bls) | Minimum Level (ft NGVD29) | Maximum Level (ft NGVD29) | Average Level (ft NGVD29) | Period of Record |
|---|---|---|---|---|---|
| Martin | | | | | |
| **MF-37U*** | **765 – 1039** | **50.62** | **54.60** | **52.74** | **05/01/2008 to 06/27/2021** |
| **MF-37L*** | **1,486 – 1,690** | **49.04** | **53.15** | **51.44** | **05/01/2008 to 06/27/2021** |
| **MF-40U*** | **790 – 970** | **46.61** | **51.34** | **49.41** | **02/04/2009 to 06/30/2021** |
| **MF-40L*** | **1,100 – 1,200** | **46.48** | **51.11** | **49.17** | **02/04/2009 to 06/30/2021** |
| MF-52 | 400 – 1,320 | 48.42 | 54.13 | 51.04 | 08/23/2002 to 01/05/2018 |
| St. Lucie | | | | | |
| SLF-21 | 156 – 707 | 30.61 | 38.38 | 35.10 | 08/23/2002 to 06/28/2021 |
| **SLF-74** | **1,068 – 1,450** | **37.25** | **43.60** | **40.83** | **08/20/2002 to 06/28/2021** |
| **SLF-75** | **480 – 700** | **38.10** | **44.32** | **41.36** | **08/20/2002 to 06/28/2021** |
| **SLF-76** | **790 – 860** | **38.14** | **44.25** | **41.53** | **08/20/2002 to 06/28/2021** |

bls = below land surface; ft = foot; NGVD29 = National Geodetic Vertical Datum of 1929.

* Paired well; L denotes the well is open to the Avon Park Permeable Zone, and U denotes the well is open to the Upper Floridan aquifer.

Note: Bolded wells are discussed in this chapter. Hydrographs for the remaining wells are presented in **Appendix D**.

**Figure 6-12** shows long-term groundwater levels for the paired wells MF-40U (open to the UFA) and MF-40L (open to the APPZ). Water levels in the two zones closely track each other, and there is minimal difference between them. This is consistent with a hydrogeologic assessment from this site, which reported minimal confinement between these zones (Sunderland 2008). Both wells show less than 4 feet of variation over the period of record.

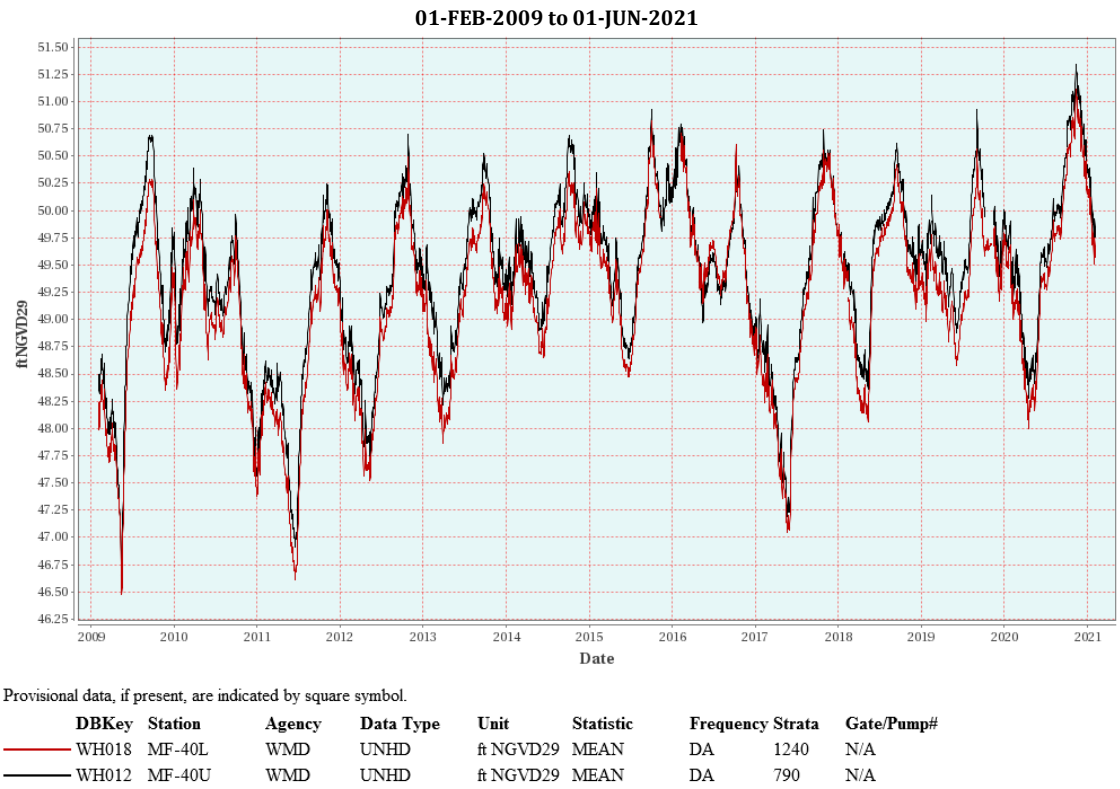



Figure 6-12. Water levels in Floridan aquifer system monitor wells MF-40U and MF-40L, north central Martin County.

**Figure 6-13** shows long-term groundwater levels for the paired wells MF-37U (open to the UFA) and MF-37L (open to the APPZ). Water levels in the two zones closely track each other, but the difference in the water levels between the zones indicates some level of confinement. Both wells show less than 4 feet of variation over the period of record.

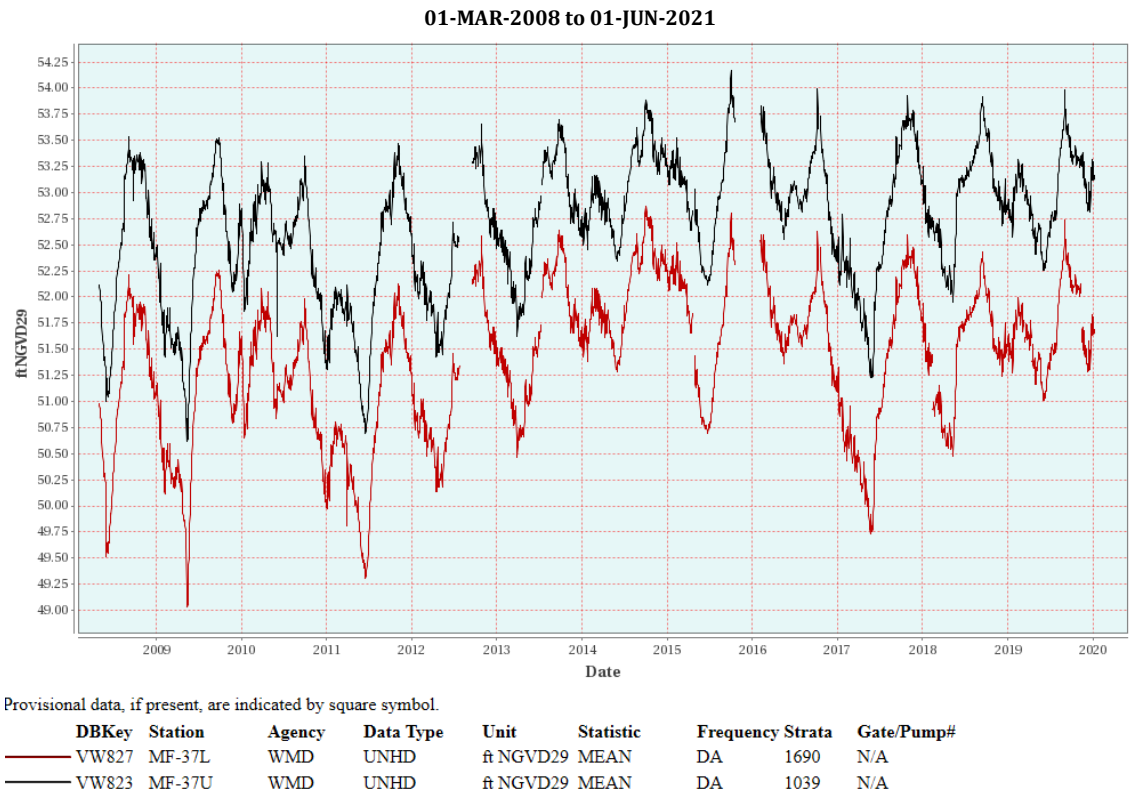
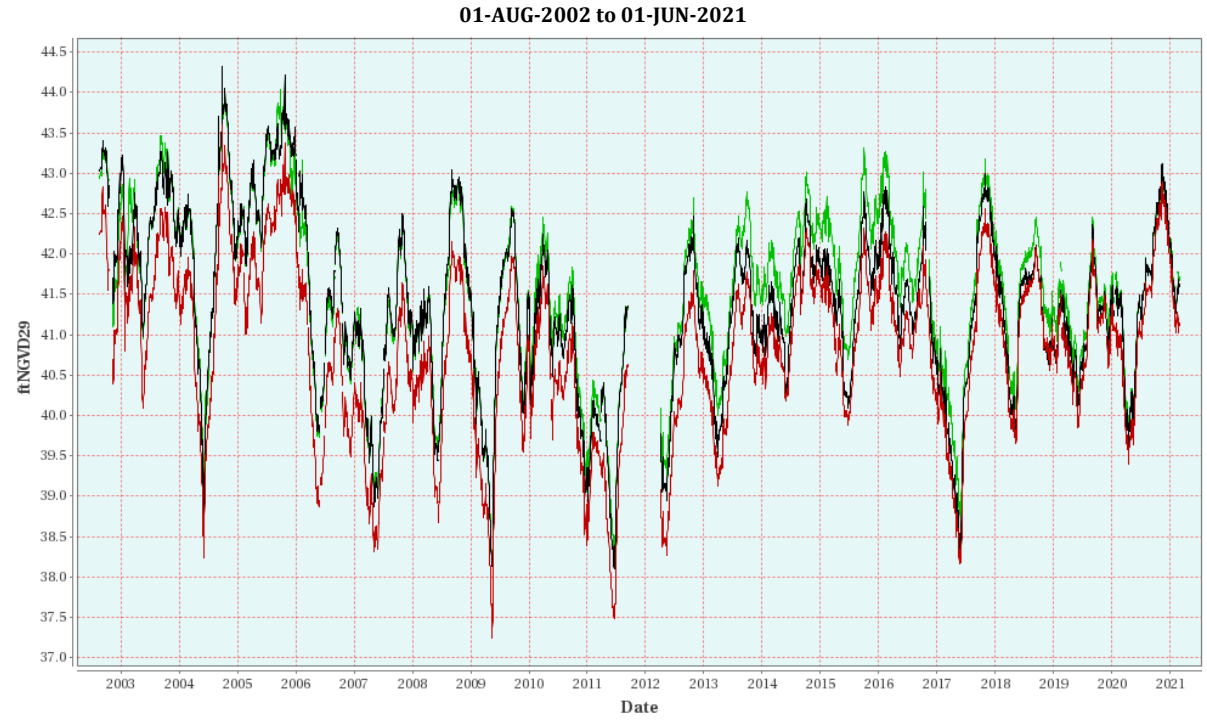



Figure 6-13. Water levels in Floridan aquifer system monitor wells MF-37U and MF-37L, southwestern Martin County.

**Figure 6-14** shows long-term groundwater levels for the three clustered wells SLF-74, SLF-75, and SLF-76, which are open to different zones within the UFA. Water levels in all three flow zones fluctuate in a similar manner. In general, the three wells have not experienced large changes in water levels.

Overall, FAS groundwater levels appear stable, with seasonal and dry year fluctuations. While the magnitude of these fluctuations may vary from year to year, no FAS monitor wells show declining trends.




Provisional data, if present, are indicated by square symbol.

| DBKey | Station | Agency | Data Type | Unit | Statistic | Frequency | Strata | Gate/Pump# |
|---|---|---|---|---|---|---|---|---|
| OH809 | SLF-74 | WMD | UNHD | ft NGVD29 | MEAN | DA | 1450 | N/A |
| OH808 | SLF-75 | WMD | UNHD | ft NGVD29 | MEAN | DA | 700 | N/A |
| OH807 | SLF-76 | WMD | UNHD | ft NGVD29 | MEAN | DA | 860 | N/A |

Figure 6-14. Water levels in Floridan aquifer system monitor wells SLF-74, SLF-75, and SLF-76, central St. Lucie County.

## *Floridan Aquifer System Water Quality*

In the UEC Planning Area, the FAS is brackish and requires desalination treatment prior to potable use. Water quality in the UFA generally is better in the northern and western portions of the UEC Planning Area and degrades to the south and east. The UFA supplies water primarily for PS utilities, and several AG users have permits to withdraw from the UFA for freeze protection or backup supply. While the APPZ is used by several PS utilities in the UEC Planning Area (**Table 6-4**), it requires reverse osmosis treatment to meet drinking water standards. Due to high chloride concentrations, the APPZ is rarely used for AG irrigation. Similarly, the UFA and APPZ are infrequently used for other applications (e.g., urban irrigation, industrial uses, cooling water) due to poor water quality and high treatment costs.

Although chloride concentrations are expected to be high (>250 mg/L) in the FAS, it is important to monitor water quality trends to ensure treatment processes are suitable to deliver fresh drinking water and consumptive uses are not impacting the resource. Increased chloride concentrations suggest that deeper FAS water is being drawn upward into a wellfield. If this should occur, FAS wellfield operations may need to be adjusted to shift pumpage within the wellfield or temporarily cease FAS pumping and instead use SAS wells until water quality stabilizes in the FAS.

Table 6-4. Major Public Supply utilities withdrawing from the Floridan aquifer system.

| Utility | Permit Number | Number of Existing Permitted FAS Wells | FAS Allocation (mgd) |
|---|---|---|---|
| Martin County | | | |
| Martin County Utilities | 43-00102-W | 9 | 15.09 |
| South Martin Regional Utility* | 43-00066-W | 2 | 4.76 |
| St. Lucie County | | | |
| Fort Pierce Utilities Authority | 56-00085-W | 11 | 13.13 |
| Port St. Lucie Utility Systems Dept., City of | 56-00142-W | 19 | 46.38 |

FAS = Floridan aquifer system; mgd = million gallons per day.
* Not required to submit chloride data.

## Martin County Utilities

Martin County Utilities has withdrawn water from the FAS since the 1990s. Chloride concentrations were stable from 2015 to 2019, with seasonal fluctuations (**Figure 6-15**). A notable increase in chloride concentrations occurred at some wells in 2019-2020, but concentrations have since decreased to seasonal levels.

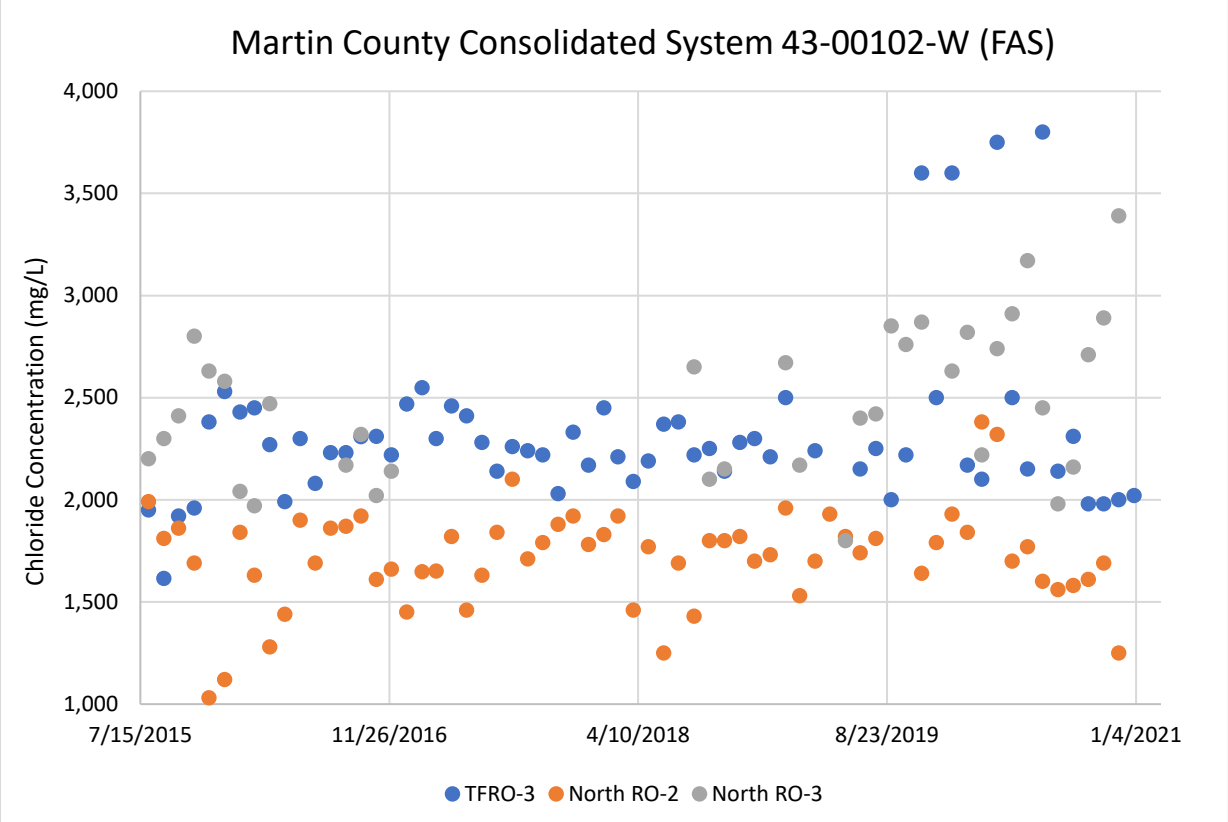



Figure 6-15. Chloride concentration trends at Floridan aquifer system well TFRO-3, North RO-2, and North RO-3 (open to the Upper Floridan aquifer and Avon Park permeable zone), monitored by Martin County Utilities.

## Fort Pierce Utilities Authority

Fort Pierce Utilities Authority has withdrawn water from the FAS since the late 1980s. Chloride concentrations have been stable since 2009, with seasonal fluctuations (**Figure 6-16**). An upward trend in chloride concentrations occurred from 2017 to 2019 but has since decreased.

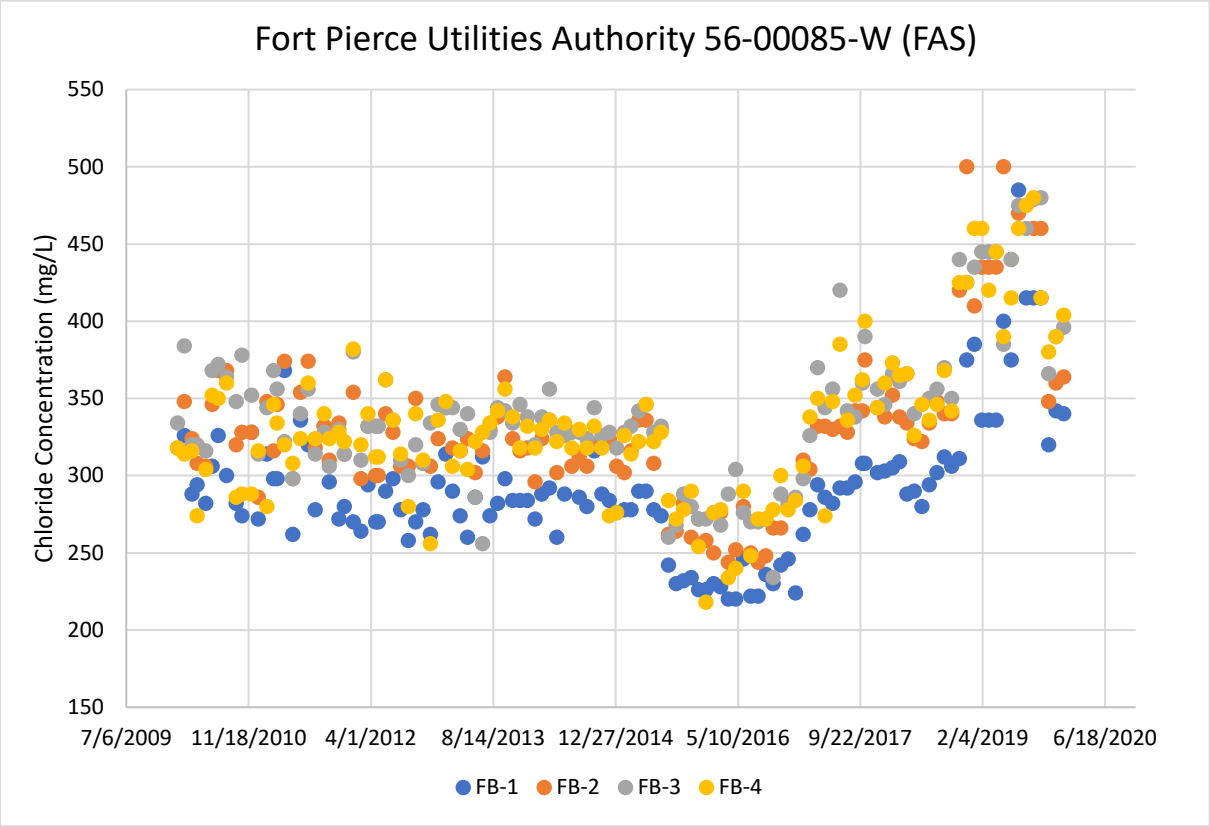



Figure 6-16. Chloride concentration trends at Floridan aquifer system wells FB-1 (open to the Upper Floridan aquifer) and FB-2 through FB-4 (open to the Upper Floridan aquifer and Avon Park permeable zone) monitored by Fort Pierce Utilities Authority.

## City of Port St. Lucie Utility Systems Department

The City of Port St Lucie Utility System Department has withdrawn water from the FAS since the early 2000s. Most of the utility's FAS wells have reported chloride concentrations less than 2,000 mg/L; therefore, only a representative sample is shown in **Figure 6-17.** Chloride concentrations have been stable since 2009 in the majority of wells, with seasonal fluctuations. A notable upward trend in chloride concentrations began in 2014, but concentrations in most wells have since stabilized or decreased.

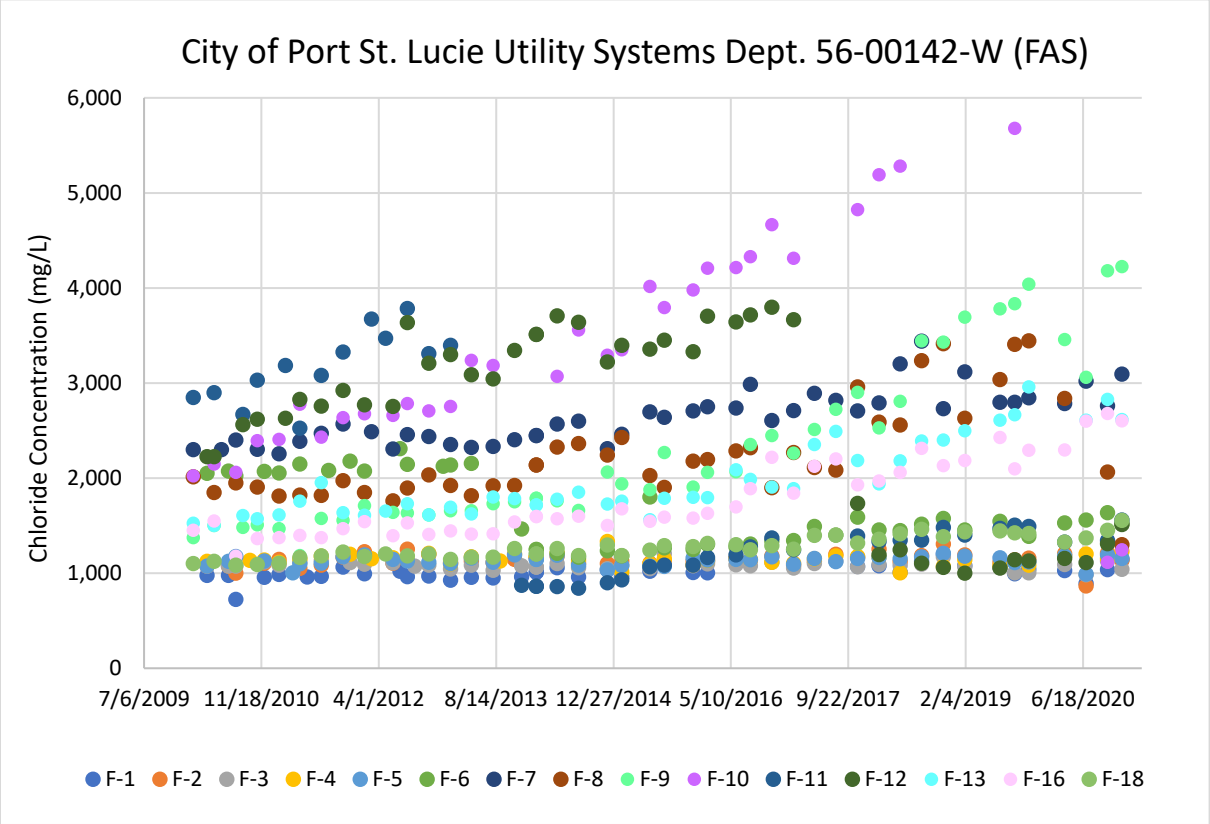



Figure 6-17. Chloride concentration trends at Floridan aquifer system wells F-6, F-9, and F-10 to F-12 (open to the Upper Floridan aquifer) and wells F-1 to F-5, F-7, F-8, F-13, F-16, and F-18 (open to the Upper Floridan aquifer and Avon Park permeable zone) monitored by the City of Port St. Lucie Utility Systems Department.

### *Floridan Aquifer System Modeling*

The East Coast Floridan Model (ECFM) simulates regional groundwater levels, flows, and water quality (total dissolved solids) changes in the FAS in response to withdrawals. The SFWMD used the ECFM to simulate 2019 and 2045 demands from the FAS in the UEC Planning Area. Reported pumpage or estimated data were used for 2019 withdrawals, and 2045 withdrawals were obtained from the estimated demands identified in **Chapter 2** and **Appendix A.** Water level changes between 2019 and 2045 are shown in **Figures 6-18** and **6-19**. Water quality changes between 2019 and 2045 are shown in **Figures 6-20** and **6-21**.

Based on the model results, minimal changes in water levels and quality in the UFA and APPZ are expected for most of the model domain from the 2019 scenario to the 2045 scenario. In the APPZ, the 2019 scenario modeling results indicate a change of 500 to 1,000 mg/L of total dissolved solids can be expected in central and eastern Martin County and southeastern St. Lucie County over the 24-year simulation period. There are some isolated areas with potential issues (e.g., decreases in water levels, increases in total dissolved solids) that may require further evaluation. For example, in the northeastern portion of the planning area, there is a notable decrease in water levels and increase in total dissolved solids in the UFA (**Figures 6-18** and **6-20**).

Review of historical data and the ECFM results concluded that properly designed and managed FAS wellfields appear able to meet projected demands through 2045 in the UEC Planning Area. The ECFM simulations and analyses conducted to support this plan update are considered conservative and provide insight to potential water level and water quality changes that may occur in the FAS if no wellfield design or operations plan is implemented to minimize the movement of poor-quality water. The FAS will continue to provide a substantial and increasing portion of the water needed to meet the projected 2045 demands. Water quality should remain adequate for all users with reverse osmosis treatment, as needed. Additional graphics and a detailed discussion of the ECFM results, conclusions, and recommendations are provided in **Appendix D** and the model technical report (Billah et al. 2021).

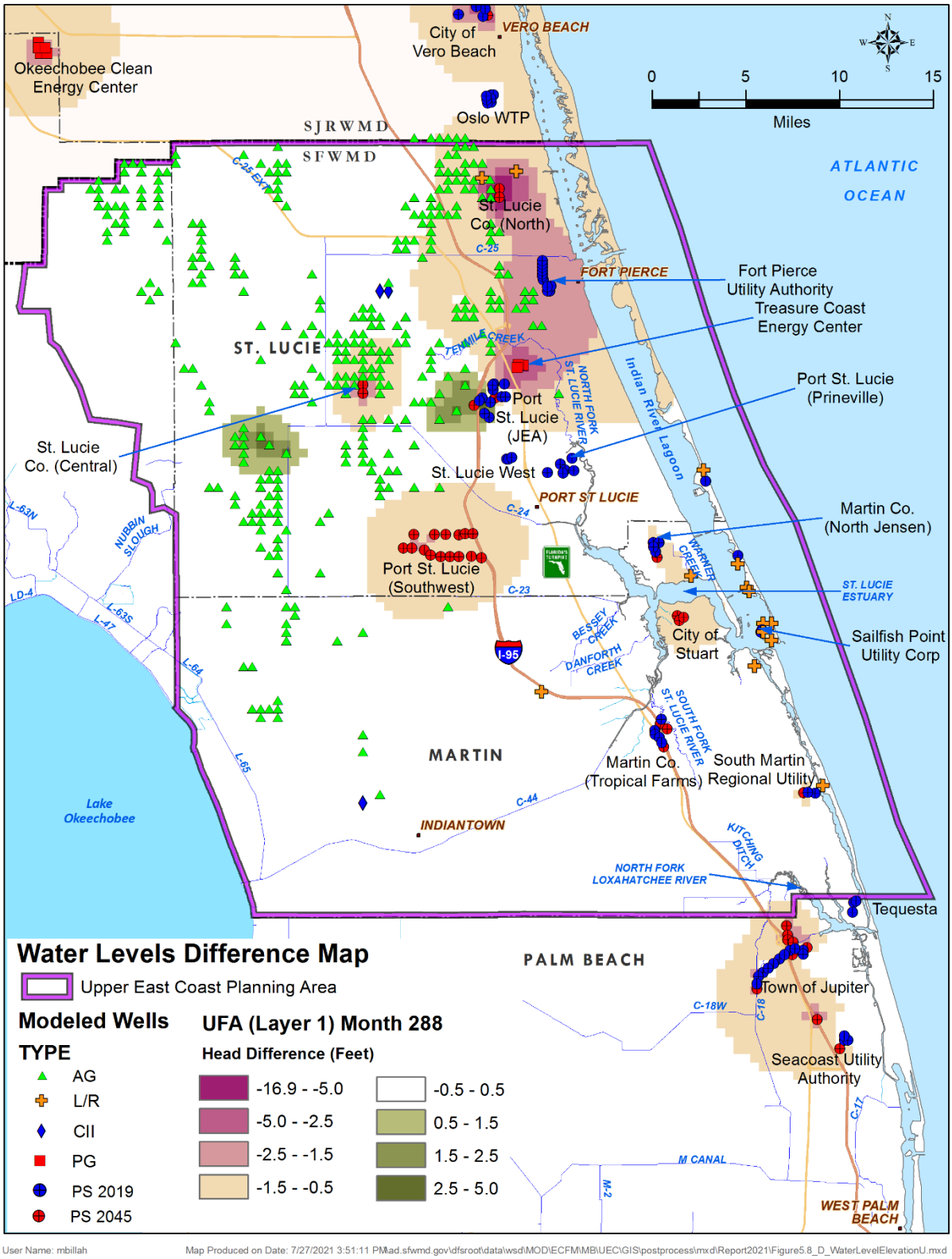



Figure 6-18. Water level changes (head difference) in the Upper Floridan aquifer between 2019 and 2045.

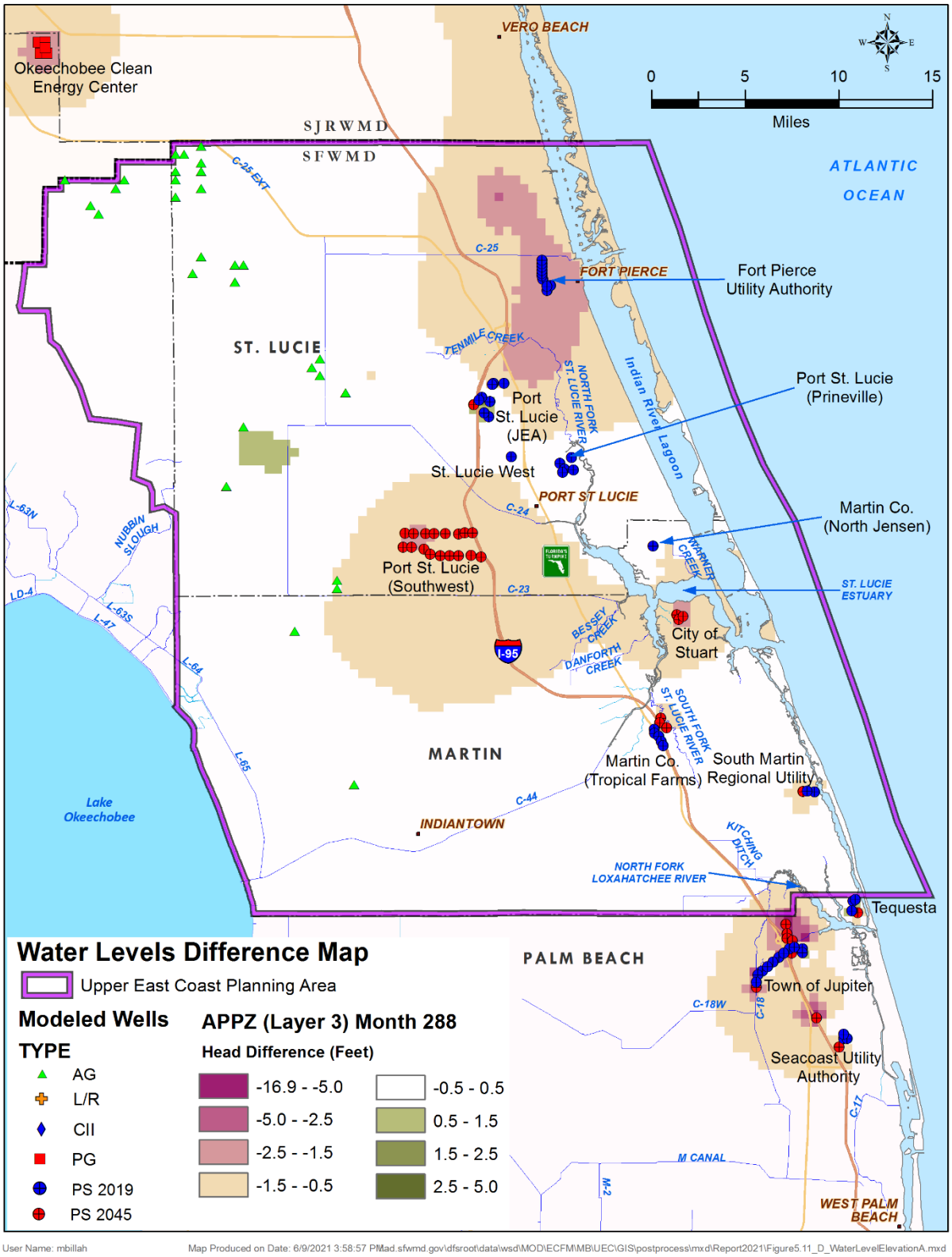



Figure 6-19. Water level changes (head difference) in the Avon Park permeable zone between 2019 and 2045.

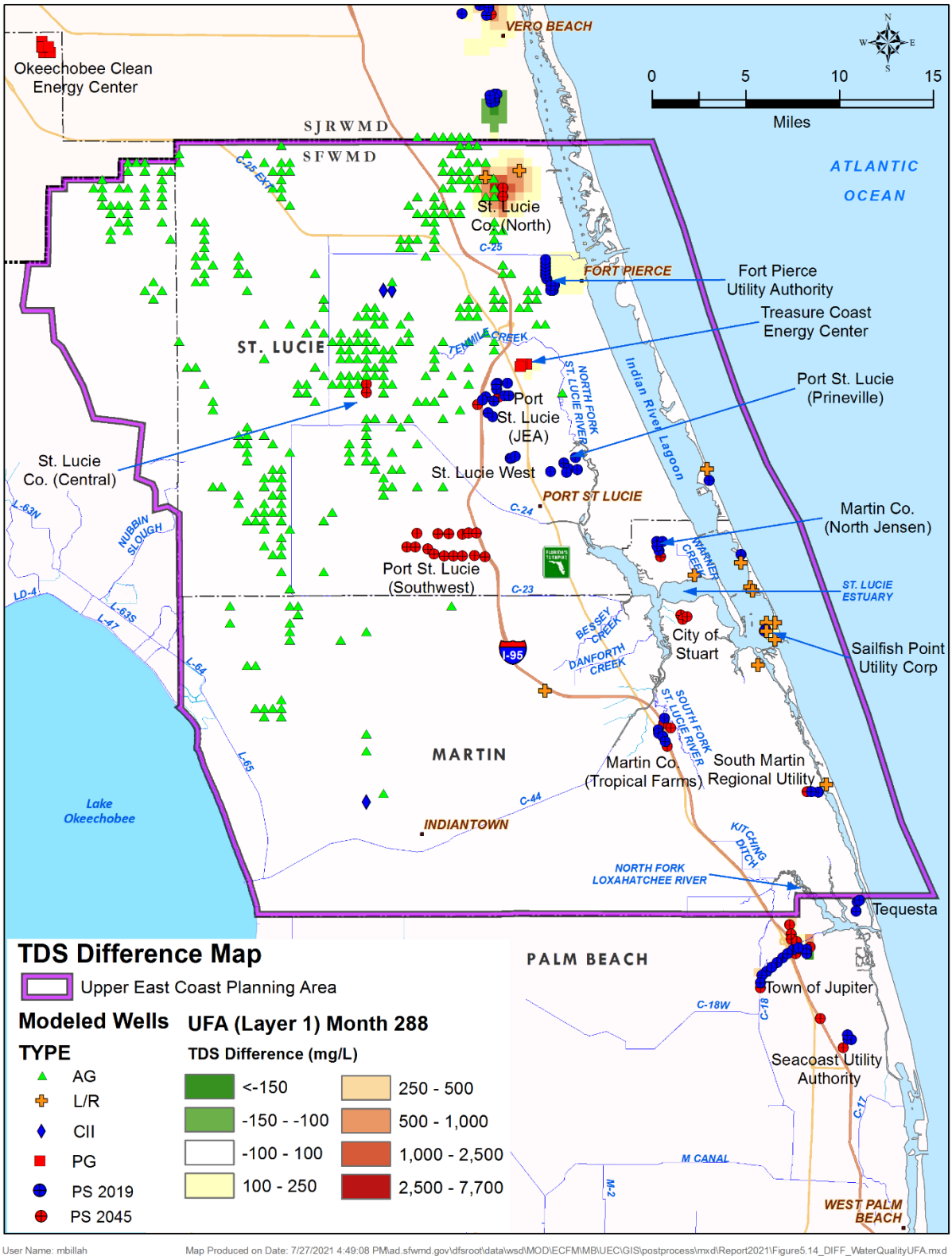



Figure 6-20. Water quality (total dissolved solids) changes in the Upper Floridan aquifer between 2019 and 2045.

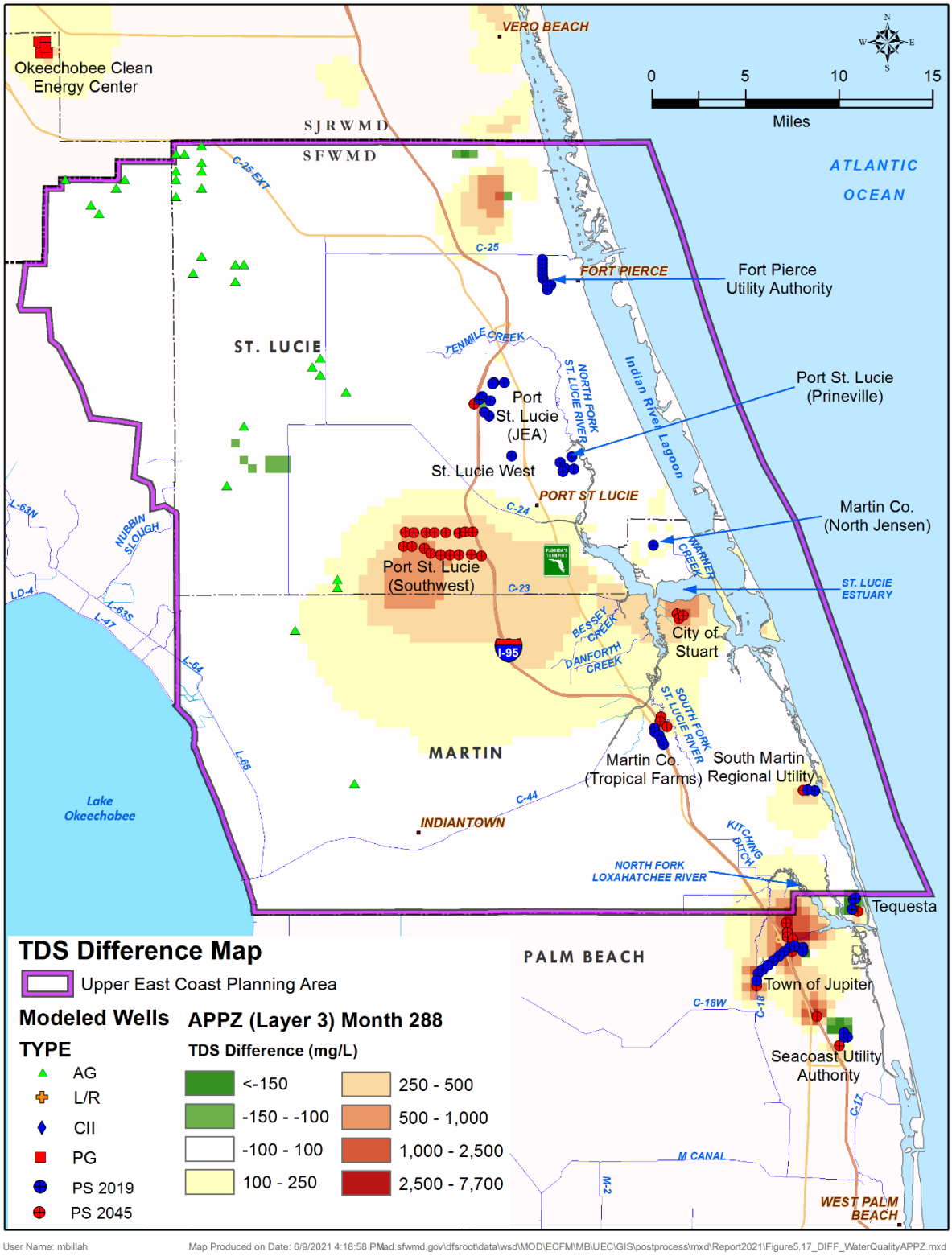



Figure 6-21. Water quality (total dissolved solids) changes in the Avon Park permeable zone between 2019 and 2045.

### *Floridan Aquifer System Conclusions*

Review of recent data and modeling results indicates the FAS can meet current and projected demands through 2045 with proper wellfield management. Water levels in the FAS appear stable at current withdrawal rates. Chloride concentration trends show FAS wellfields have experienced some water quality degradation after several years of operation, which is likely to continue. Water quality degradation can be minimized by PS utilities through the following activities:

- Maximizing well spacing to reduce interference effects and stress on the FAS.
- Plugging and abandoning individual wells experiencing chloride concentration increases and replacing them with new wells elsewhere in the wellfield area.
- Partially back-plugging individual wells to isolate deeper poor-quality layers from overlying higher-quality layers, thereby keeping the wells in operation.
- Reducing pumping rates at individual wells to minimize the potential for poor-quality water to be pulled into the well's production zone from below.
- Rotating the operation of individual wells to reduce pumping stress and the potential influx of poor-quality water from below.
- Installing additional monitor wells to provide early warning of upconing or lateral movement of poor-quality water.

## CLIMATE CHANGE AND SEA LEVEL RISE

Climate change is an issue of concern globally and especially in coastal regions such as South Florida. Because of its location, climate, hydrology, geology, topography, natural resources, and dense coastal populations, South Florida is particularly vulnerable to the effects of future changes in climate, including sea level rise. The nature and rate of change are highly uncertain, particularly at regional scales, but effects of sea level rise are already being experienced in South Florida.

Sea level rise affects flood control operations at coastal structures and contributes to inland movement of salt water into aquifers. In addition, increased air temperatures and changes in precipitation regimes and storm frequency associated with climate change could result in greater evaporation, longer drought periods, and higher risk of flooding throughout South Florida. These changes could affect regional water resources and planning and thus need to be considered when evaluating the ability of water supplies to meet future demands.

The SFWMD is responsible for managing and protecting water resources in South Florida by balancing and improving flood control, water supply, water quality, and natural systems. Over the last decade, the SFWMD has implemented strategies to adapt its operations and infrastructure to ensure this mission continues to be met under changing climate conditions. The SFWMD's approach focuses on assessing how sea level rise and extreme events, including flood and drought events, are likely to happen under current and future climate conditions. In addition, the SFWMD is working to ensure its resiliency planning is based on the best available science. These efforts require collaboration and cooperation with local governments; other regional, state, and federal agencies; universities; nongovernmental entities; a wide array of stakeholders; and concerned citizens throughout South Florida.

Coordination is essential because effective solutions and adaptations require action across multiple agencies and administrative boundaries. Additional information regarding climate change and sea level rise is provided in **Appendix D**.

## Sea Level Rise and Saltwater Intrusion

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 and irrigation supplies. Sea level rise is anticipated to exacerbate the situation.

Most PS utilities in the UEC Planning Area use the SAS for all or part of their water needs, and several utilities have limited ability to desalinate water. Therefore, many utilities are required by their water use permit to maintain a network of SAS monitor wells to identify possible inland movement of the saltwater interface. The four largest utilities using SAS wellfields near tidal surface waters are City of Stuart, South Martin Regional Utility, Martin County Utilities, and Fort Pierce Utilities Authority. Except the City of Stuart, these utilities currently use the FAS and reverse osmosis treatment plants to meet a portion of their demands. The City of Stuart is installing FAS wells to be used in conjunction with a new reverse osmosis treatment facility to meet a portion of its future demands.

## Saltwater Interface Mapping

Saltwater intrusion monitoring is an important component of water management and water supply planning. For example, if coastal wellfields are over pumped, salt water can be drawn into the wells, resulting in the need to shut down operations, relocate wellfields, or develop AWS sources. The SFWMD periodically develops maps estimating the position of the coastal saltwater interface (250 mg/L isochlor line) using salinity data to identify wellfields and coastal aquifers that could be affected. Salinity data from monitor wells are compiled from multiple sources (e.g., United States Geological Survey, SFWMD, water use permittees) and contoured to estimate the position of the saltwater interface.

To date, three series of maps have been developed (2009, 2014 and 2019), with plans to update the maps every 5 years. This approach tracks the position of the saltwater interface over time, can be used to identify areas of concern that may need additional monitoring, and may suggest the need for changes in wellfield operations. The SFWMD's saltwater interface monitoring and mapping program is described by Shaw and Zamorano (2020). The 2019 maps are available on the SFWMD's website at https://www.sfwmd.gov/documents-by-tag/saltwaterinterface. **Appendix D** provides a discussion of PS utilities that have wells or wellfields near the saltwater interface and are potentially vulnerable to saltwater intrusion during drought conditions.

There were 206 monitor wells evaluated for the 2019 St. Lucie and Martin County SAS isochlor map. There has been little movement of the saltwater interface in this region, as evidenced by all three isochlor lines (2009, 2014, and 2019) overlapping in much of the mapped area (**Figure 6-22**). In general, the 2019 maps are similar to the 2014 maps; however, relatively small differences indicate the interface is regionally dynamic, with inland movement in some areas and seaward movement in other areas. Local-scale investigation of the saltwater interface position could be warranted in some areas, depending on the network of monitor wells available, the proximity of salt water to wellfield locations, and withdrawal rates.

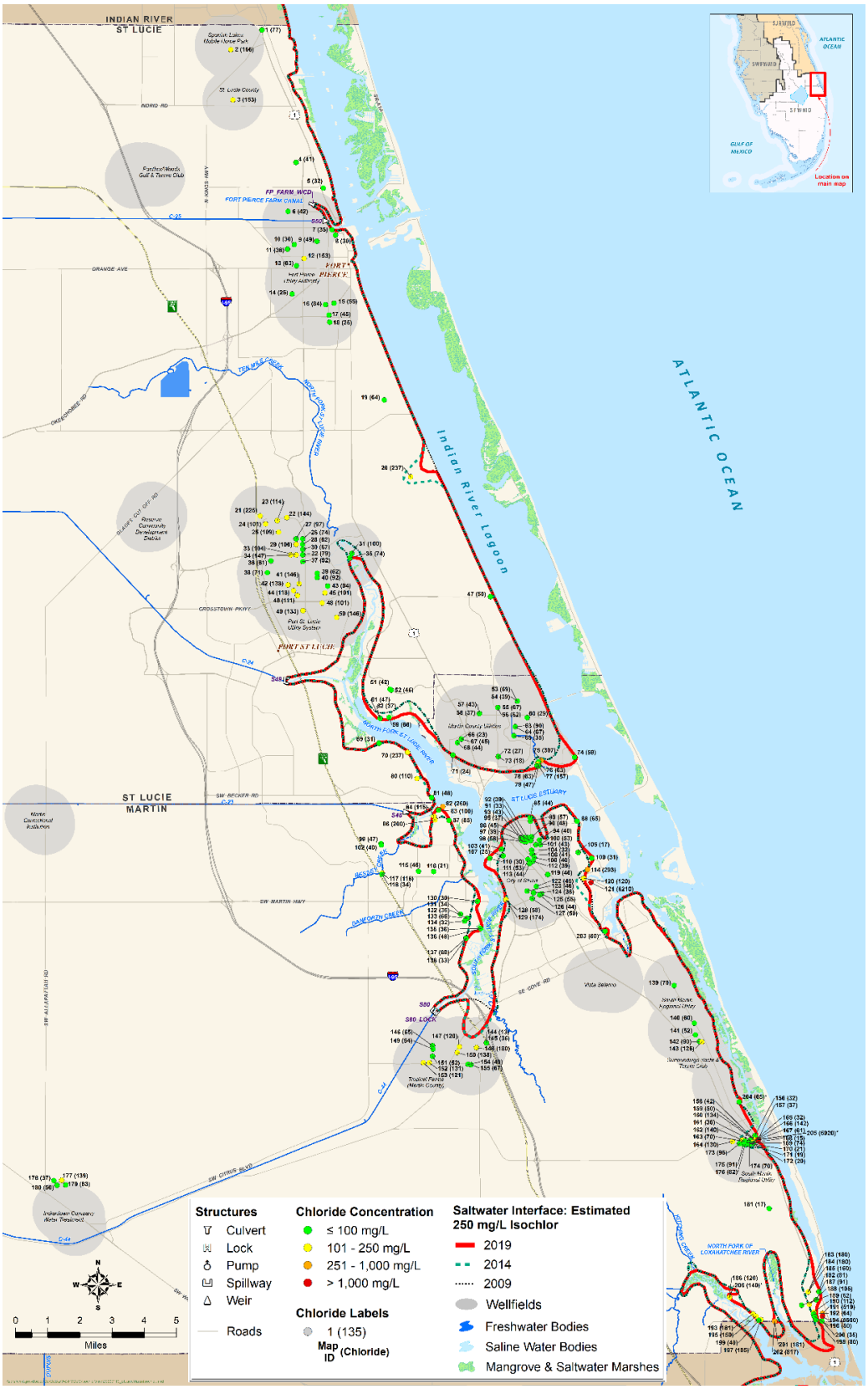



Figure 6-22. Estimated position of the saltwater interface in 2009, 2014, and 2019 in Martin and St. Lucie counties.

# SUMMARY OF WATER RESOURCE ANALYSES

The evaluations and analyses associated with this 2021 UEC Plan Update support the findings and conclusions of the 2016 UEC Plan Update. The following are findings regarding the availability of water resources in the UEC Planning Area to meet projected 2045 water demands:

- New or increased allocations of surface water from the C-23, C-24, and C-25 canal system and from Lake Okeechobee and LOSA, including the C-44 Canal, are limited in accordance with RAA criteria.
- Surface water will remain the primary source for agricultural irrigation, with the UFA as a supplemental source. Due to the continued anticipated decline in irrigated agriculture acreage, surface water demands will likely decrease over time.
- The SAS historically has served as the primary source of water for urban demands in the UEC Planning Area. However, expansion of SAS withdrawals is limited due to potential impacts to wetlands and the increased potential for saltwater intrusion. New or increased allocations of water from the SAS in coastal areas beyond those currently permitted will require evaluation on an application-by-application basis.
- Monitoring well networks have been established for the SAS and FAS and provide valuable data for evaluation of saltwater intrusion, aquifer assessment, and groundwater modeling.
- Most PS utilities in the UEC Planning Area use the FAS to meet some or all of their demands and plan to increase their use of the FAS to meet increased future demands.
- The results of the ECFM simulations indicated no widespread water level or water quality impacts are projected to occur in the FAS. However, increased withdrawals at projected future rates (2045) will have a greater effect on water levels and water quality in the UFA, primarily in northeastern St. Lucie County.
- Saltwater intrusion monitoring and mapping indicate little movement of the saltwater interface in the SAS from 2009 to 2019. Local-scale investigation of the interface position could be warranted in some areas.

# REFERENCES


Billah M., R. Earle, and U. Bandara. 2021. *Re-Calibration and Application of the East Coast Floridan Model*. South Florida Water Management District. West Palm Beach, FL.

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# 7

# 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 development efforts presented in this chapter reflect the current budget categories the SFWMD 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 chapter was created using the Fiscal Year (FY) 2021 Districtwide water resource budget and includes schedules and costs for FY2021 to FY2025. Additional details on the status of these projects can be found in Chapter 5A (Kraft and Medellin 2021) of the *2020 South Florida Environmental Report – Volume II* (www.sfwmd.gov/sfer).

TOPICS

- Regional Groundwater Modeling
- Districtwide Water Resource Development Projects
- Comprehensive Everglades Restoration Plan
- Additional Resource Development Efforts
- 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 (**Chapter 8**). Water resource development is defined in Section 373.019(24), 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.*

Most water resource development activities in the SFWMD support and enhance water supply development but do not directly yield specific quantities of water. Instead, these projects are intended to assess the availability of an adequate water supply for existing and future uses, including maintaining the functions of natural systems. For example, project-related hydrologic investigations as well as groundwater monitoring and modeling provide important information about aquifer characteristics (e.g., hydraulic properties, water quality), which are useful for appropriate facility design, identifying safe aquifer yields, and evaluating the economic viability of projects, but do not increase water availability.

Water supply development projects (**Chapter 8**) generally are the responsibility of water users (e.g., utilities) and involve the water source options described in **Chapter 5** to meet specific needs. These projects often include construction of wellfields, water treatment plants, distribution lines, reclaimed water facilities, and storage systems.

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, CERP builds on and complements other state and federal initiatives to revitalize South Florida's ecosystems. These efforts have multiple implementation phases, which are supported by water resource development activities such as modeling, land acquisition, project controls, and technical services. CERP efforts are described in this chapter and in the annual updates of the *South Florida Environmental Report* (www.sfwmd.gov/sfer).

Since 2005, the SFWMD has been working with a coalition of government agencies, environmental organizations, farmers, ranchers, and researchers to enhance opportunities for storing excess surface water on private and public lands. The effort, known as dispersed water management, includes the former pilot project Florida Ranchlands Environmental Services Project (FRESP), Northern Everglades Payment for Environmental Services (NE-PES), water farming, storage on public lands, and Northern Everglades public-private partnerships. Dispersed water management projects are constructed and managed primarily to attenuate wet season water releases into Lake Okeechobee and the coastal estuaries, 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, dispersed water management projects are not constructed for the purpose of water supply development. Additional information can be found at www.sfwmd.gov/storage.

# REGIONAL GROUNDWATER MODELING

The SFWMD funds development and application of numerical models for evaluation of groundwater and surface water resources in the District's five planning areas. The models support development of regional water supply plans, minimum flows and minimum water levels (MFLs), water reservations, and other projects benefitting water resources. Regional groundwater flow models simulate the rate and direction of water movement through the subsurface. Such models include the major components of the hydrologic cycle and are used in water supply planning to understand the effects of current and future water use. These models also can be designed to simulate salinity changes in the form of total dissolved solids, which are referred to as density-dependent and solute transport models.

## East Coast Floridan Model

Groundwater withdrawals, particularly from the Floridan aquifer system (FAS), are anticipated to increase with growing demand for water and limited availability of surface water sources throughout South Florida. In 2014, the SFWMD developed the East Coast Floridan Model (ECFM), a peer-reviewed, density-dependent groundwater flow and transport model designed to help manage the FAS, given the limits on surface water bodies and the surficial aquifer system (SAS) in the Upper and Lower East Coast planning areas (Giddings et al. 2014). The ECFM boundary extends from Indian River County (within the St. Johns River Water Management District) to the Florida Keys (**Figure 7-1**). For this 2021 UEC Plan Update, the ECFM was 1) re-calibrated with additional hydrogeologic and hydrostratigraphic (layer) data collected since the previous calibration, and 2) updated with 2019 to 2045 demands to provide a planning-level evaluation of regional conditions in the FAS. **Chapter 6** and **Appendix D** provide further information about the ECFM updates and simulation results.

## East Coast Surficial Model

The SFWMD is currently developing the East Coast Surficial Model, a regional, density-dependent groundwater flow and transport model for the SAS along the east coast of South Florida. The model boundary extends from Vero Beach in Indian River County (within the St. Johns River Water Management District) to Marathon (in the Florida Keys) (**Figure 7-1**). The model will undergo an independent, scientific peer-review concurrently with its development and calibration. The model is anticipated to be completed in 2023 and will be used to support future water supply plan updates for the UEC and Lower East Coast planning areas.

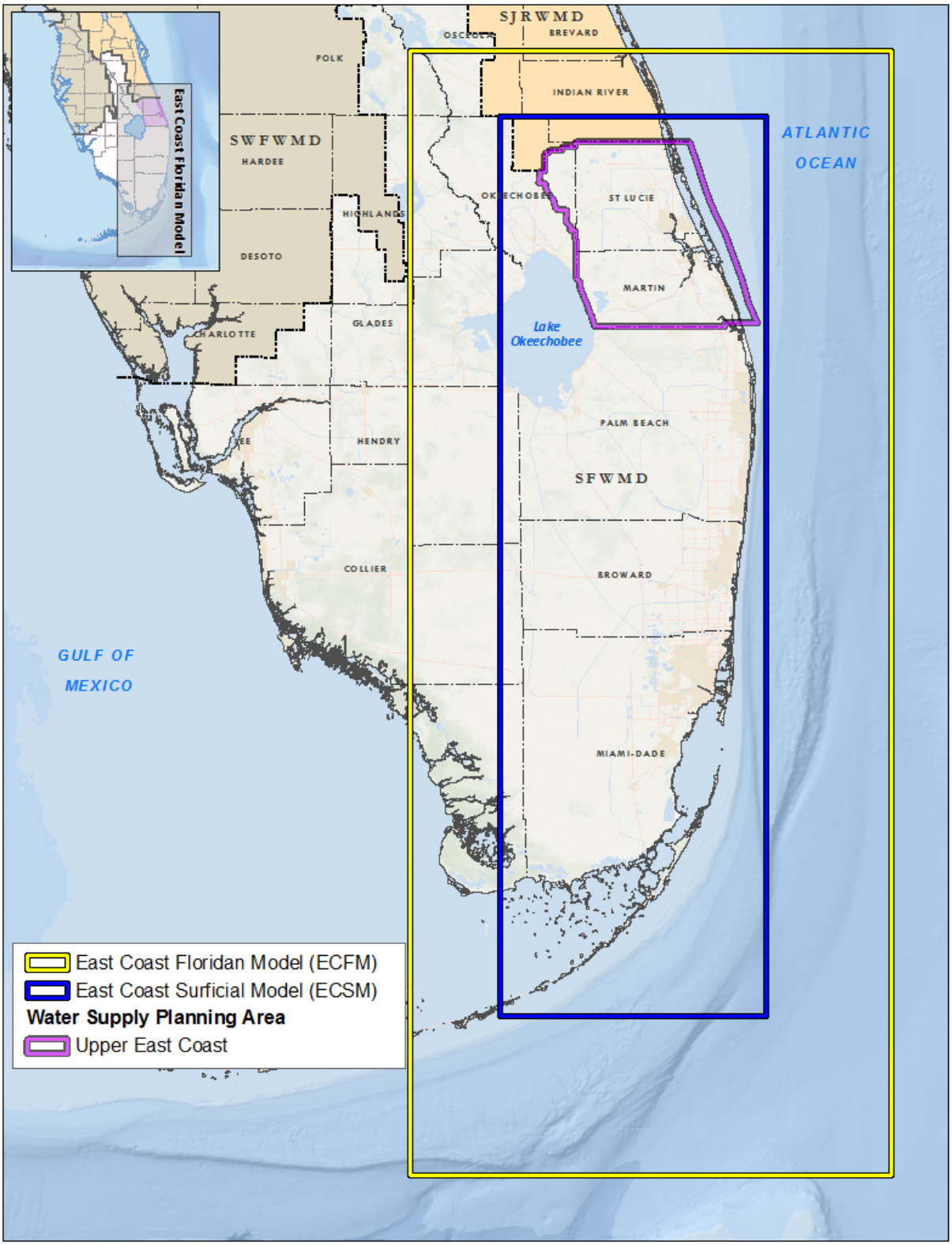


Figure 7-1. East Coast Floridan Model and East Coast Surficial Model boundaries.

# DISTRICTWIDE WATER RESOURCE DEVELOPMENT PROJECTS

Water resource development projects encompassing more than one planning area generally are considered Districtwide projects. **Table 7-1** summarizes the estimated costs through 2025 of Districtwide water resource development projects and regional projects that benefit water supply. The following categories are types of ongoing Districtwide water resource development projects:

- MFL, water reservation, and restricted allocation area (RAA) rule activities
- Comprehensive Water Conservation Program
- Cooperative Funding Program for alternative water supply (AWS) development and water conservation
- Drilling and testing groundwater resources
- Groundwater assessment through data collection and modeling
- Groundwater, surface water, and wetland monitoring

## MFL, Water Reservation, and RAA Rule Activities

MFLs, water reservations, and RAA rules as well as other water resource protection measures have been developed to ensure the sustainability of water resources within the SFWMD. **Chapter 4** provides information on MFLs, water reservations, and RAAs in the UEC Planning Area. Additional information about water resource protection can be found in the *Support Document for the 2021-2024 Water Supply Plan Updates* (2021-2024 Support Document; SFWMD 2021).

## 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; use of alternative sources, including reclaimed water; public education; and demand reduction through conservation technology, best management practices, and water-saving funding programs. The Comprehensive Water Conservation Program is a series of implementation strategies designed to create an enduring conservation ethic and permanent reduction in water use. The program is discussed further in **Chapter 3**. Additional information can be found in the 2021-2024 Support Document (SFWMD 2021).

## Cooperative Funding Program

AWS projects and source diversification are important supplements to traditional water sources in order to meet current and future water needs Districtwide. The SFWMD has provided cost-share funding for AWS development for more than two decades. In 2016, the SFWMD combined funding programs for stormwater, AWS, and water conservation projects into one streamlined program, the Cooperative Funding Program (**Chapter 8**). AWS funding helps water users develop reclaimed water projects, water reclamation facilities, brackish water wellfields, reverse osmosis treatment facilities, stormwater capture systems, and aquifer storage and recovery (ASR) well systems. 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 annual updates of the *South Florida Environmental Report*. Further information about AWS options (e.g., reservoirs, ASR systems) is provided in **Chapter 5**.

Table 7-1. Fiscal Year 2021-2025 implementation schedule and projected expenditures (including salaries, benefits, and operating expenses) for water resource development activities within the SFWMD. All activities are ongoing unless noted otherwise (Modified from: Kraft and Medellin 2021).

| Regional Water Activities | Plan Implementation Costs ($ thousands) | | | | | Total |
|---|---|---|---|---|---|---|
| | 2021 | 2022 | 2023 | 2024 | 2025 | |
| Water Supply Planning | 1,280 | 1,280 | 1,280 | 1,280 | 1,280 | **6,400** |
| CFWI Water Supply Planning Project | 1,838 | 1,838 | 1,838 | 1,838 | 1,838 | **9,190** |
| Comprehensive Plan, Documents Review, and Technical Assistance to Local Governments | 2224 | 224 | 224 | 224 | 224 | **1,120** |
| Water Supply Implementation | 243 | 243 | 243 | 243 | 243 | **1,215** |
| MFL, Water Reservation, and RAA Rule Activities | 354 | 354 | 354 | 354 | 354 | **1,770** |
| Comprehensive Water Conservation Program | 1,462[a] | 358[b] | 358[b] | 358[b] | 358[b] | **3,290** |
| Cooperative Funding Program | 15,057 | 0[b] | 0[b] | 0[b] | 0[b] | **14,661** |
| Groundwater Monitoring | 2,249 | 2,249 | 2,249 | 2,249 | 2,249 | **11,245** |
| Groundwater Modeling | 1,033 | 1,033 | 1,033 | 1,033 | 1,033 | **5,165** |
| Estimated portion of C&SF Project Operation & Maintenance budget allocated to Water Supply[c] | 120,139 | 120,139 | 120,139 | 120,139 | 120,139 | **600,695** |
| **Subtotal** | **143,879** | **127,718** | **127,718** | **127,718** | **127,718** | **654,751** |
| Regional Projects Benefitting Water Supply | | | | | | |
| Lake Okeechobee Watershed Restoration[d] | 98,000 | 50,000[e] | 50,000[e] | 50,000[e] | 50,000[e] | **298,000** |
| EAA Storage Conveyance Improvements and Stormwater Treatment Area[d,f] | 77,532 | 70,468 | 61,229 | 29,811 | 46,095 | **285,135** |
| Other Projects Associated with MFL Recovery/Prevention Strategies[g] | 160,270 | 151,602 | 151,647 | 153,554 | 121,300 | **738,373** |
| **Subtotal** | **335,802** | **272,070** | **262,876** | **233,365** | **217,395** | **1,321,508** |
| **Total** | **479,681** | **399,788** | **390,594** | **361,083** | **345,113** | **1,976,259** |

C&SF Project = Central and Southern Florida Flood Control Project; CFP = Cooperative Funding Program; CFWI = Central Florida Water Initiative; EAA = Everglades Agricultural Area; FY = Fiscal Year; MFL = minimum flow and minimum water level; RAA = restricted allocation area; SFWMD = South Florida Water Management District; STA = stormwater treatment area.

[a] FY2021 includes $1.5 million of tentative, one-time funding for CFP water conservation projects.

[b] A determination of what funds, if any, will be allocated for CFP projects will be made by the District's Governing Board during the fiscal year budget development process.

[c] Approximated based on 50% of the FY2021 operation and maintenance budget.

[d] Project cost based on information contained in the draft FY2021–FY2025 SFWMD Five-Year Capital Improvement Plan.

[e] Funding contingent upon future state appropriations.

[f] Includes the C-44/C-23 Interconnect, Site Preparation, Inflow Canal Reservoir/STA, A-2 STA, North New River and Miami Canal Improvements, and bridges.

[g] Totals from Table 5A-8 of the *2021 South Florida Environmental Report* (Kraft and Medellin 2021), less the funding for the Lake Okeechobee Watershed Restoration and EAA Storage Reservoir Conveyance Improvements and STA.

## Drilling and Testing Groundwater Resources

Drilling and testing include the installation of wells for short- to long-term monitoring of aquifer water levels and water quality. This work includes drilling and well construction, geophysical logging, aquifer tests, sediment analysis, lithologic descriptions, and water quality sampling to determine if the water is fresh or brackish. Knowledge of South Florida hydrogeology is enhanced through construction of exploratory/test wells and has improved the accuracy of the SFWMD's groundwater modeling and decision-making regarding approval of water use permits.

## Groundwater Assessment

Groundwater assessment includes results of drilling and testing programs as well as development of hydrostratigraphic maps and saltwater interface maps. A variety of technical publications related to hydrogeology, groundwater quality, project investigations, and saltwater interface mapping have been completed in the UEC Planning Area since the 2016 plan update, as summarized below:

- **Caulkins Seepage Investigation** – The Caulkins Water Farm Pilot Project, part of the SFWMD's Dispersed Water Management Program, consisted of a 414-acre surface water reservoir adjacent to the C-44 Canal (St. Lucie River) in southern Martin County. Investigations were conducted to characterize the seepage quantity and flow direction from the Caulkins Water Farm (Janzen et al. 2017).
- **Hydrogeologic Investigation at the Port Mayaca Site** – The Port Mayaca test site is approximately 30 miles west of the Atlantic Ocean and 1 mile east of Lake Okeechobee in unincorporated Martin County. This investigation (Bennett et al. 2017) provided hydrogeologic data from the FAS in support of the Lake Okeechobee ASR pilot project.
- **Geochemistry of the Upper Floridan Aquifer and Avon Park Permeable Zone** – The Regional Floridan Groundwater (RFGW) monitoring network was developed to evaluate current and future water quality and water level trends in the FAS within the SFWMD. The RFGW network includes 113 monitor wells completed in aquifers and confining units within the FAS. This investigation (Geddes et al. 2018) acquired and analyzed data from the Upper Floridan aquifer and Avon Park permeable zone.
- **Hydrogeology of the Caulkins Water Farm Project** – An expansion of the pilot project discussed above, the Caulkins Water Farm Project encompasses a 3,014-acre surface water impoundment adjacent to the C-44 Canal (St. Lucie River) in southern Martin County (Janzen and Geddes 2019). Nineteen groundwater monitor wells and six surface water stations were installed within and adjacent to the project area to characterize site lithology and conduct continuous water level monitoring and water quality sampling. Lithologic logs, geophysical logs, and aquifer performance test data were collected prior to project construction.
- **Hydrogeology of the FAS at a C-24 Canal Test Site** – Shaw and Geddes (2020) characterized three distinct producing zones in the FAS at a site on the south side of the C-24 Canal in central St. Lucie County by combining the data collected during initial construction with subsequent testing and data collection efforts through 2020.

- **Saltwater Interface Monitoring and Mapping Program** – The saltwater interface monitoring program was established to evaluate the extent of saltwater encroachment into aquifers along the South Florida coastline. Water quality data are collected and analyzed every 5 years to estimate and map the saltwater interface location in the SAS (Shaw and Zamorano 2020).
- **Groundwater modeling** – As described above, the ECFM was re-calibrated with additional hydrogeologic and hydrostratigraphic data collected since the previous calibration and updated with 2019 to 2045 demands to provide a planning-level evaluation of regional conditions in the FAS.

## Groundwater, Surface Water, and Wetland Monitoring

Water level and water quality monitoring provides critical information for developing groundwater models, assessing groundwater conditions, and managing groundwater resources. The SFWMD maintains extensive groundwater monitoring networks and partners with the United States Geological Survey (USGS) to provide additional support for ongoing monitoring. Data are archived in DBHYDRO (the SFWMD's corporate environmental database), which stores hydrologic, meteorologic, hydrogeologic, 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 by the USGS, with funding support from the SFWMD, to collect groundwater level monitoring data at 280 stations. The project includes well and recorder maintenance as well as archiving data in a USGS database for sites throughout the SFWMD.
- **Groundwater monitoring** – An ongoing effort by the SFWMD to monitor groundwater levels throughout the District. As of 2020, Districtwide monitoring includes 443 active SFWMD groundwater stations for the SAS, intermediate aquifer system (where present), and FAS. Data are collected, analyzed, validated, and archived in DBHYDRO.
- **Regional Floridan Groundwater (RFGW) well network** – Water level and water quality monitoring is ongoing at 113 FAS monitor well sites in the SFWMD, as of 2020. Well maintenance is conducted as needed.
- **Hydrogeologic database improvements** – Backlogged data are uploaded, and miscellaneous database corrections are 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.

# COMPREHENSIVE EVERGLADES RESTORATION PLAN

The Comprehensive Everglades Restoration Plan (CERP) is one of the largest environmental restoration programs in history. Authorized by Congress in the Water Resources Development Act of 2000, CERP 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 SFWMD, while providing for other water-related needs of the region. The United States Army Corps of Engineers (USACE) is the lead federal agency, and the SFWMD is the lead state agency for this multidecadal effort. The USACE and SFWMD jointly implement CERP with a 50-50 cost share plan that includes the planning, design, and construction of projects.

The Water Resources Development Act of 2000 and Section 373.470, F.S., require the SFWMD to legally reserve or allocate natural system water provided by a CERP project before execution of a cost-share agreement between the USACE and SFWMD to construct the project [Section 373.470(3)(c), F.S.]. The SFWMD has adopted water reservations and RAAs to fulfill this requirement. **Figure 7-2** presents a map of CERP project components and other restoration projects planned for construction over the next 20 years in the UEC Planning Area that provide water supplies supporting MFL, water reservation, and RAA water bodies. A map of CERP project components throughout the entire District can be found in the 2021-2024 Support Document (SFWMD 2021). Further information on MFLs, water reservations, and RAAs is provided in **Chapter 4**. One CERP project, the Indian River Lagoon – South (IRL-S) Project, is located within the UEC Planning Area.

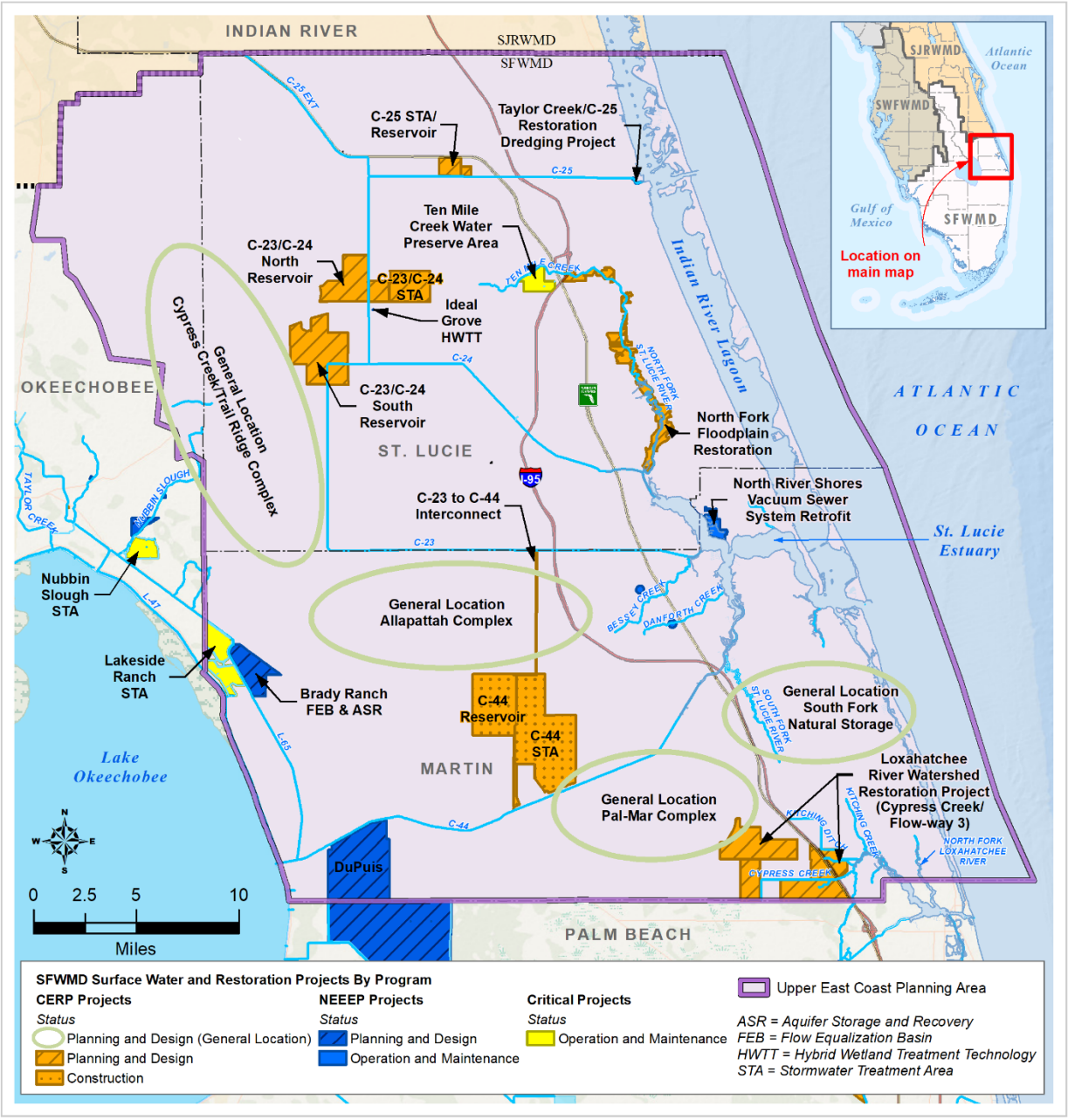


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Figure 7-2. Comprehensive Everglades Restoration Plan (CERP) and other projects planned for construction over the next 20 years in the UEC Planning Area.

## CERP Indian River Lagoon – South Project

The CERP IRL-S Project is designed to improve water quality within the St. Lucie Estuary and Indian River Lagoon 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 IRL-S Project includes many project components throughout the St. Lucie watershed, as discussed below and shown on **Figure 7-3**. Based on the current CERP Integrated Delivery Schedule (USACE 2020), the C-23 and C-24 reservoirs of the IRL-S Project are in the design phase, and construction is expected to begin in 2023. Proposed structural changes are designed to provide additional retention basins (i.e., aboveground reservoirs), improved water conveyance facilities, and new operational strategies within the watershed. The changes are expected to capture, store, and attenuate excess water previously discharged to tide and redistribute the water north and south via historical flow pathways. Flows will be discharged down the North and South Forks of the St. Lucie River. The retention basins are designed to reduce the volume and frequency of damaging freshwater discharges to the St. Lucie Estuary and to restore a more natural volume, timing, and distribution of freshwater flows to the estuary, enhancing the opportunity for recovery of estuarine biota. The project may increase surface water availability, which will enhance water supply for agriculture and offset reliance on the FAS.

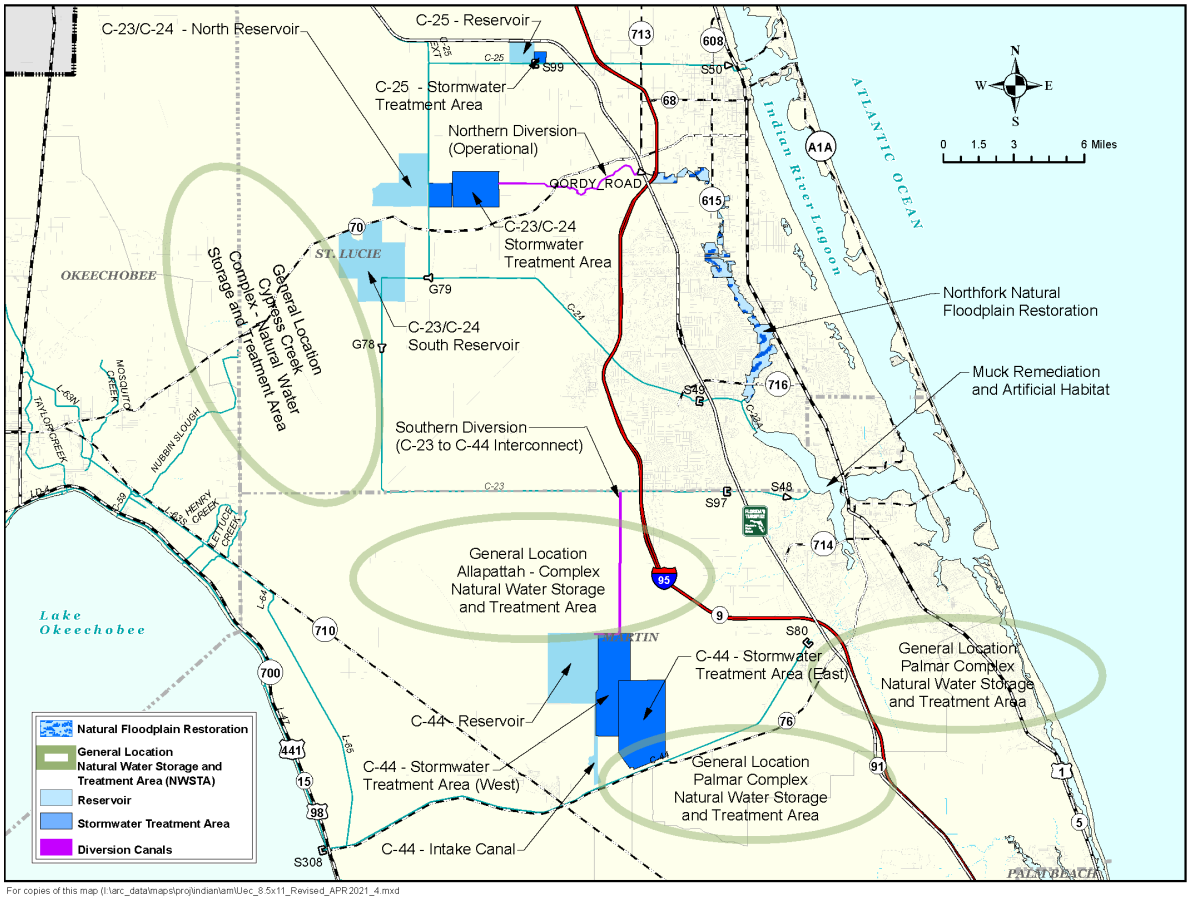


Figure 7-3. Indian River Lagoon – South Project components within the St. Lucie watershed.

The IRL-S Integrated Project Implementation Report and Environmental Impact Statement (USACE and SFWMD 2004) details the following features and operational modifications that are expected to achieve the stated objectives of the project:

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

Once constructed and in operation, six project features (summarized below) 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 (**Appendix C**). The status and estimated completion dates of the current activities for the structural components of the IRL-S Project features are provided in **Table 7-2**.

1. **C-44 Reservoir and STA** – These features are located on the north side of the C-44 Canal in central Martin County. The reservoir and STA are 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, the St. Lucie Estuary. This component of the IRL-S Project consists of a 3,400-acre aboveground reservoir, capable of storing 50,600 acre-feet of water, and a 6,400-acre STA, divided into six cells that operate independently of each other (**Figure 7-4**). Implementation of this component is expected to improve water quality within the St. Lucie Estuary and Indian River Lagoon by reducing the effects of watershed runoff; decreasing peak freshwater discharges to maintain desirable salinity regimes in the estuary; and reducing nutrient loads, pesticides, and other pollutants. Construction was completed in June 2021 and will be followed by a 2-year operational testing and monitoring period.

2. **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 structure) 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. The redirected water will provide increased dry season flows to the St. Lucie River. Residual C-23 flows greater than natural system flows through Basin 4 will be directed through the proposed C-23 to C-44 Interconnect canal to the C-44 reservoir, STA, and canal.

3. **Stormwater Treatment Areas** – An STA will be built to treat water from the C-23/C-24 North and South reservoirs. Operation of the C-23/C-24 STA is expected to reduce sediment, phosphorus, and nitrogen deliveries to the St. Lucie 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.

4. **C-23/C-24 North and South Reservoirs** – These reservoirs will capture excess water from the C-23 and C-24 canals, reducing the extreme peaks of freshwater discharge to the St. Lucie Estuary, and deliver water to meet fish and wildlife needs. Water stored in the reservoirs could be available for agricultural use, which would reduce dependency on groundwater from the FAS (USACE and SFWMD 2004).

5. **C-25 Reservoir and STA** – An aboveground reservoir capable of storing approximately 5,400 acre-feet on 741 acres as well as a 163-acre STA, designed to capture runoff from the C-25 and Fort Pierce Farms basins. The reservoir will be located on the north side of the C-25 Canal, adjacent to the S-99 structure. Water captured in the reservoir will be delivered to the Indian River Lagoon at the Fort Pierce Inlet or upstream to augment canal water levels that could be made available to enhance water supply.

6. **Natural Storage and Treatment Areas, North Fork Floodplain Restoration** – The IRL-S Project also includes North Fork natural floodplain restoration activities, muck remediation/removal projects, and other habitat improvement efforts. Approximately 92,130 acres disturbed by land use practices were identified for acquisition and restoration within the C-23, C-24, and C-44 basins. 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 via retention in natural wetland systems. The lands also are expected to improve water quality by reducing 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 nursery area for larval and juvenile fishes. The natural lands component of the IRL-S Project will provide additional water storage and water quality treatment through restoration of the Pal-Mar, Allapattah, and Cypress Creek/Trail Ridge natural lands complexes. Construction of the Allapattah complex was completed in 2021, restoring more than 13,000 acres of land, including approximately 6,621 acres of wetlands that will provide 13,300 acre-feet per year of storage.

Table 7-2. Status and estimated completion dates of current activities for the structural components of the Indian River Lagoon – South Project.

| Indian River Lagoon – South Structural Components | Acres | Current Status | Estimated Completion Date |
|---|---|---|---|
| C-44 Reservoir | 3,400 | Construction complete and 2-year operational testing commenced | April 2021 |
| C-44 STA | 6,400 | Construction complete and 2-year operational testing commenced | June 2021 and Fall 2023 |
| Southern Diversion C-23 to C-44 Interconnect Canal | N/A | Final Design | 2022 |
| C-23/C-24 STA | 1,970 | Final Design/Construction Contract | Late 2021 |
| C-23/C-24 Reservoir North | 2,000 | Initial Design | 2023 to 2029 |
| C-23/C-24 Reservoir South | 3,500 | Initial Design | 2024 to 2030 |
| C-25 Reservoir and STA* | TBD | Land Acquisition | 2027 |

TBD = to be determined.
* Real estate acquisition under way; project details are unknown.

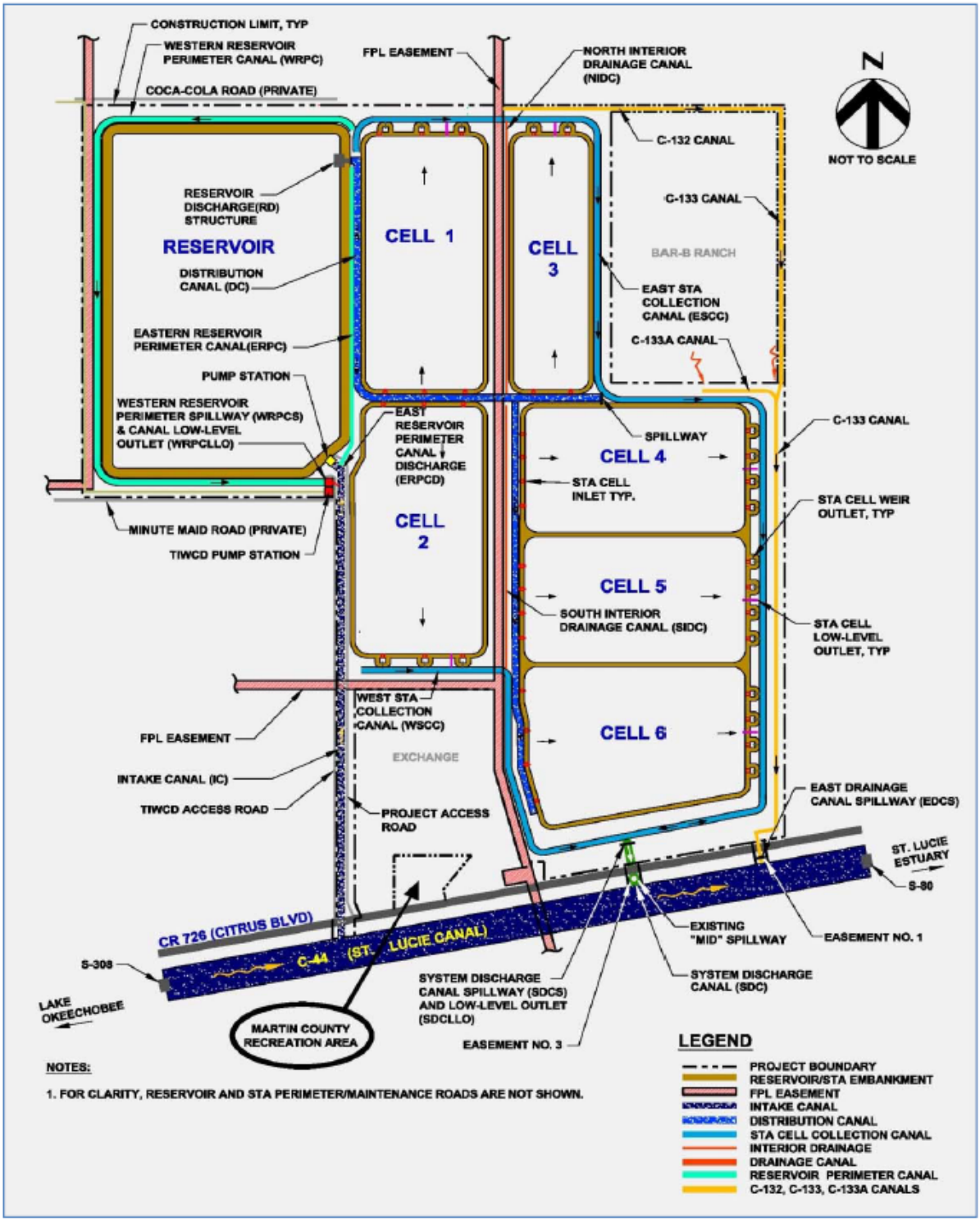


Figure 7-4. C-44 reservoir and stormwater treatment area cells.

## Lake Okeechobee Watershed Restoration Project

Part of CERP and approved by the U.S. Congress in 2000, the Lake Okeechobee Watershed Restoration Project (LOWRP) is meant to improve the ecology of Lake Okeechobee, decrease regulatory releases to the St. Lucie and Caloosahatchee estuaries, restore freshwater wetlands in the watershed, and improve water supply for existing legal users. Although LOWRP is not within the UEC Planning Area boundary, it does affect the region's water resources (i.e., the St. Lucie River and Estuary). The project team prepared a Final Integrated Project Implementation Report and Environmental Impact Statement (USACE and SFWMD 2020) that was released for public review in August 2020. A Final Chief's Report and Congressional authorization is pending for the project.

In 2019 and 2020, the Florida Legislature appropriated $100 million to the SFWMD for the design, engineering, and construction of specific LOWRP components designed to achieve the greatest reduction in harmful discharges to the Caloosahatchee and St. Lucie estuaries. The SFWMD and USACE determined the ASR well component would provide the greatest benefits to the estuaries. Senate Bill 2516, approved by the Florida Legislature and signed into law by the Governor in June 2021, provides funding and direction to the SFWMD to expedite the planning, design, and construction of LOWRP. Under Senate Bill 2516, $50 million will be appropriated annually from 2021 through 2026 for LOWRP implementation.

# ADDITIONAL RESOURCE DEVELOPMENT EFFORTS

Water resource development and restoration efforts are under way throughout the UEC Planning Area. In addition, some projects outside the boundaries of the UEC Planning Area impact the region's water resources. 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 specifically for water supply development, there are potential benefits towards offsetting seasonal impacts to water sources. The following project descriptions provide an overview of additional water resource development activities in and around the UEC Planning Area.

## SFWMD Ten Mile Creek Project

The Ten Mile Creek Project, located near Fort Pierce in St. Lucie County, consists of a 526-acre water preserve area and 132-acre STA (**Figure 7-5**). The Ten Mile Creek Project is designed to help control the quantity, quality, and timing of water deliveries to the St. Lucie River and Estuary. Water that would otherwise go over the Gordy Road structure is captured in the reservoir and routed through the STA to improve water quality before being released back to Ten Mile Creek, which flows to the St. Lucie River. At full operation, 2,500 acre-feet of water (815 million gallons) can be stored and sent through the project's wetlands before flowing back to Ten Mile Creek. The USACE completed project construction in April 2006. Structural and operational concerns were identified after project construction, and the project remained in passive or limited operation until the USACE transferred the project to the SFWMD in May 2016. Subsequent rehabilitation of the project reservoir was completed, and routine operation at a 4-foot maximum depth commenced in August 2017. Additional benefits anticipated from the project include reduction of sediment and nutrient load to the St. Lucie River, increased freshwater recharge into the SAS, and the ability to make minor water supply releases back to Ten Mile Creek when needed.

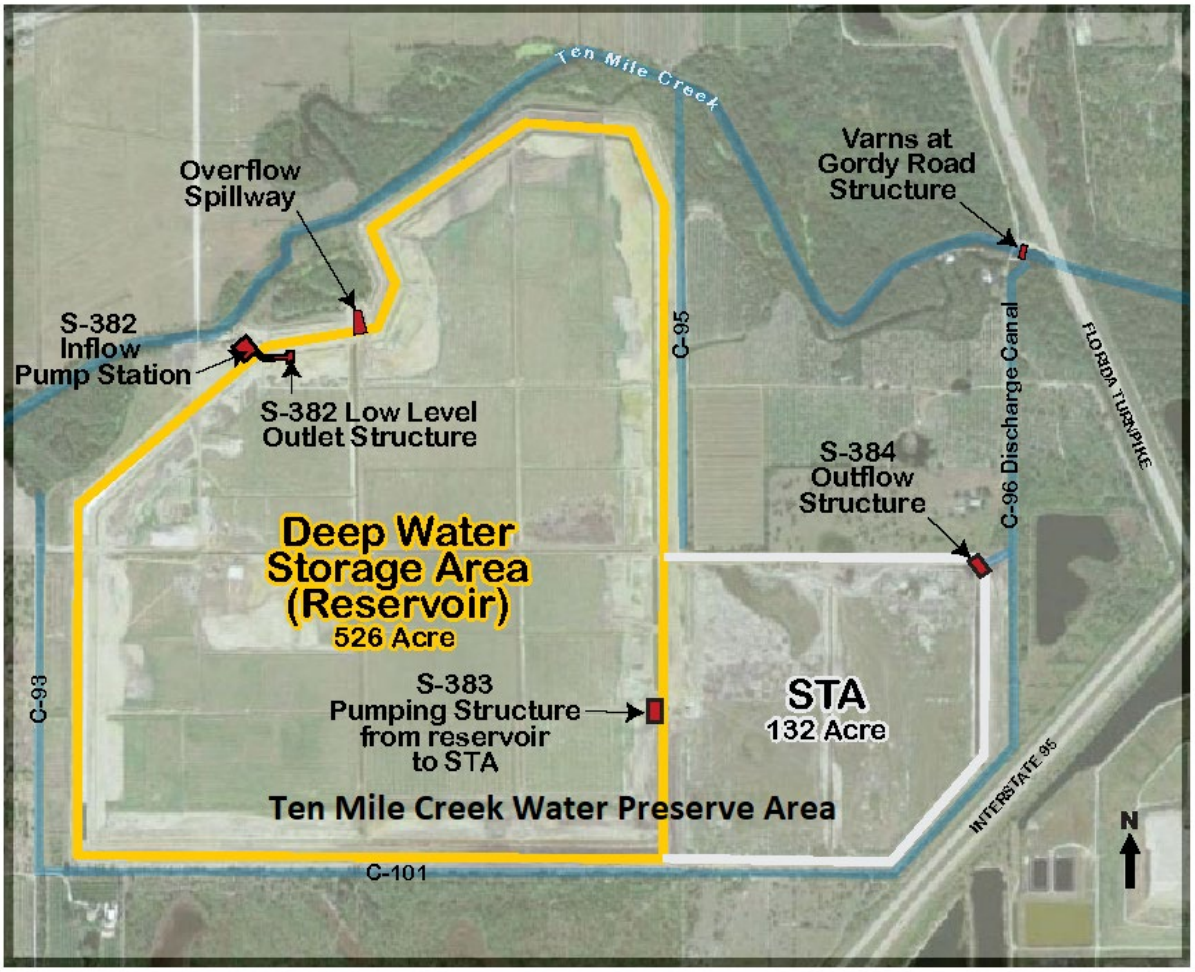


Figure 7-5. Ten Mile Creek Project components.

## Lakeside Ranch Stormwater Treatment Area

Located in western Martin County, the Lakeside Ranch STA plays a crucial role in restoring the Lake Okeechobee watershed by improving the quality of water flowing into the lake. The wetland area treats stormwater runoff from the Taylor Creek and Nubbin Slough basins to the north before that runoff enters Lake Okeechobee. The 2,700-acre STA is a component of the Lake Okeechobee Watershed Construction Project, which is designed to reduce phosphorus loads to Lake Okeechobee. Phase I (cells 1 to 3; **Figure 7-6**) became operational in 2013. Phase II (cells 4 to 8; **Figure 7-6**) includes construction of the S-191A pump station to assist with flood control and recirculation in response to reduced inflow volumes that began in 2017 and resulted in treatment cell dryout, vegetation decline, and performance issues. Final project completion is expected in August 2021.


Figure 7-6. Lakeside Ranch stormwater treatment area components.

## Northern Everglades and Estuaries Protection Program

In 2007, the Governor and Florida Legislature authorized the Northern Everglades and Estuaries Protection Program (NEEPP) (Section 373.4595, F.S.), which expanded the existing Lake Okeechobee Protection Act. As part of NEEPP, legislation required the completion of watershed protection plans for the Lake Okeechobee, Caloosahatchee River, and St. Lucie River watersheds. The watershed protection plans build on existing approaches and consolidate restoration efforts throughout the Northern Everglades system. Information about specific projects and activities under the watershed protection plans are included in annual updates of the *South Florida Environmental Report* (www.sfwmd.gov/sfer). Further information about NEEPP can be found on the SFWMD website (www.sfwmd.gov/wpps).

# SUMMARY

Water resource development projects serve various purposes in support of water supply development and planning. 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
- Preservation of existing supplies through better understanding, management, and continued monitoring of resources
- Prevention of natural system losses
- Water conservation and retention to protect water sources and provide an efficient way to expand current water supplies
- Improvement of the ECFM for evaluation of regional FAS conditions
- Coordination with other agencies and stakeholders to exchange hydrogeologic knowledge and data
- Comprehensive planning and construction of environmental restoration projects associated with the Everglades, St. Lucie Estuary, and Indian River Lagoon

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# 8

# Water Supply Development Projects

TOPICS

- Projects Identified for this Plan Update
- Cooperative Funding Program
- Summary of Water Supply Development Projects

This chapter summarizes the proposed water supply development projects anticipated to meet water needs in the Upper East Coast (UEC) Planning Area of the South Florida Water Management District (SFWMD or District) for the 2019 to 2045 planning period. Water supply development projects are proposed by water users due to restrictions and limitations on traditional water sources. Water users such as Public Supply (PS) utilities; local governments; and self-suppliers, including Commercial/Industrial/Institutional (CII) and Agriculture (AG) users, are primarily responsible for water supply development projects. For this *2021 Upper East Coast Water Supply Plan Update* (2021 UEC Plan Update), alternative water supply development projects have been proposed by PS utilities and one AG user. Six agricultural water conservation projects are also included in this update.

Water use permits typically are required for water supply development projects. 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.). Further information is provided in the *Support Document for the 2021-2024 Water Supply Plan Updates* (2021-2024 Support Document; SFWMD 2021). Future water supply development projects should be consistent among the plans and permits and must meet or exceed projected water demands. However, local economic conditions and population growth may affect when water is needed, which projects are required, and how water use permits need to be modified to accommodate demand.

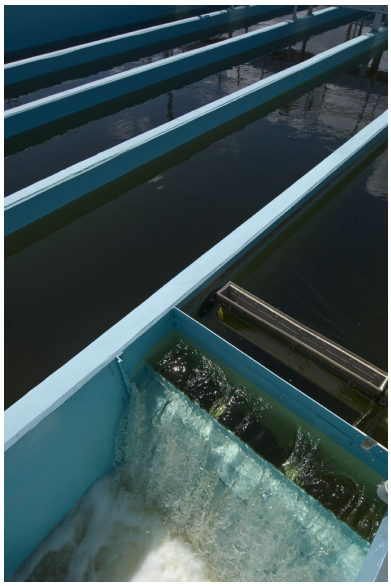
# PROJECTS IDENTIFIED FOR THIS PLAN UPDATE

Projects proposed for inclusion in this plan update were evaluated based on the level of detail provided (e.g., project scope, cost, and schedule) and whether the project is expected to increase conservation or contribute new water supply, possibly increasing a utility's permit allocation(s) or a treatment system's rated capacity. A Florida Department of Environmental Protection (FDEP) 2012 guidance memorandum addressed internal coordination between the SFWMD water use permitting and water supply planning staff on projects included in regional water supply plans and updates (FDEP 2012). Projects listed in this plan update were discussed with the SFWMD's Water Use Bureau to determine if a proposed project is likely to be permitted.

Users are not required to select a project included in this plan update. 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. In addition, a proposed project may not be implemented or may be deferred if there is insufficient need.

## Public Supply

PS demand includes all potable uses served by public and private utilities with an allocation of 0.10 million gallons per day (mgd) or greater. In 2019, PS demand in the UEC Planning Area was met by fresh groundwater from the surficial aquifer system (SAS; 43%) and brackish groundwater from the Floridan aquifer system (FAS; 57%). The PS average net demand (finished water) is projected to grow from 47.37 mgd in 2019 to 67.83 mgd by 2045, a 43% increase. A combination of existing and additional capacity developed by water supply development projects will be used to meet the projected demand.



Water Treatment Facility

In addition to meeting demands, utilities may propose water supply development projects to address specific situations such as accommodating a change in treatment processes or sources or optimizing distribution systems to match future demand locations. Although water conservation of potable water does not produce potable water, it is a demand management option for utilities that can extend existing potable supplies to meet future demand. In addition, utilities can implement reuse projects to reduce current or projected potable demands or reduce withdrawals from traditional water sources. Proposed projects are listed in the utility profiles contained in **Appendix B** and summarized at the end of this chapter. In addition to proposed water supply development projects, each profile includes population and demand projections (**Chapter 2**, **Appendix A**), permitted water allocations, and permitted treatment capacities for potable water and wastewater.

In the UEC Planning Area, four PS utilities have proposed eight projects relating to source diversification, changes in treatment technology, expansion of existing plants, and construction of new production wells. In total, the proposed PS development projects could create 39.86 mgd of additional potable water treatment capacity. Combined with existing capacity (103.02 mgd), this will exceed the projected 2045 PS total net (finished) demand of 67.83 mgd. One PS utility (St. Lucie County Utilities) needs to construct 3.78 mgd of water supply to meet its projected 2045 demands. The existing potable water treatment capacity for St. Lucie County Utilities is 0.29 mgd, and the projected net demand for 2045 is 4.07 mgd (**Appendix B**). The utility has proposed three FAS projects for a total additional capacity of 12.00 mgd by 2045.

PS utilities also have proposed nonpotable water supply projects that could create 43.59 mgd of additional water supply for landscape and golf course irrigation as well as groundwater recharge (**Table 8-1**). The proposed nonpotable water projects include construction and expansion of reclaimed water production facilities and construction of aquifer storage and recovery (ASR) and surface water/stormwater storage projects.

The *2019 FDEP Reuse Inventory Report* (FDEP 2020) indicated 55% of wastewater generated in Martin County and 28% generated in St. Lucie County is reused for irrigation and aquifer recharge. In 2019, 16.00 mgd of potentially reusable wastewater effluent was disposed of in the UEC Planning Area. Wastewater flows are projected to increase by 21.91 mgd from 2019 to 2045. Combined, this represents 37.91 mgd of potential alternative water supply.

Table 8-1. Number and capacity of potable and nonpotable water supply development projects proposed by utilities for construction/implementation between 2019 and 2045.

| Water Source | Number of Projects[a,b] | Capacity (mgd) | Cost ($ million) |
|---|---|---|---|
| Potable Projects | | | |
| Surface Water/Stormwater | 1 | 10.00 | $147.00 |
| Floridan Aquifer System | 7 | 29.86 | $267.35 |
| **Potable Total** | **8** | **39.86** | **$414.35** |
| Nonpotable Projects | | | |
| Reclaimed Water | 4 | 17.20 | $272.76 |
| Aquifer Storage and Recovery | 1 | 7.50[c] | $14.00 |
| Surface Water/Stormwater Storage | 3 | 18.89[d] | $73.30 |
| **Nonpotable Total** | **8** | **43.59** | **$360.06** |
| **Total** | **16** | **83.45** | **$774.41** |

mgd = million gallons per day.

[a] Projects designed to expand distribution of treated water are not included because they do not generate new water. Wellfield expansion projects are not included if they do not increase treatment capacity.

[b] Many of the projects are multi-phased (e.g., more than one project at the same water treatment plant).

[c] Estimated recoverable storage capacity, not new water supply capacity.

[d] Reflects storage capacity, not new water supply capacity.

## Domestic Self-Supply

Domestic Self-Supply (DSS) includes potable water used by households served by small utilities (less than 0.10 mgd) or self-supplied by private wells. DSS average net (finished) demands in the UEC Planning Area are projected to decrease from 5.76 mgd in 2019 to 5.61 mgd in 2045 due to the expansion of PS distribution systems and service areas. DSS needs currently are met and are expected to continue being met with fresh groundwater from the SAS. As such, no water supply development projects are proposed for this use category.

## Agriculture

AG water use includes self-supplied water used for crop irrigation, greenhouses, nurseries, livestock watering, and aquaculture. AG is the largest water use category in the UEC Planning Area and is projected to remain so over the planning horizon. However, irrigated crop acreage is expected to decrease from 107,383 acres in 2019 to 79,004 acres in 2045. Gross agricultural water demand is projected to decrease 26%, from 174.72 mgd in 2019 to 130.10 mgd in 2045, under average rainfall conditions. **Chapter 2** and **Appendix A** provide more information about agricultural water use and projected demands.

The primary water source for AG in the UEC Planning Area is fresh surface water from the C-23, C-24, and C-25 canals. Some farms withdraw brackish groundwater from the FAS as a backup source during periods of low rainfall and limited surface water availability. Restricted allocation area criteria are in effect for the C-23, C-24, and C-25 canals and Lake Okeechobee Service Area (**Chapter 4**).

Water supply opportunities for AG may be available in the future by capture and use of water normally lost to a farm's water management system (tailwater recovery), capture and use of stormwater, and blending of brackish groundwater with fresh water. The storage and use of reclaimed water may be possible for a limited number of crops when meeting food safety and market standards, but there are no reclaimed water sources near AG areas in the region. More efficient irrigation systems could substantially reduce the amount of water needed to meet future crop demands; however, implementation of such systems can be economically and technically challenging.

Continued use of best management practices (BMPs), including water conservation, could reduce the amount of water needed to meet crop demands (**Chapter 3**). The Florida Department of Agriculture and Consumer Services (FDACS) develops and adopts (by rule) agricultural BMPs addressing water quality. Some BMPs contain an implicit water conservation component. Growers who enroll in the FDACS BMP program and implement the BMPs demonstrate their commitment to water resource protection, have a presumption of compliance with state water quality standards, and are eligible for technical and financial assistance towards meeting water resource protection goals.

### *Grove Land Reservoir and Stormwater Treatment Area*

Located in Okeechobee and Indian River counties, the Grove Land Reservoir and Stormwater Treatment Area Project (**Figure 8-1**) is a proposed 5,000-acre reservoir to retain C-25 Canal water that would otherwise lost to tide. The reservoir will be capable of storing 75,000 acre-feet of water and be connected to a 2,000-acre stormwater treatment area to

improve water quality. The project development and environmental study was recently completed. The project may be able to deliver up to 100 mgd of water to the headwaters of the St. Johns River or back to the C-25 Canal after water availability determinations have been calculated and regulatory issues resolved. SFWMD staff are reviewing the environmental resource and water use permits for the project as well as an inter-district transfer authorization.

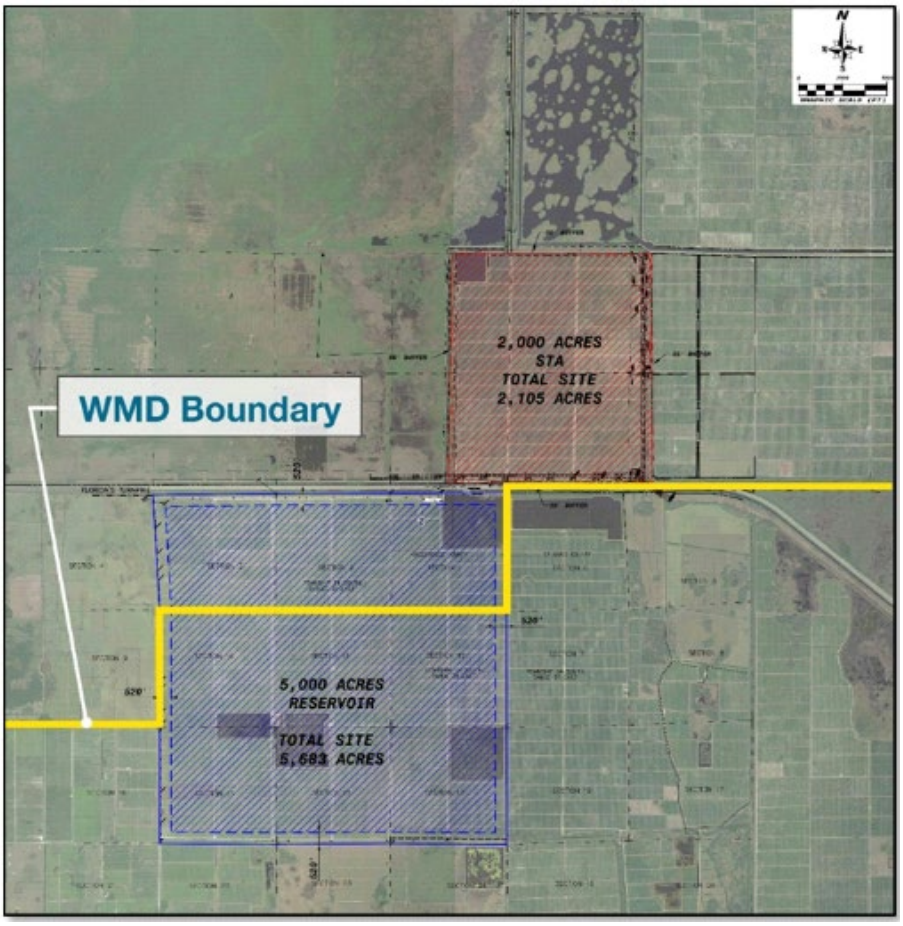



Figure 8-1. Proposed Grove Land reservoir and stormwater treatment area.

## Commercial/Industrial/Institutional

The CII water use category includes self-supplied water associated with the production of goods or provision of services by industrial, commercial, and institutional establishments. Users historically have relied on fresh groundwater and, to a limited extent, fresh surface water. The projected average gross demand for this category is estimated to be 5.74 mgd by 2045, which is a slight increase from 2019 demands (4.43 mgd).

Although fresh groundwater supplies generally are considered adequate to meet the relatively small demands projected for CII, alternative water supply (AWS) options should be considered based on local conditions. If reclaimed water is available to meet existing and/or new CII demands, the feasibility of such opportunities will be evaluated through water use permitting. No specific water supply development projects for this category were provided or identified for this 2021 UEC Plan Update.

## Landscape/Recreational

The Landscape/Recreational (L/R) category includes self-supplied water used for irrigation of golf courses, sports fields, parks, cemeteries, and large common areas (e.g., land managed by homeowners' associations and commercial developments). Historically, irrigation supplies for this category included local fresh groundwater and surface water from canals or ponds in stormwater management systems. Several golf courses use reclaimed water or brackish groundwater treated by reverse osmosis. In the UEC Planning Area, L/R average gross demand is projected to increase from 32.03 mgd in 2019 to 40.64 mgd in 2045.

Golf Course – Martin County

The projected increase in growth for this category is expected to be met, for the most part, by currently proposed reclaimed water projects, and to a lesser extent, the SAS or on-site stormwater management ponds. 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. Proposed projects submitted by utilities and wastewater treatment facilities are expected to add 17.20 mgd of reclaimed water treatment capacity by 2045. Additional reclaimed water supply may provide an opportunity to convert current irrigation from freshwater to reclaimed water. No specific water supply development projects for this category have been provided or identified for this 2021 UEC Plan Update; however, nonpotable reclaimed water main extension projects have been proposed and will provide reclaimed water for L/R irrigation.

## Power Generation

The Power Generation (PG) water use category demands are expected to remain stable, with no increases from 2020 to 2045. Because the availability of fresh water is limited in the UEC Planning Area, AWS sources may be the most feasible options to meet future PG use, if a new use is proposed.

Currently, there are three PG facilities in the UEC Planning Area: Florida Power & Light (FPL) Martin Plant, Treasure Coast Energy Center, and St. Lucie Nuclear Plant. The FPL Martin Plant uses fresh water from the SAS for processing water and from the C-44 Canal for cooling pond makeup water only. The Treasure Coast Energy Center uses groundwater from the FAS and plans to utilize reclaimed water when it becomes available. The St. Lucie Nuclear Plant uses potable water from Fort Pierce Utilities Authority for processing water and seawater for cooling water. The Indiantown Cogeneration Plant, which previously withdrew water from Taylor Creek/Nubbin Slough in the adjacent Lower Kissimmee Basin Planning Area, is inactive and will be demolished by 2022. No specific water supply development projects were provided or identified for this category.

# COOPERATIVE FUNDING PROGRAM

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 AWS and measurable water conservation programs. One guideline for funding consideration is that the project must be included in, or consistent with, a regional water supply plan update. Some projects not included in this 2021 UEC Plan Update but consistent with the plan's goals may be funded. When the SFWMD deems appropriate, a plan may identify the need for multijurisdictional approaches to project options based on the ability to permit and finance the project and its technical feasibility.

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 AWS, water conservation, and stormwater projects that are consistent with the District's core mission. In 2016, these cooperative funding efforts were combined under the 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 SFWMD's 16-county jurisdiction.

Each fiscal year, the District's Governing Board determines the amount of funding to allocate to the CFP, the project priorities for that year, and the cost share to be allocated. SFWMD staff review the proposed projects based on guidelines and priorities established by the District's Governing Board. Program funding is subject to approval by the District's Governing Board.

## Alternative Water Supply

The AWS component of the CFP provides cost-share funding for projects that increase water supply. These projects include development of saltwater or brackish water, reclaimed or recycled water, surface water captured during heavy rainfalls, sources made available through addition of new storage capacity, and stormwater (for use by a water use permittee), among others. From Fiscal Year (FY) 2016 through FY2021, the SFWMD provided more than $24.7 million in AWS funding for 32 projects located throughout the District. Four projects within the UEC Planning Area were funded and are under way, generating 9.50 mgd of AWS capacity and 14.85 mgd of additional reclaimed water distribution or brackish water (FAS) production (**Table 8-2**).

Table 8-2. AWS projects in the UEC Planning Area funded through the FDEP AWS Program and the Water Protection and Sustainability Program (FY2016 to FY2021).

| Project Name | County | Fiscal Year | Total Capacity (mgd) |
|---|---|---|---|
| Martin County Utilities – Tropical Farms: FAS Wells 6 and 7 | Martin | 2020 | 4.70 |
| City of Stuart – Construct FAS Production Well FA-1 | Martin | 2020 | 1.00 |
| City of Port St. Lucie Utility Systems Department – McCarty Ranch Reservoir and Water Treatment Plant (Areas 3, 4, and 6) | St. Lucie | 2020 | 8.50 |
| City of Port St. Lucie Utility Systems Department – Tradition and Western Grove Communities Reclaimed Water Main Extension | St. Lucie | 2021 | 10.15 |
| | | **Total** | **24.35** |

AWS = alternative water supply; FAS = Floridan aquifer system; FDEP = Florida Department of Environmental Protection; FY = Fiscal Year; mgd = million gallons per day; UEC = Upper East Coast.

## Water Conservation

The water conservation component of the CFP, formerly known as the WaterSIP, provides cost-share funding for projects that reduce urban and agricultural water use. The SFWMD has provided matching funds up to 50% to water providers and users (e.g., local governments, utilities, agricultural operations, industrial groups, schools, hospitals, homeowners' associations) for water-saving technologies such as low-flow plumbing fixtures, rain sensors, fire hydrant flushing devices, and other hardware. From FY2016 to FY2021, the SFWMD partially funded more than $3 million towards 60 water conservation projects through the CFP, with an estimated water savings of 1.50 billion gallons per year, or 4.30 mgd. In the UEC Planning Area, more than $433,000 went towards eight projects with estimated water savings of 402 million gallons per year, or 1.1 mgd (**Table 8-3**). **Chapter 3** contains additional information on water conservation efforts in the UEC Planning Area.

Table 8-3. Water conservation projects in UEC Planning Area supported by the FDEP AWS Program and Water Protection and Sustainability Program (FY2016 to FY2021).

| Project Name | Entity Name | Project Type | Fiscal Year | Proposed Water Savings (mgy) |
|---|---|---|---|---|
| Martin County | | | | |
| Engineering Irrigation H2O Conservation Retrofit Project | Field Operations Division of Martin County Engineering Department | Irrigation | 2016-2018 | 3.80 |
| St. Lucie County | | | | |
| Irrigation Water Conservation Retrofit | Nettles Island, Inc. A Condominium | Irrigation | 2016-2018 | 2.50 |
| Scott Grove #2 Citrus Ag Irrigation Retrofit (511 acres) | Scott Groves, Inc. | Irrigation | 2020 | 81.90 |
| Scott Groves #3 Citrus Ag Irrigation Retrofit (196 acres) | Scott Groves, Inc. | Irrigation | 2020 | 39.60 |
| Wescott Grove 1 Citrus Ag Irrigation Retrofit (986 acres) | Wescott Groves, LLC | Irrigation | 2020 | 100.80 |
| River Basket Citrus Grove Ag Irrigation Retrofit (225 acres) | Bernard Egan & Company | Irrigation | 2021 | 54.00 |
| Cow Creek Citrus Grove Ag Irrigation Retrofit (1,200 acres) | Bernard A Egan Groves, Inc. | Irrigation | 2021 | 70.20 |
| Ashland Citrus Grove Ag Irrigation Retrofit – Pump 10, 11, 12 (203.5 acres) | Graves Brothers Company | Irrigation | 2021 | 49.60 |
| | | | **Estimated Total Water Savings** | **402.40** |

AWS = alternative water supply; FDEP = Florida Department of Environmental Protection; FY = Fiscal Year; mgy = million gallons per year; UEC = Upper East Coast.

# SUMMARY OF WATER SUPPLY DEVELOPMENT PROJECTS

Total average gross water demands within the UEC Planning Area, from all sources, are projected to decrease 9.93 mgd (3%) by 2045. During the planning horizon, the PS category has a projected 43% increase in average finished water demand. While utilities proposed a total of 13 potable water multi-phased projects, only one utility appears to need an increase in treatment capacity before 2045, based on demand projections and treatment system requirements. Some utilities will meet future demand by purchasing water from other suppliers. Based on the evaluation for this 2021 UEC Plan Update, groundwater and surface water supplies are believed to be adequate to meet all projected demands through the planning horizon of 2045.

Fifteen PS utilities are located within the UEC Planning Area. The City of Port St. Lucie Utility Systems Department is the region's largest utility and is projected to serve approximately 324,447 residents by 2045. St. Lucie County Utilities needs to construct 3.78 mgd of water supply development projects to meet 2045 projected demands. All other PS growth within the UEC Planning Area can be served with existing facilities, although six utilities have proposed projects. The proposed water supply development projects could generate 56.09 mgd of new potable water treatment capacity to meet the 2045 net PS demand of 67.83 mgd. The new capacity consists of 27.20 mgd produced by projects using groundwater from the FAS and 28.89 mgd produced by capturing excess surface water/stormwater from the C-23 Canal. Summaries of existing and proposed project capacities are provided in **Tables 8-4** and **8-5**.

Several projects are for construction of additional FAS wells without a corresponding increase in treatment capacity. These wells will increase raw water production capacity to the treatment facility capacity and/or address water quality degradation and sustainability of the FAS as a water supply source. Current operations have shown water quality degradation caused by pumping can be managed by PS utilities through appropriate wellfield design and operating protocols, including the following activities:

- Increasing well spacing (more than 1,000 feet) to minimize interference effects and reduce stress on the FAS.
- Installing monitor wells to provide early warning of the need for changes to wellfield operations to minimize upconing or lateral movement of poor-quality water.
- Rotating the operation of individual wells, thereby reducing overall pumping stress on the well's production zone.
- Plugging and abandoning individual wells that have increased chloride concentrations and replacing them with new wells elsewhere within the wellfield.
- Reducing pumping rates at individual wells to minimize water level declines, which increase the potential for poor-quality water to enter the well's production zone from below.

Table 8-4. Existing and proposed water supply capacities (in mgd) for Public Supply utilities in the UEC Planning Area.

| County | Public Supply Utility | Surface Water/ Stormwater | | SAS | | FAS | | ASR | | Reclaimed Water[a] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Existing | Proposed | Existing | Proposed | Existing | Proposed | Existing | Proposed | Existing | Proposed[b] |
| Martin | Indiantown, Village of | | | 1.29 | | | | | | 0.75 | |
| | Martin County Utilities | | | 4.19 | | 9.31 | | | | | |
| | Sailfish Point | | | | | 0.35 | | | | 0.25 | |
| | South Martin Regional Utility | | | 6.14 | | 2.00 | 2.20 | | | 1.40 | 0.20 |
| | St. Lucie Mobile Village | | | 0.17 | | | | | | | |
| | Stuart, City of | | | 6.00 | | | 3.00 | | | 4.00 | |
| St. Lucie | Fort Pierce Utilities Authority | | | 12.99 | | 10.33 | | | | 10.00 | 7.00 |
| | Harbour Ridge | | | 0.36 | | | | | | 0.12 | |
| | Meadowood Community Association | | | 0.43 | | | | | | 0.11 | |
| | Port St. Lucie Utility Systems Department, City of | | 10.00[c] | 8.00 | | 33.65 | 12.66 | | | 18.00 | 6.00 |
| | Reserve Community Development District | | | 0.41 | | | | | | | |
| | Spanish Lakes Country Club | | | 0.48 | | | | | | | |
| | Spanish Lakes Fairways | | | 0.57 | | | | | | 0.25 | |
| | St. Lucie County Utilities | | | 0.29 | | | 12.00 | | | 2.75 | 4.00 |
| | St. Lucie West Services District | | | | | 3.40 | | | | 2.13 | |
| | **Total** | **0.00** | **10.00** | **41.32** | **0.00** | **59.04** | **29.86** | **0.00** | **0.00** | **39.76** | **17.20** |

ASR = aquifer storage and recovery; FAS = Floridan aquifer system; mgd = million gallons per day; SAS = surficial aquifer system; UEC = Upper East Coast.

[a] Reclaimed water is not a potable water source in the UEC Planning Area; however, it is an alternative water supply used to reduce reliance on traditional water sources.

[b] Distribution lines, wells, and other infrastructure projects that do not generate additional water supplies are not counted as adding increased capacity.

[c] Includes surface water treatment capacity only. Projects that do not increase capacity are not included (**Appendix B**).

Table 8-5. Proposed potable and nonpotable Public Supply development projects in the UEC Planning Area (2019 to 2045).*

| County | Project Name | Implementing Agency or Entity | Project Description | Project Capacity (mgd) | Total Capital ($M) | Estimated Completion Date |
|---|---|---|---|---|---|---|
| Potable – Surface Water | | | | | | |
| St. Lucie | McCarty Ranch Surface Water WTP | City of Port St. Lucie | Construct new surface water treatment plant | 10.00 | $147.00 | 2045 |
| Potable – FAS | | | | | | |
| Martin | Expand Tropical Farms FAS wellfield | Martin County Utilities | Construct two FAS wells | 0.00[b] | $3.77 | 2021 |
| | Expand North Jensen Beach FAS wellfield | Martin County Utilities | Construct one FAS well | 0.00[b] | $3.30 | 2022 |
| | Expand Tropical Farms FAS wellfield | Martin County Utilities | Construct one FAS well | 0.00[b] | $4.00 | 2025 |
| | RO Train #3 project | South Martin Regional Utility | Expand RO WTP and add one FAS well | 2.20 | $3.50 | 2035 |
| | FAS Well and RO Facility Phase 1 | City of Stuart | Construct one FAS well and new RO facility | 1.00 | $34.66 | 2023 |
| | FAS Well and RO Facility Phase 2 | City of Stuart | Construct one FAS well and expand RO facility | 1.00 | $5.24 | 2027 |
| | FAS Well and RO Facility Phase 3 | City of Stuart | Construct one FAS well and expand RO facility | 1.00 | $7.86 | 2032 |
| St. Lucie | James E Anderson Water Treatment Facility Expansion Phase III | City of Port St. Lucie | Construct one FAS well and expand RO facility | 2.66 | $3.09 | 2025 |
| | Rangeline WTP and FAS Wells | City of Port St. Lucie | Construct RO facility and FAS wellfield | 10.00 | $75.00 | 2035 |
| | North County WTP | St. Lucie County | Construct new RO facility | 4.00 | $46.00 | 2032 |
| | Central County WTP | St. Lucie County | Construct new RO facility | 4.00 | $46.00 | 2040 |
| | South County WTP | St. Lucie County | Construct new RO facility | 4.00 | $46.00 | 2035 |

| County | Project Name | Implementing Agency or Entity | Project Description | Project Capacity (mgd) | Total Capital ($M) | Estimated Completion Date |
|---|---|---|---|---|---|---|
| Nonpotable – Reclaimed Water | | | | | | |
| Martin | Reclaimed Water Expansion | South Martin Regional Utility | Expand reclaimed water treatment capacity | 0.20 | $1.26 | 2026 |
| St. Lucie | Mainland Water Reclamation Wastewater Treatment Facility | Fort Pierce Utilities Authority | Construct new reclaimed water treatment facility | 7.00 | $131.50 | 2045 |
| | Reclaimed Water Main from Glades WWTF to Tradition | City of Port St. Lucie | Construct reclaimed water main extension | 0.00[b] | $3.10 | 2022 or 2023 based on current FY21 contract |
| | Far West Reclaimed Water Main | City of Port St. Lucie | Construct reclaimed water main extension | 0.00[b] | $6.60 | 2036 |
| | Glades WWTF Expansion and Interconnect with Westport WWTF | City of Port St. Lucie | Expand reclaimed water treatment facility and construct reclaimed water main interconnect | 6.00 | $90.00 | 2045 |
| | North County WWTF | St. Lucie County | Construct new reclaimed water treatment facility | 4.00 | $50.00 | 2037 |
| Nonpotable – Surface Water Storage | | | | | | |
| St. Lucie | McCarty Ranch Areas 1-6 | City of Port St. Lucie | Construct six water storage areas to capture excess water from the C-23 Canal | 5.59 | $8.30 | 2019-2023 |
| | McCarty Ranch Area 7 | City of Port St. Lucie | Construct water storage area to capture excess water from the C-23 Canal | 3.30 | $5.00 | 2025 |
| | McCarty Ranch Reservoir | City of Port St. Lucie | Construct 350-acre reservoir to capture excess water from the C-23 Canal | 10.00 | $60.00 | 2030 |
| Nonpotable – ASR | | | | | | |
| St. Lucie | ASR Wells at McCarty Ranch WTP | City of Port St. Lucie | Construct ASR wells | 7.50 | $14.00 | 2045 |

ASR = aquifer storage and recovery; FAS = Floridan aquifer system; mgd = million gallons per day; PS = Public Supply; RO = reverse osmosis; SAS = surficial aquifer system; UEC= Upper East Coast; WTP = water treatment plant; WWTF = wastewater treatment facility.

[a] Based on planning-level screening, water supply projects are identified in this plan update to meet 2045 projected demands and generally have a likelihood of being permitted. However, each proposed use of water must meet the conditions for permit issuance found in Section 373.223, F.S., and the implementing criteria found in Chapter 40E-2, F.A.C., and will be reviewed on an application-by-application basis.

[b] Distribution lines, wells, and other infrastructure projects that do not generate additional water supplies are not counted as adding increased capacity.

# REFERENCES

FDEP. 2012. *Guidance for Improved Linkage between Regional Water Supply Plans and the Consumptive Use Permitting Process*. Office of Water Policy, Florida Department of Environmental Protection, Tallahassee, FL. March 23, 2012.

FDEP. 2020. *2019 Reuse Inventory*. Water Reuse Program, Florida Department of Environmental Protection, Tallahassee, FL.

SFWMD. 2021. *Support Document for the 2021-2024 Water Supply Plan Updates*. South Florida Water Management District, West Palm Beach, FL.

# 9

# Conclusions and Future Direction

This chapter of the *2021 Upper East Coast Water Supply Plan Update* (2021 UEC Plan Update) provides conclusions and summarizes future direction for water supply in the UEC Planning Area of the South Florida Water Management District (SFWMD or District). This plan update assesses the water demands and available sources through 2045. Water demand is expected to decrease 9.93 million gallons per day (mgd) by 2045, primarily due to decreases in the Agriculture (AG) water use category (**Chapter 2**). Water 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 reduces demands and is a component of meeting future water needs (**Chapter 3**).

TOPICS

- Demand Summary
- Demand Management: Water Conservation
- Natural Systems and Resource Protection
- Water Source Options
- Coordination
- Climate Change and Sea Level Rise
- Conclusions

There are several activities planned or under way to meet natural systems water needs, including Comprehensive Everglades Restoration Plan (CERP) projects and changes to lake regulation schedules, that can affect (enhance or limit) future water supplies within the UEC Planning Area (**Chapter 7**). In addition, regulatory criteria designed to protect water resources, including elements identified in minimum flow and minimum water level (MFL) recovery and prevention strategies, place limitations on water available for allocation (**Chapter 4**, **Appendix C**).

Guidance in this 2021 UEC 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 water users are addressed. All water users are encouraged to continue being prudent with water use decisions and use water efficiently. The SFWMD's recommendations for water supply planning in the UEC Planning Area include continued coordination with agricultural stakeholders, Public Supply (PS) utilities, and other water users; natural resource protection; diversification of water sources; and continued monitoring of water levels and water quality in surface water and groundwater.

# DEMAND SUMMARY

Total average annual demand for all water use categories for 2045 is projected to be 281.18 mgd (**Table 9-1**). This is a 3% decrease from the estimated 2019 demands (291.11 mgd) and 21% less than the projected 2040 demands in the 2016 UEC Plan Update.

Table 9-1. Summary of current and projected gross water demands under average rainfall conditions in the UEC Planning Area, by water use category.

| Water Use Category | 2019 Estimated Use | 2045 Projected Demand | Percent Change | Percent of Projected 2045 Total Demand |
|---|---|---|---|---|
| PS | 56.26 | 81.62 | 45.1% | 29.0% |
| DSS | 5.76 | 5.61 | -2.6% | 2.0% |
| AG | 174.72 | 130.10 | -25.5% | 46.3% |
| CII | 4.43 | 5.74 | 29.6% | 2.0% |
| L/R | 32.03 | 40.64 | 26.9% | 14.5% |
| PG | 17.91 | 17.47 | -2.5% | 6.2% |
| **Total** | **291.11** | **281.18** | **-3.4%** | **100.0%** |

AG = Agriculture; CII = Commercial/Industrial/Institutional; DSS = Domestic Self-Supply; L/R = Landscape/Recreational; mgd = million gallons per day; PG = Power Generation; PS = Public Supply; UEC = Upper East Coast.

# DEMAND MANAGEMENT: WATER CONSERVATION

Water conservation programs for all water use categories offer the potential to reduce the amount of water needed to meet future demands (**Chapter 3**). All water users are urged to implement water conservation measures to reduce demands and defer construction of capital-intensive projects. The following conservation-related actions are recommended:

- The SFWMD will continue to implement the its Comprehensive Water Conservation Program.
- All water users are encouraged to implement water conservation measures and practices that increase water use efficiency to help reduce future demands.
- AG water users are encouraged to install or upgrade high-efficiency irrigation systems and advanced irrigation technology.
- When applicable, AG water users are encouraged to use Florida Automated Weather Network irrigation tools.
- PS utilities are encouraged to develop goal-based water conservation plans to implement water-saving measures and programs.
- Local governments should evaluate whether mandated water conservation measures, such as requirements for construction of water-efficient homes and commercial properties, are appropriate for their jurisdiction.
- Local governments should adopt a year-round irrigation ordinance that fully comports with the SFWMD's Mandatory Year-Round Landscape Irrigation Conservation Measures Rule [Chapter 40E-24, Florida Administrative Code (F.A.C.)].

- Local governments should develop or enhance existing ordinances to be consistent with Florida-Friendly Landscaping provisions (Section 373.185, Florida Statutes).
- Public education programs can help instill a year-round conservation ethic. Local governments and PS utilities are encouraged to provide conservation-related educational programs in cooperation with the SFWMD.
- Water users are encouraged to seek cost-share funding opportunities that may be available for water conservation projects.
- Landscape/Recreational (L/R) water users are encouraged to implement advanced irrigation technology, improve landscape design and management practices, and participate in recognition programs (e.g., Florida-Friendly Landscaping program) to further increase landscape water use efficiency.
- Commercial/Industrial/Institutional (CII) entities are encouraged to use the *Water Efficiency Self-Assessment Guide for Commercial and Institutional Facilities, A Guide for Facility Managers* (SFWMD 2013) to improve water use efficiency and reduce operating costs.

## NATURAL SYSTEMS AND RESOURCE PROTECTION

St Lucie Estuary

In addition to meeting the water needs of natural systems, a wide range of activities related to natural systems can affect future water supplies within the UEC Planning Area. Such activities include CERP projects; changes by the United States Army Corps of Engineers (USACE) to regulation schedules for the Everglades, Lake Okeechobee, and other water bodies; and monitoring and research projects. In addition, regulatory criteria designed to protect water resources, including elements identified in MFL recovery and prevention strategies, can place limitations on water available for allocation (**Chapter 4**, **Appendix C**).

Water supply needs for natural systems are addressed through water resource development projects such as CERP (**Chapter 7**). CERP includes regional projects to improve the quality, timing, volume, distribution, and delivery of water to the natural system and can enhance water availability for other uses. Future environmental restoration and water resource protection efforts include the following:

- The SFWMD will continue to make progress towards completion of the Indian River Lagoon – South Project, including operation of the C-44 reservoir and stormwater treatment area (STA) and construction and operation of the C-23, C-24, and C-25 project components and other ecosystem restoration projects.
- The SFWMD will continue to partner with the USACE on planning for future CERP projects in the Lake Okeechobee and Loxahatchee River watersheds.

- The SFWMD will continue to monitor natural areas, including the St. Lucie River watershed, Allapattah Flats, Ten Mile Creek Water Preserve Area, Cypress Creek, Taylor Creek, and Lakeside Ranch, and provide annual updates on the health of these areas in the *South Florida Environmental Report* to meet regulatory requirements.
- The SFWMD will continue to implement MFL prevention strategy components for the St. Lucie Estuary and update them, if needed, in conjunction with future plan updates.

# WATER SOURCE OPTIONS

The UEC Planning Area relies primarily on surface water from the C-23, C-24, and C-25 canals as well as Lake Okeechobee and its connected canals for AG irrigation, with supplemental water from the Floridan aquifer system (FAS) during dry periods. Fresh groundwater from the surficial aquifer system (SAS) and brackish water from the FAS are the primary sources for PS and other urban and industrial uses (**Chapter 5**).

Withdrawals from the SAS have been maximized in many areas, especially along the coast, due to potential impacts on wetlands, potential for saltwater intrusion into freshwater sources, and low aquifer productivity. Therefore, PS utilities are expected to continue increasing use of the FAS to meet future water demands. Additionally, blending brackish water with fresh water from the SAS or surface water is a practical solution to meet some of the region's AG needs when surface water availability is limited or during freezes. However, the suitability of supplementing water from the FAS may depend on the salt tolerance of the intended crops.

Pumps on FAS wells in Martin and St. Lucie counties are restricted, as outlined in the *Applicant's Handbook for Water Use Permit Applications within the South Florida Water Management District* (SFWMD 2021). In addition, restricted allocation area criteria limit surface water withdrawals from the C-23, C-24, and C-25 canals and Lake Okeechobee and its hydraulically connected canals, such as the C-44 (St. Lucie) Canal.

Alternative water supply (AWS) sources, such as reclaimed water, can be used to meet new uses or replace freshwater sources and potable water currently used for irrigation or industrial purposes. Additionally, water storage features such as reservoirs, aquifer storage and recovery (ASR) wells, and impoundments can capture excess stormwater, groundwater, and surface water during wet weather periods and provide supplemental water supply for AG, PS, natural systems, and other needs during dry periods. Seawater is a potential AWS source as technology costs continue to decline; however, no seawater projects are proposed in this plan update.

The following sections offer guidance for consideration by local governments, water users, and the SFWMD as a basis for the future direction of water supply planning in the UEC Planning Area.

## Surface Water

Surface water is the primary source for the AG water use category in the UEC Planning Area. Surface water supply sources in/adjacent to the UEC Planning Area include the C-23, C-24, C-25, and C-44 canals and Lake Okeechobee and its connected secondary system in the Lake Okeechobee Service Area. Water availability in most of these systems is limited due to restricted allocation area criteria or other protective measures. Additional water storage features could enhance water availability. The following actions should be implemented:

C-23 Canal in the St. Lucie Agricultural Area

- The SFWMD and USACE will continue operating the C-44 reservoir and STA and implementing C-23, C-24, and C-25 project components.
- The SFWMD and USACE will complete and implement the components identified in the Lake Okeechobee Watershed Restoration Project Tentatively Selected Plan. Part of CERP, this project will increase the watershed's storage capacity and improve the quantity and timing of water deliveries to Lake Okeechobee.
- The USACE will complete rehabilitation of the Herbert Hoover Dike and the Lake Okeechobee System Operation Manual by 2022.
- Local governments, PS utilities, and agricultural operations are encouraged to create additional storage capacity for surface water, where appropriate and feasible.
- AG users should consider reducing or augmenting surface water use with options such as stormwater and tailwater recovery, the blending of brackish groundwater with fresh water where available, and more efficient water conservation practices.

## Groundwater

Groundwater is the primary source of water for urban needs in the UEC Planning Area, with approximately 31% of the 2019 PS demand met with fresh groundwater from the SAS and 69% with brackish groundwater from the FAS. The FAS also serves as a supplemental source for many AG stakeholders. This 2021 UEC Plan Update supports the use of reclaimed water for urban irrigation, thereby reducing demands on the potable water system and freshwater resources.

### *Surficial Aquifer System*

At current use rates and locations, water levels in the SAS appear stable. Potential 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 SFWMD's water use permitting criteria. The following actions are suggested:

- Water users are encouraged to reduce reliance on the SAS by diversifying water sources and developing AWS sources to meet future water demands.
- PS utilities should design wellfield locations, configurations, and pumping regimes to minimize the potential for saltwater intrusion, pollution, harm to natural systems, or increased dependence on the regional system (as demonstrated through modeling).
- PS utilities should continue to expand interconnections with other utilities for supply reliability and assess existing interconnections to confirm they operate as intended.
- The SFWMD, United States Geological Survey, and local governments should continue coordinating saltwater intrusion monitoring efforts to delineate the location and movement of the saltwater interface and identify areas of concern. The SFWMD will continue to update saltwater interface maps every 5 years.
- The SFWMD will periodically review, maintain, and enhance existing groundwater monitoring networks that collect water level and water quality data.
- The SFWMD will continue developing the East Coast Surficial Model, a density-dependent groundwater flow and solute transport model that will be used to simulate the effects of sea level rise and climate change on the SAS.

### *Floridan Aquifer System*

The FAS is expected to be the primary water source to meet increased PS demands. Brackish groundwater from the FAS is considered an AWS source in the UEC Planning Area. The following future actions are suggested:

- Local water users installing FAS wells are encouraged to collaborate with the SFWMD to gather and share hydrogeologic data. Additional data will increase knowledge of FAS properties and could support updates to future groundwater modeling efforts.
- The monitoring networks used to assess and model the FAS are a hybrid of regional monitoring by agencies such as the SFWMD and monitoring performed by water use permittees as part of their permit requirements. Efforts should be made to identify wells considered critical to long-term monitoring and modeling to ensure they are maintained or replaced, as necessary.
- Local water users, other agencies, local governments, and PS utilities are encouraged to coordinate with the SFWMD to improve ongoing water level and water quality monitoring of the FAS. Geophysical assessment of monitor wells should be conducted, as appropriate.

- PS utilities should use an incremental approach when installing and testing production wells due to geologic variability within the FAS. Wellfields should be designed and monitored to prevent over-stressing production zones and to minimize harmful changes in water quality.
- The SFWMD will continue to work with FAS stakeholders, including the St. Johns River Water Management District, to further refine assumptions and data used in the East Coast Floridan Model simulations.
- AG water users should consider blending brackish water from the FAS with fresh groundwater or surface water to produce acceptable irrigation-quality water. Blended water supplies depend on crop requirements, water sources, treatment type, volume of stored water, and natural system requirements. These blended supplies require monitoring to ensure acceptable water quality.
- Landowners are encouraged to plug and abandon free-flowing inactive or nonfunctional FAS wells in accordance with existing rules and regulations. This will prevent loss of water via free-flowing wells and contamination of the overlying SAS and with more saline water from the FAS.

Floridan Aquifer System Monitor Well

## Reclaimed Water

Reclaimed Water Pipes

In the UEC Planning Area, reclaimed water is used primarily for L/R irrigation, with some used for groundwater recharge, cooling water, and environmental enhancement. Reclaimed water can be used to meet new uses or replace freshwater sources currently used for irrigation and industrial purposes, thereby decreasing the use of traditional water sources. Opportunities to expand reclaimed water use include the following:

- Local governments should consider requiring construction of reclaimed water infrastructure in new development projects. Building codes, ordinances, and land development regulations are options to promote reclaimed water use.
- Local governments and PS utilities should support the installation of additional reclaimed water lines for irrigation of residential lots, medians, common areas, and golf courses to decrease reliance on traditional freshwater sources and potable water distribution systems. When funds are available, entities are encouraged to apply for AWS grants for "shovel-ready" reclaimed water construction projects.

- Local governments should consider establishing mandatory reuse zones, where reclaimed water use is required by ordinance. The SFWMD can provide technical assistance to local governments who wish to establish mandatory reuse zones.
- PS utilities should consider using substitution credits and impact offsets (Section 373.250, Florida Statutes) during the water use permitting process to promote increased use of reclaimed water.
- Utilities should extend their reclaimed water supply by implementing feasible options such as reclaimed water augmentation, increased storage, residential customer metering, tiered rate structures, limiting landscape irrigation frequency, and interconnects with other reclaimed water utilities.

## New Storage Capacity for Surface Water or Groundwater

In the UEC Planning Area, water storage options include reservoirs, ASR wells, and surface water impoundments that capture excess groundwater or surface water for later use. In addition, ASR can be used to store excess potable water and reclaimed water. Proposed projects that develop new storage and create additional water supply may be considered AWS sources. Opportunities for new storage capacity include the following:

- Surface water storage systems (e.g., reservoirs) can help meet environmental, agricultural, and urban water supply needs.
- New or retrofitted surface water storage systems for agricultural operations could provide additional water supply for irrigation.
- ASR systems can store water during periods of low demand and high water levels (i.e., during the wet season) for subsequent recovery during dry periods, which could reduce withdrawals from the SAS and FAS wells.

Ten Mile Creek Reservoir

## 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.

# COORDINATION

Coordination and collaboration among regional and local government agencies and utility planning entities is essential to ensure the supply of water is sufficient and sustainable to meet urban, agricultural, and environmental needs. Examples of coordination activities include the following:

- Water Supply Facilities Work Plans are due within 18 months of approval of this 2021 UEC Plan Update. Local governments must provide linkages and coordination between the SFWMD's plan update and the water supply-related components of their Comprehensive Plans.
- The SFWMD will continue to work with the Florida Department of Agriculture and Consumer Services and agricultural stakeholders to provide data for annual updates to the Florida Statewide Agricultural Irrigation Demand simulation for future crop acreage and water demand projections.
- The SFWMD will continue to coordinate with utilities, counties, and the United States Geological Survey to review, recommend improvements, and provide data and analysis for saltwater intrusion monitoring networks.
- Where wellfields are at risk of saltwater intrusion, the SFWMD will work with utility and county staff to identify additional monitoring needs and potential solutions.
- The SFWMD will coordinate with stakeholders on the development and use of regional groundwater and surface water models to evaluate water resource availability.
- The SFWMD will coordinate ongoing activities outside the basin with St. Johns River Water Management District's planning efforts along the District boundaries.

# CLIMATE CHANGE AND SEA LEVEL RISE

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 and sea level rise include the following:

- The SFWMD will continue to investigate climate change and sea level rise projection models for use in water supply planning and system operations.
- The SFWMD will continue to support AWS development and promote water conservation to increase the security and diversity of water sources, as withdrawing less water from aquifers helps prevent saltwater intrusion.
- The SFWMD, USACE, and coastal utilities and municipalities should identify methods to evaluate the consequences of climate change and sea level rise and use them to assess the cumulative impacts to existing structures, water resources, and legal users.
- The SFWMD will continue to provide technical assistance to local governments as they develop climate change adaptation efforts.
- Water users should periodically review irrigation schedules and install weather-based controllers to adapt to changes in climate.

- PS utilities should plan for climate change and sea level rise by shifting pumpage from coastal wells to inland wells, reducing withdrawals from the SAS by using the FAS, employing water conservation measures to reduce overall water demands, and expanding reuse programs to reduce potable and self-supplied SAS withdrawals for irrigation.
- Local governments, utilities, and private entities should develop adaptive strategies to address climate change and sea level rise (e.g., constructing defensive barriers, improving infrastructure, rezoning property threatened by inundation or transferring it to public ownership).

# CONCLUSIONS

This 2021 UEC Plan Update concludes that future water needs of the region can continue to be met through 2045 with appropriate management, conservation, and implementation of projects identified herein. Meeting future water needs through 2045 depends on the following:

- Construction of one potable water supply development project by one PS utility.
- Implementation of the CERP Indian River Lagoon – South Project and other ecosystem restoration projects.
- Completion of repairs to the Herbert Hoover Dike by the USACE and subsequent implementation of a new Lake Okeechobee regulation schedule.

Successful implementation of this 2021 UEC Plan Update requires close coordination and collaboration with local governments, utilities, agricultural interests, and other stakeholders. This partnering should ensure water resources in the UEC Planning Area are prudently managed and available to meet future demands while also protecting the environment.

# REFERENCES

SFWMD. 2013. *Water Efficiency and Self-Conducted Water Audits at Commercial and Institutional Facilities, A Guide for Facility Managers*. Second Edition. South Florida Water Management District, West Palm Beach, FL. July 2013.

SFWMD. 2021. *Applicant's Handbook for Water Use Permit Applications within the South Florida Water Management District*. South Florida Water Management District, West Palm Beach, FL. March 2021.

# Glossary

**1-in-10-year drought** A year in which below normal rainfall occurs with a 90% probability of being exceeded in any other year. It has an expected return frequency of once in 10 years.

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

**Acre-foot, acre-feet** The volume of water that covers 1 acre (43,560 square feet) to a depth of 1 foot. The equivalent of 43,560 cubic feet, 1,233.5 cubic meters, or 325,872 gallons.

**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 water budget model for calculating 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.

**Agriculture (AG)** Self-supplied water used for commercial crop irrigation, greenhouses, nurseries, livestock watering, pasture, and aquaculture.

**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; stormwater; 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, Florida Statutes (F.S.)].

***Applicant's Handbook for Water Use Permit Applications within the South Florida Water Management District*** **(Applicant's Handbook)** Read in conjunction with Chapter 40E-2, Florida Administrative Code (F.A.C.), the Applicant's Handbook further specifies the general procedures and criteria used by SFWMD staff for review of water use permit applications to ensure water uses permitted by the SFWMD are reasonable-beneficial, do not interfere with existing legal users, and are in the public interest.

**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 potable water, stormwater, surface water, fresh groundwater, or reclaimed water, which is appropriately treated to potable standards and injected into an aquifer through wells. 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 injected during the wet season or when water is readily available and 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.

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

**Base condition** A specified period of time during which collected data are used for comparison with subsequent data.

**Basin** There are two types of basins: 1) a groundwater basin is a hydrologic unit consisting of one large aquifer, or several connecting and interconnecting aquifers; and 2) a surface water basin is 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.

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

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

**Canal** A manmade waterway used for draining or irrigating land or for navigation by boat.

**Capacity** The ability to treat, move, or reuse water. Typically, capacity is expressed in millions of gallons per day (mgd).

**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 the east and west coasts and from Orlando south to the Everglades. It was designed and constructed during the 1950s by the United States Army Corps of Engineers (USACE) to provide flood control and improve navigation and recreation.

**Commercial/Industrial/Institutional (CII)** Self-supplied water associated the production of goods or provision of services by industrial, commercial, or institutional establishments.

**Comprehensive Everglades Restoration Plan (CERP)** The federal-state partnership 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.

**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*)

**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).

**Cubic feet per second (cfs)** A rate of flow (e.g., in streams and rivers) equal to a volume of water 1 foot high and 1 foot wide flowing a distance of 1 foot in 1 second. One cfs is equal to 7.48 gallons of water flowing each second.

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

**Demand** The quantity of water needed to fulfill a requirement.

**Demand management** 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.

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

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

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

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

**Domestic Self-Supply (DSS)** Potable water used by households served by small utilities (less than 0.10 mgd) or self-supplied by private wells.

**Domestic wastewater** Wastewater derived principally from residential dwellings, commercial buildings, and institutions; sanitary wastewater; sewage.

**Drainage basin** The land area where precipitation ultimately drains to a particular watercourse (e.g., river, stream) or body of water (e.g., lake, reservoir). Drainage basins in South Florida are defined by rule and periodically are 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 reduces water supply availability.

**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.

**Elevation** The height in feet above mean sea level according to National Geodetic Vertical Datum of 1929 (NGVD29) or North American Vertical Datum of 1988 (NAVD88). May also be expressed in feet above mean sea level as reference datum.

**Environmental impact statement** An evaluation of the positive and negative environmental effects of a proposed agency action 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."

**Estuary** A body of water found where a river meets the ocean that is characterized by fresh water mixing with salt water.

**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.

**Exceedance (MFL)** As defined in Rule 40E-8.021(17), F.A.C., to fall below a minimum flow or level, which is established in Parts II and III of Chapter 40E-8, F.A.C, for a duration greater than specified for the MFL water body.

**Finished water** Water that has undergone a purification or treatment process; water that has passed through all the processes in a water treatment plant and is ready to be delivered to consumers. Contrast with *Raw water*.

**Finished water demand** (see *Net water demand*)

**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)** An executive department of the Government of Florida. FDACS supports and promotes Florida agriculture, protects the environment, safeguards consumers, and ensures the safety and wholesomeness of food. The Office of Agricultural Water Policy works with agricultural producers, industry groups, the Florida Department of Environmental Protection, universities, and water management districts to develop and implement agricultural best management practices, addressing water quality and water conservation.

**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, deep aquifer system composed of the Upper and Lower Floridan aquifers. It is the principal source of water supply north of Lake Okeechobee and is highly mineralized south of the lake, requiring membrane treatment prior to use.

**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).

**Fresh water** An aqueous solution with a chloride concentration less than or equal to 250 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.

**Gross (raw) water demand** The amount of water withdrawn from a water resource to meet a particular need of a water user or customer. Gross demand is the amount of water allocated in a water use permit. Gross or raw water demands are nearly always higher than net or user/customer water demands to account for treatment and distribution losses.

**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 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 emphasis on the chemistry and movement of water.

**Hydrologic condition(s)** The state of an area pertaining to the amount and timing 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.

**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.

**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.

**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 contain drinking water.

**Irrigation** The application of water to crops and other plants by artificial means to supplement rainfall.

**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.

**Landscape/Recreational (L/R)** Self-supplied and reclaimed water used to irrigate golf, courses, sports fields, parks, cemeteries, and large common areas such as land managed by homeowners' associations and commercial developments.

**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% 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.

**Million gallons per day (mgd)** A rate of flow of water equal to 133,680.56 cubic feet per day, 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).

**Minimum flow and minimum water level (MFL)** A flow or level established by the SFWMD 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 lab (MIL)** A vehicle furnished with irrigation evaluation equipment that 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. Groundwater flow models are a numerical representation of water flow and water quality within an aquifer or aquifer system.

**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.

**National Geodetic Vertical Datum of 1929 (NGVD29)** 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. As technology has improved and the demand for greater accuracy increased, inherent inaccuracies were uncovered in NGVD29. As a result, NGVD29 has been superseded by the North American Vertical Datum (NAVD) of 1988.

**Natural system(s)** A self-sustaining living system that supports an interdependent network of aquatic, wetland-dependent, and upland living resources.

**Outflow** The measured quantity of water that has left an area or water body (through pumping or gravity) during a certain period of time.

**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.

**Permeability** The capacity of a porous rock, sediment, or soil for transmitting a fluid.

**Planning Area** The SFWMD is divided into five areas within which planning activities are focused: Upper Kissimmee Basin (part of the Central Florida Water Initiative), Lower Kissimmee Basin, Upper East Coast, Lower West Coast, and Lower East Coast.

**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 placed in a confined aquifer.

**Power Generation (PG)** 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.

**Priority Water Bodies List and Schedule** Required in Section 373.042(2), F.S. of the state's five water management districts to provide the Florida Department of Environmental Protection with an annual list and schedule of specific surface waters and groundwaters 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 use, e.g., mixing cement.

**Public Supply (PS)** Water supplied by water treatment facilities for potable use (drinking quality) with projected average pumpages greater than 0.10 million gallons per day.

**Public Supply (PS) demand** All potable (drinking quality) water supplied by water treatment plants with projected average pumpages of 0.10 million gallons per day or greater to all types of customers, not just residential.

**Rapid infiltration basin** A disposal method by which treated wastewater is applied in deep and permeable deposits of highly porous soils for percolation.

**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 plant. 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 almost always higher than user/customer demands because of 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 (groundwater)** The natural or intentional infiltration of surface water or reclaimed water into the ground to raise groundwater levels.

**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.].

**Recovery** The rate and extent of return of a natural 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.

**Reservoir** An artificial or natural water body used for water storage. Reservoirs can be above or below ground.

**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** An area designated within the South Florida Water Management District boundaries 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.

**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 more efficient irrigation system, such as a conversion from an overhead sprinkler system to a micro-irrigation system. May also include rain or soil moisture sensors to increase efficiency.

**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** A treatment process for desalting water using applied pressure to drive the feed water (source water) through a semipermeable membrane.

**Rule(s)** Of or pertaining to the SFWMD's regulatory programs, which are set forth in various statutes, codes, 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.

**Salinity** Of or relating to chemical salts, usually measured in milligrams per liter (mg/L), or practical salinity units.

**Salt water** (see *Seawater or Salt water*)

**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.

**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.

**Seawater** or **Salt water** Water with a chloride concentration at or above 19,000 mg/L.

**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 movement 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.

**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 that results from a change in surface water or groundwater hydrology and takes more than 2 years to recover, but which is considered less severe than serious harm.

**Stormwater** Water that does not infiltrate but accumulates on land as a result of storm runoff, snowmelt, irrigation, or drainage from impervious surfaces.

**Stormwater discharge** Precipitation runoff from roadways, parking lots, and roof drains that is collected in gutters and drains. A major source of nonpoint source pollution to water bodies and sewage treatment facilities in municipalities where stormwater 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.

**Surface water** Water above the soil or substrate surface, whether contained in bounds, created naturally or artificially, or diffused. Water from natural springs is classified as surface water when it exits from the spring onto the earth's surface.

**Surficial aquifer system (SAS)** Often the principal source of water for urban uses. 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.

**Treatment facility** Any facility or other works used for the purpose of treating, stabilizing, or holding water or wastewater.

**Tributary** A stream that flows into a larger stream or other body of water.

**United States Army Corps of Engineers (USACE)** As part of the Department of the Army, the USACE 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.

**United States 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. The USGS works with partners to monitor, assess, conduct targeted research, and deliver information on a wide range of water resources and conditions, including streamflow, groundwater, water quality, and water use and availability.

**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" means 365 days from the last day of the previous MFL exceedance.

**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 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 demand management measure because it reduces the need for future expansion of water supply infrastructure (see *Demand management*).

**Water conservation rate structure** A water rate structure designed to conserve water. Examples of conservation rate structures include 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, navigation, 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, whether it is for recreation, fishing, drinking, navigation, shellfish harvesting, or agriculture.

**Water reservation** 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 resource development** The formulation and implementation of regional water resource management strategies, including collection and evaluation of surface water and groundwater data; structural and nonstructural programs to protect and manage the water resources; development of regional water resource implementation programs; 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 standards and can be divided into subwatersheds 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(s)** 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 Lake Okeechobee, 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** Detailed water supply plan developed by the water management districts 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 at least 20 years and recommends projects to meet identified needs.

**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 a specified quantity of water withdrawal for consumptive use over a specified time period.

**Wellfield** One or more wells producing water from a groundwater 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, marshes).

**Withdrawal** Water removed from a groundwater or surface water source for use.

**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.

South Florida Water Management District is committed to managing and protecting our region's water resources

Meeting South Florida's water supply needs while safeguarding its natural systems requires innovative solutions, cohesive planning, and a shared vision.

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