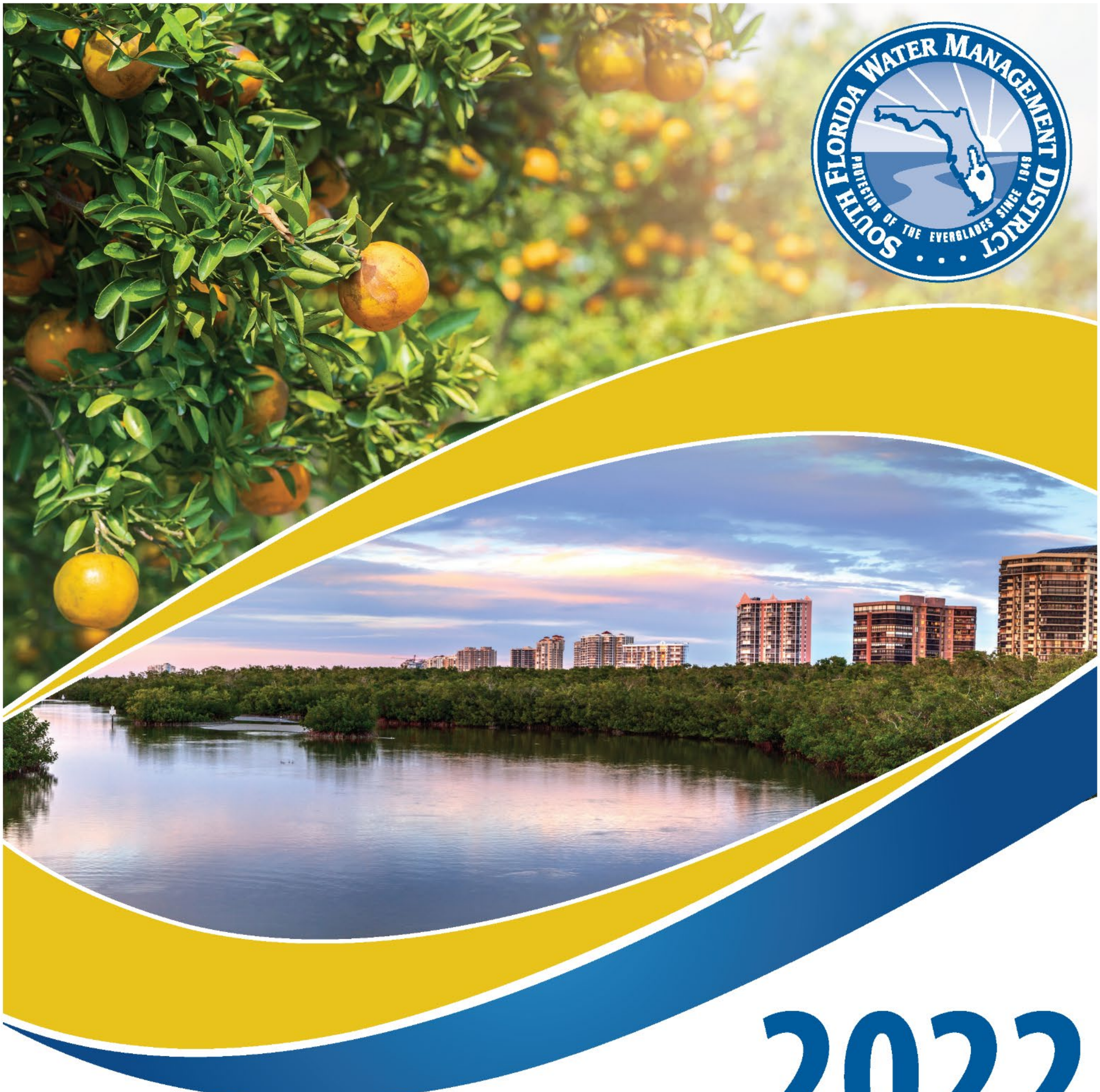


2022 LOWER WEST COAST

WATER SUPPLY PLAN UPDATE

PLANNING DOCUMENT/APPENDICES

Cover Photos

Front Top: Florida Oranges
Front Bottom: Clam Pass River, Naples, Florida
Back: Merritt Pump Station (S-488), Picayune Strand Restoration Project

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 *2022 Lower West Coast Water Supply Plan Update.*

Furthermore, the SFWMD expresses appreciation to all staff who contributed to the development and production of this plan update.

For further information about this document, please contact:

Bob Verrastro
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406
Telephone: (561) 682-6136
Email: bverras@sfwmd.gov

sfwmd.gov

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 *2022 Lower West Coast Water Supply Plan Update* (2022 LWC Plan Update) is the fifth update to the 1994 Lower West Coast Water Supply Plan, which previously was updated in 2000, 2006, 2012, and 2017. 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 and describes water resource and water supply development projects completed since the 2017 plan update.

This 2022 LWC Plan Update was developed in an open, public forum (**Chapter 1**). Meetings and workshops were held with water users, local and tribal governments, utilities, agricultural industry and environmental representatives, other stakeholders, and the general public to solicit input, provide information about planning results, and receive comments on draft sections. Due to the COVID-19 pandemic, the SFWMD held three virtual workshops for this water supply plan update.

The LWC Planning Area includes all of Lee County, most of Collier County, and portions of Charlotte, Glades, Hendry, and Monroe counties and the Seminole Tribe of Florida Immokalee Reservation. The LWC Planning Area covers more than 5,100 square miles and generally reflects the drainage patterns of the Caloosahatchee River Basin to the north and Big Cypress National Preserve to the south. The northern area of the Caloosahatchee River Basin also is the general jurisdictional boundary between the SFWMD and the Southwest Florida Water Management District in Charlotte County. The eastern boundary of the LWC Planning Area is along the western edge of the historic Everglades watershed, dividing the Big Cypress and Lake Okeechobee drainage basins. The southern end of the LWC Planning Area encompasses a coastal portion of Everglades National Park and ends just north of Shark River Slough.

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, agencies, and local 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 LWC Planning Area is home to nearly 1,200,000 people and supports a large agricultural industry. The permanent population is projected to exceed 1,600,000 people by 2045, an approximately 38% increase from the 2020 base year estimate for this plan update. Approximately two-thirds of the LWC Planning Area's permanent population resides in Lee 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. Agricultural irrigated acres are projected to increase modestly by 5%, from 291,765 acres in 2020 to 307,062 acres in 2045. Citrus is the dominant crop, covering more than 118,000 acres. Sugarcane also is a dominant crop in the region, accounting for more than 88,000 acres in 2020 and is expected to decrease by 2,000 acres in 2045. Average water demands for the Agriculture (AG) use category are projected to increase approximately 5%, from an average total water use of 592.02 million gallons per day (mgd) in 2020 to 621.40 mgd in 2045 (**Table ES-1**).

AG is projected to remain the largest water use category in the LWC Planning Area, accounting for approximately 57% of the total 2045 projected demand. Landscape/Recreational (L/R) is the second largest water use category, representing 25% of the total 2045 projected demand. PS is the third largest water use category, representing 20% of the total 2045 projected demand. Domestic Self-Supply (DSS), Commercial/Industrial/Institutional (CII), and Power Generation (PG) collectively account for approximately 23% of the total 2045 projected demand. In the LWC Planning Area, the overall demands are projected to increase by approximately 14% from 2020 to 2045. The total demand projection for 2045 in this 2022 LWC Plan Update is 4% lower than the estimated 2040 demand projected in the 2017 LWC Plan Update.

Table ES-1. Estimated (2020) and projected (2045) gross water demands (in mgd) under average rainfall conditions in the LWC Planning Area by use category.

Water Use Category	2020	2045	Percent Change	Percent of Projected 2045 Total
Public Supply	138.50	186.02	34%	15.7%
Domestic Self-Supply	24.53	34.01	38%	2.9%
Agriculture	592.02	621.40	5%	52.6%
Commercial/Industrial/Institutional	37.73	48.23	28%	4.1%
Landscape/Recreational	219.17	289.23	32%	24.5%
Power Generation	1.54	2.03	32%	0.2%
LWC Planning Area Total	**1,013.49**	**1,180.92**	**17%**	**100.0%**

LWC = Lower West Coast; mgd = million gallons per day.

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 LWC Planning Area have effectively lowered the net (finished) water per capita use rate for PS over the past two decades, from 178 gallons per capita per day in 2000 to approximately 123 gallons per capita per day in 2020. Analyses suggest that water users in the LWC Planning Area can collectively save an additional 43 mgd by 2045 if various urban and agricultural conservation options are implemented.

NATURAL SYSTEMS AND RESOURCE PROTECTION

Natural surface water systems in the LWC Planning Area include the Caloosahatchee River Estuary, Lake Trafford, Corkscrew Regional Ecosystem Watershed, Big Cypress Swamp, Picayune Strand State Forest, southern Charlotte Harbor, Estero Bay, Naples Bay, Ten Thousand Islands National Wildlife Refuge, Rookery Bay National Estuarine Research Reserve, and the Fakahatchee Estuary, among others. The water supply needs for natural systems are protected and addressed through regulatory mechanisms, restoration projects, and water resource development projects.

In the LWC Planning Area, minimum flows and minimum water levels (MFLs) with their associated prevention and recovery strategies have been adopted for the LWC aquifers, Lake Okeechobee, and the Caloosahatchee River (**Chapter 4**, **Appendix C**). The MFL and recovery strategy for Lake Okeechobee affects portions of the LWC Planning Area but is described in the Lower East Coast water supply plan updates (last updated in 2018). A restricted allocation area has also been established for the Lake Okeechobee Service Area as part of the Lake Okeechobee MFL recovery strategy. Water reservations, another resource protection regulatory mechanism, have been adopted for the C-43 West Basin Storage Reservoir, the Fakahatchee Estuary, and the Picayune Strand.

Large ecosystem restoration projects are under way in the LWC Planning Area (**Chapter 7**) that are vital to improving and maintaining the viability of the region's water resources, including elements identified in the Caloosahatchee River MFL recovery 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. CERP includes numerous capital projects needed to protect and restore natural systems and increase water availability, including the C-43 West Basin Storage Reservoir, Picayune Strand Restoration Project, and Lake Okeechobee Watershed Restoration Project. Although the Lake Okeechobee Watershed Restoration Project is not within the LWC Planning Area boundary, it does affect the region's water resources (i.e., the C-43 Canal and the Caloosahatchee 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; restore wetlands; and improve water supply for existing legal users.

WATER SOURCE OPTIONS

Water users in the LWC 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) and intermediate aquifer system (IAS) are considered traditional water sources. Alternative water supply sources include brackish groundwater from the IAS and 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.

PS utilities within the LWC Planning Area rely on groundwater from the SAS and IAS and brackish groundwater from the IAS and 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 24 PS utilities in the LWC Planning Area, one utility will need to construct new projects to meet its projected 2045 demands. However, 9 utilities have proposed 18 new projects through 2045. These new projects will increase water supply capacity, reliability, and distribution primarily through source diversification, changes in treatment technology, expanded use of the FAS, and extension of reclaimed water lines.

Fresh groundwater from the SAS and IAS supplies 100% of the estimated demand for DSS in the LWC Planning Area. Although DSS demand is expected to increase by 39% over the planning horizon, groundwater from the SAS can continue to meet the 2045 DSS demands in most areas. However, there are concentrated DSS withdrawals that have depressed IAS groundwater levels locally in northern Cape Coral (Mid-Hawthorn aquifer) and Lehigh Acres (Sandstone aquifer) towards established MFLs. The District is coordinating with Lee County, Cape Coral, and local utilities to identify potential solutions to protect the water resources for all stakeholders.

AG users rely primarily on surface water to meet their demands. Groundwater from the SAS and IAS is utilized to a much lesser extent and to a very small extent brackish groundwater. 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 small increase in AG demands is expected over the planning horizon; therefore, existing surface and groundwater 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 and to a very small extent brackish groundwater. 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 LWC Planning Area by water use category.

Table ES-2. Typical water source options for the water use categories in the LWC Planning Area.

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 LWC Planning Area include Lake Okeechobee and the C-43 Canal as well as county and water control district canals, lakes, reservoirs, and on-site ponds. Water availability from Lake Okeechobee and the C-43 Canal is limited due to the implementation of restricted allocation area rules. AG is the largest user of surface water in the LWC Planning Area. In 2020, approximately 52% of AG demands were met with surface water, and this percentage is expected to remain the same through 2045. Surface water is used primarily for AG and to a lesser extent L/R and CII uses. Based on demand projections, surface water sources appear sufficient to meet the projected 2045 demands.

Fresh Groundwater

The SAS and to a lesser extent the IAS are the primary sources of fresh groundwater in the LWC Planning Area and are used by all water use categories. Large-scale use of the SAS and IAS is limited by rate of groundwater recharge, potential impacts on wetlands, proximity to contamination sources, potential impacts to existing legal users, and the potential for saltwater intrusion. However, new small-scale uses of the SAS and IAS are viable in many locations. In general, saltwater interface mapping of the region indicates little to no appreciable movement of the saltwater interface in the SAS and IAS from 2009 to 2019 (**Chapter 6**, **Appendix D**). PS, DSS, and AG are the largest users of fresh groundwater from the SAS and IAS. Water availability from the SAS and IAS 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 2020, fresh groundwater from the SAS and IAS accounted for approximately 45% of PS use and 100% of DSS use in the LWC Planning Area. SAS and IAS use for PS is projected to increase minimally by 2045, as utilities maximize their permitted allocations from these sources. Most PS utilities are expanding their use of the FAS to meet demand increases and have proposed projects to meet future growth (**Chapter 8**). DSS use of fresh groundwater from the IAS has created localized areas of low groundwater elevations in Cape Coral and Lehigh Acres, which will require local solutions to reduce aquifer stress in these areas.

Current and future SAS and IAS demands were simulated using the SFWMD's Lower West Coast Surficial and Intermediate Aquifer Systems Model to assess the potential impacts of withdrawals on water levels and the viability of the source through the planning horizon. The model results indicate no large-scale changes in water levels and harm to the water resources are expected for most of the model domain through 2045. Modeling results are provided in **Appendix D**.

Brackish Groundwater

Brackish groundwater from the IAS and FAS is used primarily by PS utilities and to a very small extent by AG and L/R. There are currently 11 PS utilities utilizing brackish groundwater treating it via reverse osmosis and have a combined treatment capacity of 138.17 mgd. In 2020, FAS water met 52% of PS demand. Current and future FAS demands were simulated using the SFWMD's West 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. 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 analyses 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 LWC Planning Area. In 2020, 39 existing wastewater treatment facilities provided all or a portion of their treated wastewater for reuse (**Appendix E**). In total, these facilities generated 85 mgd of reclaimed water, primarily for irrigation of golf courses, parks, schools, and residences. However, 23 mgd of potentially reusable water was disposed, mainly through deep well injection. Wastewater flows are projected to increase to 170 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 2022, there are 18 operating ASR wells in the LWC Planning Area. Several test ASR wells have been constructed at other locations, but at this time are inactive or in various stages of planning. The SFWMD has previously constructed an ASR exploratory well at Moore Haven, and up to 55 ASR wells are planned as components of the Lake Okeechobee Watershed Restoration Project.

Regional reservoirs (e.g., C-43) associated with large ecosystem restoration projects (**Chapter 7**) will attenuate stormwater, provide water quality treatment, store excess surface water, and enhance surface water availability for the estuary 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, local and tribal governments, agricultural interests, and environmental groups, are as follows:

- Continue implementation of water conservation programs throughout the LWC Planning Area to increase water use efficiency and reduce the amount of water needed to meet future demands.
- Continue implementation of the Caloosahatchee River and Lake Okeechobee MFL recovery strategies, and review and update the strategies, 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.
- Continue development of alternative water supplies, including maximizing the use of reclaimed water.
- Develop regional and local reservoirs and other storage systems (e.g., ASR systems), where possible, to increase surface water availability for environmental, agricultural, and urban water supply needs.
- Coordinate with local governments and utilities in the Cape Coral and Lehigh Acres areas to develop solutions to reduce stress on the Mid-Hawthorn and Sandstone aquifers, respectively.

CONCLUSIONS

Building on the findings and conclusions of previous LWC water supply plan updates, this 2022 LWC Plan Update assesses water supply demand and available sources for the LWC 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 (**Chapter 9**). Meeting future water needs through 2045 depends on the following:

- Construction of one potable water supply development project by one PS utility (Florida Governmental Utility Authority – Lehigh Acres);

- Implementation of the CERP C-43 West Basin Storage Reservoir, Picayune Strand Restoration Project, and other ecosystem restoration projects;
- Coordination between the SFWMD and appropriate local governments to identify long-term sustainable water supply solutions in DSS demand areas that are currently or projected to experience aquifer stress; and
- Completion of repairs to the Herbert Hoover Dike by the USACE and implementation of the new Lake Okeechobee System Operating Manual.

Successful implementation of this 2022 LWC Plan Update requires coordination and collaboration with local and tribal governments, utilities, agricultural interests, and other stakeholders. This partnering should ensure that water resources can continue to be prudently managed and available to meet future demands while also protecting natural systems.

Table of Contents

List of Tables

List of Figures

List of Appendices

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
BMAP	basin management action plan
BMP	best management practice
CERP	Comprehensive Everglades Restoration Plan
CFP	Cooperative Funding Program
cfs	cubic feet per second
CII	Commercial/Industrial/Institutional
District	South Florida Water Management District
DSS	Domestic Self-Supply
ENP	Everglades National Park
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
FEB	flow equalization basin
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
IAS	intermediate aquifer system
L/R	Landscape/Recreational
LFA	Lower Floridan aquifer

LOSA	Lake Okeechobee Service Area
LOSOM	Lake Okeechobee System Operating Manual
LOWPP	Lake Okeechobee Watershed Protection Plan
LOWRP	Lake Okeechobee Watershed Restoration Project
LWC	Lower West Coast
LWCSIM	Lower West Coast Surficial and Intermediate Aquifer Systems Model
MDL	maximum developable limit
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
NGVD29	National Geodetic Vertical Datum of 1929
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
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
WCFM	West Coast Floridan Model
WPP	watershed protection plan
WTP	water treatment plant
WWTF	wastewater treatment facility

1

Introduction

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 *2022 Lower West Coast Water Supply Plan Update* (2022 LWC Plan Update) assesses existing and projected water demands as well as water sources to meet those demands through 2045.

TOPICS

- 2022 LWC Plan Update
- Goal and Objectives
- Legal Authority and Requirements
- Seminole Tribe of Florida
- Regional and Local Planning Linkage
- Plan Development Process
- Progress Since the 2017 LWC Plan Update

The LWC Planning Area includes all of Lee County, most of Collier County, and portions of Charlotte, Glades, Hendry, and Monroe counties and the Seminole Tribe of Florida Immokalee Reservation (**Figure 1-1**). The portions of the Big Cypress National Preserve and Monroe County within the LWC Planning Area have no permanent residents. The 2022 LWC Plan Update presents population estimates and associated 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 2020 to 2045 planning horizon. Designed to be a planning guide for local and tribal governments, utilities, agricultural operations, and other water users, the 2022 LWC Plan Update provides a framework for local and regional water supply planning and management decisions in the LWC Planning Area.

The LWC Planning Area covers more than 5,100 square miles and generally reflects the drainage patterns of the Caloosahatchee River Basin to the north and Big Cypress National Preserve to the south. The northern area of the Caloosahatchee River Basin is also the general jurisdictional boundary between the SFWMD and the Southwest Florida Water Management District in Charlotte County. The eastern boundary is along the western edge of the historic Everglades watershed, dividing the Big Cypress and Lake Okeechobee drainage basins. Lake Okeechobee borders four water supply planning areas and is formally included in the Lower East Coast Water Supply Plan. The southern end of the LWC Planning Area encompasses a coastal portion of Everglades National Park and ends just north of Shark River Slough. There are also extensive natural systems, including the Caloosahatchee River Estuary, Okaloacoochee Slough State Forest, Lake Trafford, Corkscrew Regional Ecosystem Watershed, Big Cypress Swamp, Picayune Strand State Forest, southern Charlotte Harbor, Estero Bay, Naples Bay, Ten Thousand Islands National Wildlife Refuge, J. N. "Ding" Darling National Wildlife Refuge, Rookery Bay National Estuarine Research Reserve, and Fakahatchee Strand Preserve State Park **(Figure 1-1)**.

Figure 1-1. LWC Water Supply Planning Area.

The primary sources of fresh water throughout the LWC Planning Area are surface water and groundwater from shallow aquifers. To a much lesser extent, reclaimed water also is used for non-potable uses like irrigation. Major surface water resources include Lake Okeechobee, the Caloosahatchee River, and their hydraulically connected water bodies. The availability of surface water in the LWC Planning Area is limited, primarily due to water resource protection criteria (**Chapter 4**). Groundwater resources in the LWC Planning Area include the surficial, intermediate, and Floridan aquifer systems (SAS, IAS, and FAS). Further information about water source options is provided in **Chapter 5**.

2022 LWC PLAN UPDATE

The 2022 LWC Plan Update reflects the changes experienced in the LWC Planning Area since 2017, and their effect on water use and updates to projected water demands from 2040 to 2045. The 2022 LWC 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 with appendices focuses on the LWC 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 2021-2024 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 2022 LWC 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 2017 LWC Plan Update were reviewed and updated to develop the following objectives for this 2022 LWC 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 from harm due to water use, including declining water levels and the harmful movement of saline water.

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 the supply and use of reclaimed water.

4. **Linkage with Local and Tribal Governments** – Provide information to support local government Comprehensive Plans. Promote compatibility of the 2022 LWC Plan Update with local and tribal 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 LWC Planning Area
    - Existing and proposed environmental projects
    - Development and modifications to operating schedules for regional projects (e.g., Caloosahatchee River [C-43] West Basin Storage Reservoir) and regional systems (e.g., Lake Okeechobee)
    - 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.

SEMINOLE TRIBE OF FLORIDA IMMOKALEE RESERVATION

The Seminole Tribe of Florida is a federally recognized Indian Tribe organized pursuant to Section 16 of the Indian Reorganization Act of 1934 and recognized by the State of Florida pursuant to Chapter 285, Florida Statutes. The Seminole Tribe of Florida's Immokalee Reservation encompasses 600 acres within the central portion of the LWC Planning Area (Figure 1-1). The reservation has a population of fewer than 1,000 permanent residents.

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. Included in the coordination process is the review of Sector Plans, which are long-term plans for a geographic area of at least 5,000 acres. Within the LWC Planning area, there are two adopted plans located within western Hendry County: the Rodina Sector Plan and the Southwest Hendry County Sector Plan.

While this 2022 LWC 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 2022 LWC Plan Update. Revisions may include population projections, established planning periods, existing and future water supply development projects, intergovernmental coordination activities, conservation and reuse measures, and the capital improvements element. More information on Comprehensive Plan and Work Plan requirements 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 (https://www.floridajobs.org/community-planning-and-development/programs/community-planning-table-of-contents/water-supply-planning).

PLAN DEVELOPMENT PROCESS

This 2022 LWC Plan Update describes how anticipated water supply needs will be met in the LWC Planning Area through 2045. The planning process used to develop this 2022 LWC Plan Update is outlined below.

PLAN DEVELOPMENT PROCESS

1	2	3	4
Planning and Assessment	**Data Collection, Analyses, and Issue Identification**	**Evaluation of Water Resources and Water Source Options**	**Identification of Water Resource and Water Supply Development Projects**
The process incorporated public participation and coordination with local stakeholders, including water supply utilities, agricultural operations, nongovernmental environmental groups, local and tribal 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 2017 LWC Plan Update were key starting points.	Using the 2017 LWC 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 protection (**Chapter 4**), water source options (**Chapter 5**), and water resource analyses (**Chapter 6**).	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 demands exceed available supplies, water supply project options were identified, including alternative water supplies and water conservation.	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. The SFWMD also considers water supply projects in local government Work Plans, Tribal Work Plans, and adopted Sector Plans, which are required to identify needed water supplies and available water sources pursuant to Section 163.3245(3)(a)2., F.S. 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. The SFWMD held three virtual stakeholder 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, tribal representatives, 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, the Seminole Tribe of Florida, 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. Additionally, presentations were made to the District's Governing Board and the Big Cypress Basin Governing Board, providing overviews of the plan update and soliciting comments. Following the public comment period, the final version of the plan update was brought to the District's Governing Board for consideration of approval.

PROGRESS SINCE THE 2017 LWC PLAN UPDATE

Since the 2017 LWC Plan Update, the following activities and programs in the LWC 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 106 FAS monitor wells, 18 of which are within the LWC 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.
- **Lower West Coast Surficial and Intermediate Aquifer Systems Model** – The Lower West Coast Surficial and Intermediate Aquifer Systems Model (LWCSIM) was completed and simulations to evaluate changes in water levels in the SAS and IAS for the 2014 and 2040 withdrawal scenarios were completed during 2020.
- **West Coast Floridan Model** – The West Coast Floridan Model (WCFM) was updated and simulations to identify potential changes in water quality, flows, and water levels in the FAS for the 2014 and 2040 withdrawal scenarios were conducted during 2020. **Chapter 6** provides information about both modeling efforts for this plan update.
- **Hydrogeologic Studies** – Between 2017 and 2020, the SFWMD and its partners completed the following hydrogeologic investigations in the LWC Planning Area:
  - Aquifer performance testing of the Sandstone aquifer (Smith 2017)

- Geochemistry of the Upper Floridan aquifer and Avon Park permeable zone (Geddes et al. 2018)
- Groundwater chemistry of the Lower Floridan aquifer – upper permeable zone in Central and South Florida (Geddes et al. 2020)

- **Updated Delineation of the Saltwater Interface in Collier and Lee Counties** – The SFWMD reviewed water quality data from Collier and Lee counties and updated maps to compare the 2009, 2014, and 2019 extent of saltwater intrusion within the SAS and IAS (Shaw and Zamorano 2020). See **Chapter 6** for more details.

Water Supply Studies

- **Annual Estimated Water Use Reports** – The SFWMD prepared annual reports that summarize estimated use (based on reported withdrawals) for public supply, domestic self-supply, commercial/industrial, agriculture, landscape/recreational, and power generation. A copy of the annual reports can be found at https://www.sfwmd.gov/our-work/water-supply.

- **2022 Water Supply Cost Estimation Study** – The SFWMD funded an engineering evaluation of the capital and operational costs of various water supply facilities including groundwater wellfields, surface facilities, water treatment processes, storage, piping and distribution facilities, and other ancillary components. It is anticipated that the study report will be available in 2022.

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 by the USACE Chief of Engineers and congressional authorization are pending for the project. The recommended plan includes construction of up to 55 ASR wells located in clusters throughout the Lake Okeechobee watershed. To date, 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 St. Lucie and Caloosahatchee estuaries.
- **Picayune Strand Restoration Project** – Part of CERP, the purpose of the Picayune Strand Restoration Project is to restore and enhance wetlands in the Picayune Strand State Forest and adjacent public lands by reducing overdrainage, and to improve the water quality of coastal estuaries by moderating the large salinity fluctuations caused by point discharge of fresh water from the Faka Union Canal. Over 55,000 acres of wetland and upland habitat will be restored or enhanced for fish and wildlife resources, including threatened and endangered species. The Merritt Pump Station was completed in April 2016, Faka Union Pump Station in January 2017, and Miller Pump Station in May 2018. Plugging of the upper 3 miles of the Faka Union Canal and the East-West canals was completed in May 2021. The Southwest Protection Feature levee will provide flood protection for existing agricultural and residential properties with an anticipated completion date of 2023.
- **Caloosahatchee River (C-43) West Basin Storage Reservoir** – Part of CERP, the purpose of the Caloosahatchee River (C-43) West Basin Storage Reservoir is to improve timing and quantity of water deliveries to the Caloosahatchee Estuary, capture stormwater runoff and Lake Okeechobee releases, and meet the MFL established for the Caloosahatchee Estuary. The project team completed the Package 1 Preload and Demolition in August 2017 to remove all existing agricultural facilities and consolidate the foundation beneath the surface to prevent settling. The Package 2 Irrigation Pump Station (S-476) was completed in April 2019. This pump station replaces the need for local drainage district pump stations. The Package 3 Inflow Pump Station (S-470) and the Package 4 Civil Works (dam embankment and associated structures) are currently under construction.
- **C-43 Water Quality Feasibility Study** – The Caloosahatchee Reservoir Water Quality Feasibility Study provides options for water quality improvement opportunities for water leaving the Caloosahatchee Reservoir. After extensive public and stakeholder engagement, Phase 1 of the study is complete and identifies four water quality treatment opportunities. Phase 2 is under way and includes siting of the possible alternatives to determine cost and compatibility with other infrastructure.

- **Caloosahatchee MFL Criteria and Recovery Strategy Revisions** – In December 2019, the MFL for the Caloosahatchee River was modified to be a 30-day moving average flow of 457 cubic feet per second (cfs) at control structure S-79 (Section 40E-8.221, Florida Administrative Code [F.A.C.]). The MFL recovery strategy includes several components and is fully described in **Appendix C**. Two components involve construction of the C-43 Reservoir and implementation of a research and monitoring plan. Construction of the C-43 Reservoir began in 2015 and is scheduled to be completed in 2023. Water to be stored in the reservoir has been protected with a water reservation. The research and monitoring plan is meant to document ecological responses of indicators before and after operation of the C-43 Reservoir to determine the benefits of additional future freshwater inflows from the reservoir.
- **Lake Hicpochee Storage and Hydrologic Enhancement Project** – The Lake Hicpochee Storage and Shallow Hydrologic Enhancement Project captures water from the C-19 Canal that discharges into the C-43 Canal. The project holds water in shallow storage and redistributes it into Lake Hicpochee to reduce harmful discharges to the Caloosahatchee Estuary.
- **Southern Corkscrew Regional Ecosystem Watershed (CREW)** – The State of Florida and SFWMD have partnered with other government agencies and conservation organizations to acquire 45,000 acres of the vast CREW. The Southern CREW hydrologic enhancement project consists of a 4,150-acre mosaic of wet prairies, native uplands, freshwater marsh, hydric pine flatwoods, and cypress strand wetlands. The project goal was to restore historical sheetflow and reduce excessive freshwater discharges which include nutrients and pollutants to Estero Bay during the rainy season. This was accomplished by backfilling canals and degrading dirt roads and berms that crisscrossed the entire project area resulting in approximately 437 acres of restored wetlands that had been suffering due to reduced hydrology. The final project design and permitting was completed in 2013. Construction of the Southern CREW project was initiated in February 2016 and completed in April 2018. The SFWMD has led this restoration effort. Based on the vegetation and hydrologic monitoring efforts to date, a trend of appropriate wetland vegetation recruitment has been observed, and it is anticipated that as a result of the hydrologic enhancements, further increases in native wetland vegetation will follow.

Alternative Water Supply and Water Conservation Cost-Share Funding

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. 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 FY2017 through FY2021, the SFWMD provided AWS project funding for seven projects that were completed or are under construction in the LWC Planning Area, generating 9.87 million gallons per day (mgd) of additional water capacity.

- **Water Conservation** – From FY2017 through FY2021, the SFWMD provided funding for three water conservation projects that were completed or are being implemented in the LWC Planning Area. The projects are estimated to save 0.08 mgd.

Big Cypress Basin Initiatives

The Big Cypress Basin Board has oversight responsibilities for operation and maintenance of a network of 143 miles of primary canals and 36 water control structures. Big Cypress Basin facilities are operated in coordination with local governments. A 5-year strategic plan was prepared by the Big Cypress Basin in 2018, which included capital improvements to water management infrastructure, water supply, environmental, and flood control components. Within the past 5 years, numerous improvements to the system infrastructure, flood control components, and operational modifications have taken place.

REFERENCES

Geddes, E., S. Coonts, and R. Carroll. 2020. *Groundwater Chemistry of the Lower Floridan Aquifer – Upper Permeable Zone in Central and South Florida*. Technical Publication WS-57. South Florida Water Management District, West Palm Beach, FL.

Geddes, E., S. Coonts, and B. Collins. 2018. *Geochemistry of the Upper Floridan Aquifer and Avon Park Permeable Zone Within the South Florida Water Management District*. Technical Publication WS-47. South Florida Water Management District, West Palm Beach, FL.

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

Shaw, J.E. and M. Zamorano. 2020. *Saltwater Interface Monitoring and Mapping Program*. Technical Publication WS-58. South Florida Water Management District, West Palm Beach, FL.

Smith, K., E. Richardson, L. Lindstrom, and B. Collins. 2017. *Aquifer Performance Testing of the Sandstone Aquifer, Lower West Coast Planning Area.* Technical Publication WS-42. South Florida Water Management District, West Palm Beach, FL.

2

Demand Estimates and Projections

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

This chapter summarizes the water demand estimates and projections for the Lower West Coast (LWC) Planning Area of the South Florida Water Management District (SFWMD or District) through the planning horizon (2020 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 and tribal governments, and other interested parties. A detailed discussion of the data collection and analysis methodology is provided in **Appendix A**.

Water demands in the LWC Planning Area are driven by agricultural irrigation, followed by irrigation for landscape and recreation, and then potable water use provided by utilities. Irrigated agricultural acreage and production are projected to remain relatively stable with a slight increase. Citrus and sugarcane continue to be the two largest commodities. Acreages of all crops are projected to have small increases with the exception of sugarcane, sod, and potatoes. Starting in early 2020, the COVID-19 pandemic has had significant impacts on the economy, particularly on businesses and tourism. However, residential development has expanded at a robust rate in Collier and Lee counties.

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 *2022 Lower West Coast Water Supply Plan Update* (2022 LWC Plan Update), gross demand is equal to net demand for all water use categories except PS.

This 2022 LWC 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 2022 LWC 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 commercial, industrial, 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 (2020) and projected (2045) average gross water demands, by water use category, in the LWC Planning Area for this water supply plan update. AG accounts for the majority of current and projected demands, followed by PS, L/R, CII, DSS, and PG. An overall increase in total demand is projected through the planning horizon.

Table 2-1. Estimated (2020) and projected (2045) average gross water demands (in mgd) for the LWC Planning Area, by use category.

Water Use Category	2020	2045
Public Supply	138.50	186.02
Domestic Self-Supply	24.53	34.01
Agriculture	592.02	621.40
Commercial/Industrial/Institutional	37.73	48.23
Landscape/Recreational	219.17	289.23
Power Generation	1.54	2.03
LWC Planning Area Total	**1,013.49**	**1,180.92**

LWC = Lower West Coast; mgd = million gallons per day.

POPULATION ESTIMATES AND PROJECTIONS

NOTE

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

Population estimates and projections were used to develop demands for all water use categories except AG and PG. Developing population estimates and projections required multiple sources of information, including county-level data from the University of Florida's Bureau of Economic and Business Research (BEBR; Rayer and Wang 2021), consistent with Section 373.709(2)(a), F.S., data from the 2020 Decennial Census (United States Census Bureau 2020), and data from local government Comprehensive Plans. Additionally, data were reviewed from two adopted Sector Plans within Hendry County. **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.

In 2020, the estimated population within the LWC Planning Area was 1,188,599 permanent residents (**Table 2-2**). BEBR projections indicate the LWC Planning Area population will grow to 1,634,838 permanent residents in 2045, an increase of approximately 38%. Nearly two-thirds of the LWC Planning Area population resides in Lee County, while Collier County accounts for approximately one-third, and this trend is expected to continue. As explained in

Appendix A, BEBR medium projections were used for all counties to develop detailed population projections for PS utilities and county DSS areas (Rayer and Wang 2021).

Table 2-2. Permanent resident population served by PS and DSS in the LWC Planning Area in 2020 and 2045.

County	2020 Population			2045 Population		
	PS	DSS	**Total**	PS	DSS	**Total**
Charlotte*	2,506	3,131	**5,637**	2,875	4,400	**7,275**
Collier[1]	313,797	73,653	**387,450**	415,201	103,799	**519,000**
Glades*	4,906	4,484	**9,390**	5,942	5,029	**10,971**
Hendry*	27,551	8,078	**35,629**	28,934	12,391	**41,325**
Lee	645,114	105,379	**750,493**	912,487	143,780	**1,056,267**
LWC Planning Area Total	**993,874**	**194,725**	**1,188,599**	**1,365,439**	**269,399**	**1,634,838**

DSS = Domestic Self-Supply; LWC = Lower West Coast; PS = Public Supply.

* Values listed are only for the area within the LWC Planning Area boundary.

1 The Seminole Tribe of Florida is a sovereign Indian Tribe and an independent Tribal Government separate from Collier County. However, for discussion purposes, information relating to the Seminole Tribe of Florida Immokalee Reservation is included in the calculations for Collier County.

PUBLIC SUPPLY

The PS category includes potable water supplied by water treatment plants with a current allocation of 0.10 mgd or greater and is the third largest water use category in the LWC Planning Area. Developing PS demand projections was a multistep process that included updating PS utility service areas and estimating 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 (2016 through 2020) 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 were 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 34%, from 138.50 mgd in 2020 to 186.02 mgd in 2045 under average rainfall conditions. Calculation of 1-in-10-year demand increase is 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 LWC Planning Area, by county.

County	Gross (Raw) Demand – Average Rainfall Conditions (mgd)						2045 1-in-10-Year Demand
	2020	2025	2030	2035	2040	2045	
Charlotte*	0.25	0.26	0.27	0.28	0.29	0.30	0.31
Collier[1]	58.50	62.73	66.84	70.60	73.90	76.85	82.63
Glades*	0.82	0.87	0.91	0.94	0.97	0.99	1.05
Hendry*	3.71	3.75	3.79	3.82	3.85	3.87	4.10
Lee	75.22	81.17	87.38	91.91	96.73	104.00	109.20
LWC Planning Area Total	**138.50**	**148.78**	**159.19**	**167.56**	**175.75**	**186.02**	**197.30**

LWC = Lower West Coast; mgd = million gallons per day; PS = Public Supply.

* Values listed are only for the area within the LWC Planning Area boundary.

1 The Seminole Tribe of Florida is a sovereign Indian Tribe and an independent Tribal Government separate from Collier County. However, for discussion purposes, information relating to the Seminole Tribe of Florida Immokalee Reservation is included in the calculations for Collier County.

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

County	Net (Finished) Demand – Average Rainfall Conditions (mgd)						2045 1-in-10-Year Demand
	2020	2025	2030	2035	2040	2045	
Charlotte*	0.21	0.22	0.23	0.24	0.25	0.25	0.26
Collier[1]	52.27	56.00	59.68	63.03	65.97	68.60	74.08
Glades*	0.69	0.72	0.76	0.78	0.81	0.83	0.88
Hendry*	2.65	2.68	2.71	2.73	2.75	2.77	2.94
Lee	65.08	70.40	75.88	79.86	84.04	90.42	94.95
LWC Planning Area Total	**120.87**	**130.05**	**139.28**	**146.66**	**153.84**	**162.89**	**173.11**

LWC = Lower West Coast; mgd = million gallons per day; PS = Public Supply.

* Values listed are only for the area within the LWC Planning Area boundary.

1 The Seminole Tribe of Florida is a sovereign Indian Tribe and an independent Tribal Government separate from Collier County. However, for discussion purposes, information relating to the Seminole Tribe of Florida Immokalee Reservation is included in the calculations for Collier County.

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 LWC 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 2020 were 24.53 mgd for 194,725 permanent residents (**Table 2-2**). DSS demands are expected to increase 39%, to 34.01 mgd for 269,399 residents in 2045. This increase can be attributed to high anticipated growth in DSS areas without expansion of PS utility service within those areas.

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

County	Gross (Raw) Demand – Average Rainfall Conditions (mgd)						2045 1-in-10-Year Demand
	2020	2025	2030	2035	2040	2045	
Charlotte*	0.27	0.30	0.32	0.34	0.36	0.37	0.39
Collier[1]	12.23	14.11	15.15	15.91	16.58	17.23	18.61
Glades*	0.61	0.64	0.66	0.67	0.68	0.69	0.73
Hendry*	0.78	0.90	1.00	1.07	1.13	1.19	1.26
Lee	10.64	13.14	13.81	15.09	15.38	14.52	15.25
LWC Planning Area Total	**24.53**	**29.09**	**30.94**	**33.08**	**34.13**	**34.01**	**36.24**

DSS = Domestic Self-Supply; LWC = Lower West Coast; mgd = million gallons per day.

* Values listed are only for the area within the LWC Planning Area boundary.

[1] The Seminole Tribe of Florida is a sovereign Indian Tribe and an independent Tribal Government separate from Collier County. However, for discussion purposes, information relating to the Seminole Tribe of Florida Immokalee Reservation is included in the calculations for Collier County.

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 LWC Planning Area, accounting for over 60% of the region's total estimated water demand in 2020. Agricultural production in the LWC Planning Area is of regional significance, with 291,765 acres under irrigation (**Figure 2-1**).

Agricultural acreage data published by the Florida Department of Agriculture and Consumer Services (FDACS 2021) were used to determine water demands for this 2022 LWC 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**.

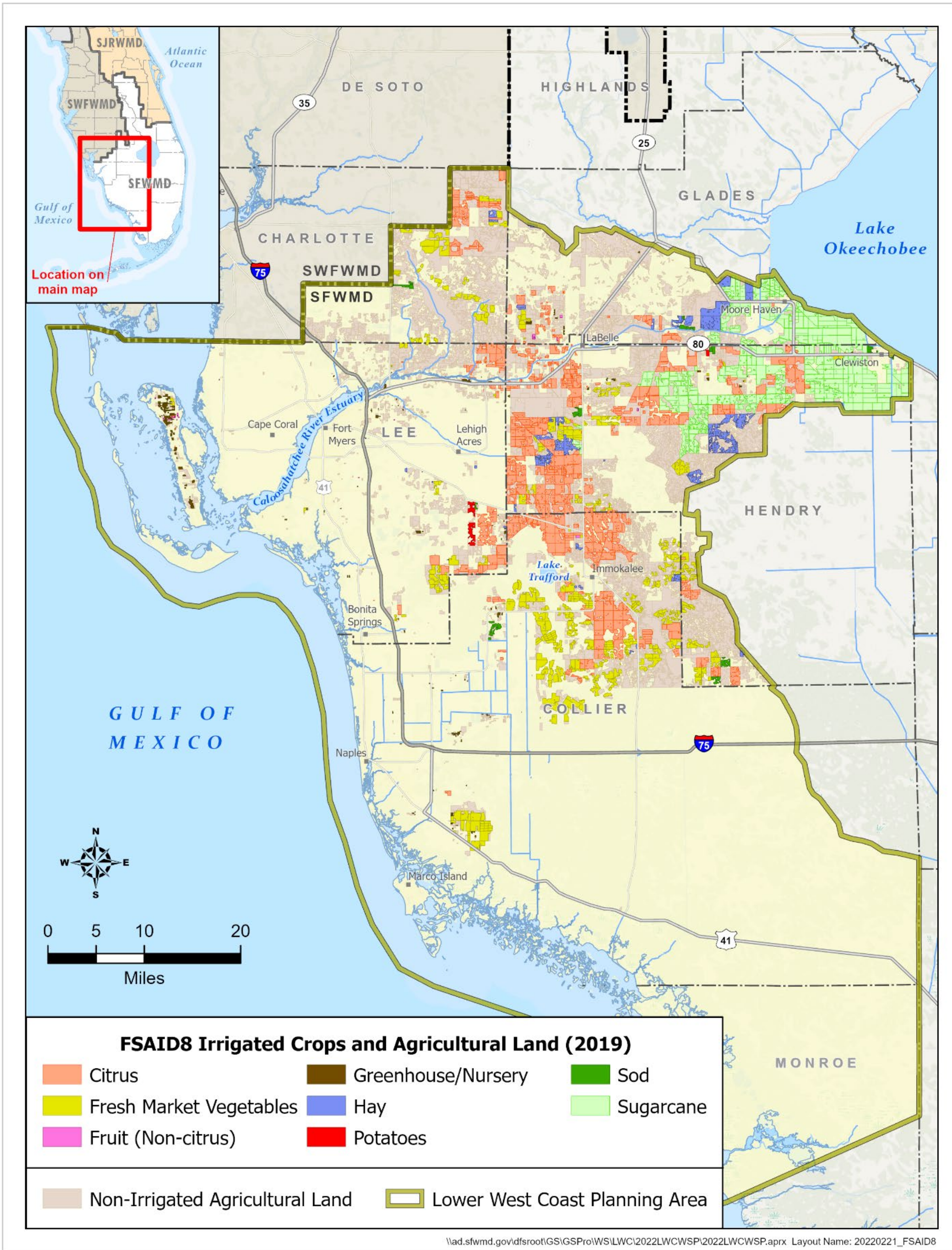


Figure 2-1. Agricultural irrigated land in the LWC Planning Area (Data from FDACS 2021).

Agricultural water demand was determined using the Agricultural Field-Scale Irrigation Requirements Simulation (AFSIRS) model (Smajstrla 1990). No distinction was made between gross and net 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 crops in the LWC Planning Area, currently encompassing 206,687 acres. Together, these two crop types account for more than half of the irrigated acreage and demand under average rainfall conditions. Irrigated fresh market vegetables, hay, greenhouse/nurseries, and sod are the next largest AG crop categories, with a combined 83,042 acres.

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

Crop	2020			2045		
	Acres	Average Demand	1-in-10-Year Demand	Acres	Average Demand	1-in-10-Year Demand
Citrus	118,047	189.07	236.69	124,820	198.45	244.72
Sugarcane	88,640	224.19	236.79	86,706	219.22	247.17
Fresh Market Vegetables	60,251	122.06	143.24	62,961	128.83	150.87
Hay/Pasture	16,223	34.03	40.53	16,806	35.34	41.84
Greenhouse/Nursery	3,239	7.86	8.54	5,239	12.76	16.37
Sod	3,328	9.20	11.29	3,287	8.99	11.08
Potatoes	1,279	2.73	3.18	1,199	2.43	2.88
Field Crops	188	0.50	0.89	4,244	10.96	11.03
Fruits (Non-Citrus)	570	0.81	1.81	1,800	2.85	3.89
Total	**291,765**	**590.45**	**693.06**	**307,062**	**619.83**	**729.85**

LWC = Lower West Coast; mgd = million gallons per day.

Total irrigated acres in the LWC Planning Area are projected to increase 5% by 2045. The majority of crops are projected to increase in acreage over the planning horizon, except for sugarcane, sod, and potatoes. The largest change in irrigated acreage and demand is expected to occur in the citrus industry. By 2045, sugarcane is expected to decrease by 1,934 acres, and average demands are projected to decrease by 4.97 mgd.

Gross AG demands under average rainfall conditions in the LWC Planning Area are projected to increase from 592.02 mgd in 2020 to 621.40 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 LWC Planning Area in 2020 are estimated to be 1.13 mgd and 0.44 mgd, respectively, with demands remaining 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):
- Mangoes
- Strawberries
- Blueberries
- Grapes

Field Crops:
- Corn
- Corn silage

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

County	Gross Demand– Average Rainfall Conditions (mgd)						2045 1-in-10-Year Demand
	2020	2025	2030	2035	2040	2045	
Charlotte*	31.88	31.88	32.06	32.48	32.75	33.07	39.68
Collier	133.13	131.33	130.57	128.66	127.95	126.39	150.46
Glades*	98.95	95.87	100.14	107.75	113.97	120.49	141.88
Hendry*	294.54	295.40	296.18	299.36	304.14	311.02	360.25
Lee	33.52	33.14	32.76	32.18	31.23	30.43	39.16
LWC Planning Area Total	**592.02**	**587.62**	**591.72**	**600.44**	**610.04**	**621.40**	**731.42**

AG = Agriculture; LWC = Lower West Coast; mgd = million gallons per day.
* Values listed are only for the area within the LWC Planning Area boundary.

COMMERCIAL/INDUSTRIAL/INSTITUTIONAL

The CII water use category includes water demands associated with commercial and industrial 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 commercial or industrial 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 gross and net water demands. Growth within the CII category is expected to be driven by regional population growth. Estimated CII demands for 2020 were 37.73 mgd, with projected growth resulting in demands of 48.23 mgd in 2045 (**Table 2-8**).

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

County	Gross Demand (mgd)					
	2020	2025	2030	2035	2040	2045
Charlotte*	0.07	0.08	0.08	0.09	0.09	0.09
Collier	7.52	8.19	8.76	9.29	9.75	10.14
Glades*	13.76	14.45	15.03	15.48	15.94	16.26
Hendry*	4.59	4.82	5.02	5.17	5.27	5.38
Lee	11.79	13.09	14.14	14.98	15.73	16.36
LWC Planning Area Total	**37.73**	**40.63**	**43.03**	**45.01**	**46.78**	**48.23**

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

LANDSCAPE/RECREATIONAL

L/R is the second largest water use category in the LWC 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 are met with the use of groundwater, surface water, and reclaimed water. L/R acreages reflect only the acres under water use permits and do not include acres irrigated solely with reclaimed water that do not have a water use permit for a supplemental or back-up supply. Details regarding development of the L/R demands are provided in **Appendix A**.

Within the L/R category, 22,476 permitted acres were attributed to landscape irrigation. These landscaped areas are expected to grow 35% to 30,378 acres by 2045, which is approximately the same growth rate as the local population through 2045. In 2020, there were 128 golf courses irrigating 13,367 acres under water use permits in the LWC Planning Area (SFWMD 2022), and this is projected to increase by 130 acres by 2045.

Under average rainfall conditions, total estimated L/R gross water demands are projected to increase from 219.17 mgd in 2020 to 289.23 mgd in 2045 (**Table 2-9**). Groundwater and surface water supply sources met approximately 64% of the 2020 L/R water demands, with reclaimed water supplementing the remaining 36%. The ratio of reclaimed water to groundwater/surface water used to meet future landscape demands is assumed to remain constant. Golf course acreage is projected to remain relatively stable over the planning period and, as a result, water demand for golf is held relatively constant over the planning horizon, with a slight increase in Charlotte County. See **Chapter 5** for a discussion of reclaimed water as an alternative water supply source.

Table 2-9. L/R gross irrigation demands under average rainfall conditions in the LWC Planning Area (including reclaimed water).

Land Use	Demand – Average Rainfall Conditions (mgd)						2045 1-in-10-Year Demand
	2020	2025	2030	2035	2040	2045	
Charlotte County*							
Landscape	2.24	2.39	2.51	2.62	2.71	2.80	3.53
Golf	0.44	0.44	0.49	0.49	0.49	0.49	0.64
Charlotte County Total	**2.68**	**2.83**	**3.00**	**3.11**	**3.20**	**3.29**	**4.17**
Collier County							
Landscape	44.34	52.00	58.29	64.06	69.53	74.51	93.88
Golf	40.46	40.46	40.46	40.46	40.46	40.46	52.60
Collier County Total	**84.80**	**92.46**	**98.75**	**104.52**	**109.99**	**114.97**	**146.48**
Glades County*							
Landscape	0.13	0.14	0.15	0.15	0.15	0.15	0.19
Golf	0.05	0.05	0.05	0.05	0.05	0.05	0.07
Glades County Total	**0.18**	**0.19**	**0.20**	**0.20**	**0.20**	**0.20**	**0.25**
Hendry County*							
Landscape	0.64	0.67	0.70	0.72	0.73	0.74	0.93
Golf	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hendry County Total	**0.64**	**0.67**	**0.70**	**0.72**	**0.73**	**0.74**	**0.93**
Lee County							
Landscape	100.75	112.55	120.87	128.13	134.53	139.91	176.29
Golf	30.12	30.12	30.12	30.12	30.12	30.12	39.16
Lee County Total	**130.87**	**142.67**	**150.99**	**158.25**	**164.65**	**170.03**	**215.44**
Landscape	148.10	167.75	182.52	195.68	207.65	218.11	274.82
Golf	71.07	71.07	71.12	71.12	71.12	71.12	92.47
LWC Planning Area Total	**219.17**	**238.82**	**253.64**	**266.80**	**278.77**	**289.23**	**367.29**

L/R = Landscape Recreational; LWC = Lower West Coast; mgd = million gallons per day.
* Values listed are only for the area within the LWC 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 gross and net water demands.

There are two power generation plants currently operating in the LWC Planning Area that are addressed in this plan update: Florida Power & Light (FPL) Fort Myers facility and the Lee County Solid Waste Energy Recovery Facility. In addition, FPL continues to expand its solar facilities throughout the LWC Planning Area; however, these facilities are photovoltaic systems and do not use water.

The FPL Fort Myers facility mainly uses brackish surface water from the Caloosahatchee River Estuary for its cooling tower technology as a one-time pass-through and is returned to the river. As a result, this is not considered as part of the demands, only the groundwater portion is considered. Groundwater is used for make-up water for steam generators, inlet spray coolers, and other industrial uses. For the planning period 2020 to 2045, the FPL Fort Myers facility is estimated to have a constant PG demand of 0.53 mgd. This demand is based on the average daily use in 2020 from groundwater sources.

The Lee County Solid Waste Energy Recovery Facility relies entirely on reclaimed water provided by the City of Fort Myers and is anticipated to continue relying on reclaimed water through the planning horizon. In 2020, 1.01 mgd of reclaimed water was supplied to this facility and demands are anticipated to increase to 1.50 mgd by 2045. PG demands are expected to increase slightly from 2020 to 2045 (**Table 2-10**). More information on the development of PG estimates and projections is provided in **Appendix A**.

Table 2-10. Average gross water demands for PG in the LWC Planning Area between 2020 and 2045.

Facilities	Gross Water Demand (mgd)					
	2020	2025	2030	2035	2040	2045
FPL – Fort Myers	0.53	0.53	0.53	0.53	0.53	0.53
Lee County Solid Waste	1.01	1.08	1.16	1.50	1.50	1.50
LWC Planning Area Total	**1.54**	**1.61**	**1.69**	**2.03**	**2.03**	**2.03**

LWC = Lower West Coast; mgd = million gallons per day; PG = Power Generation.

SUMMARY OF DEMAND ESTIMATES

Total gross water demands under average rainfall conditions in the LWC Planning Area are projected to be 1,159.73 mgd by 2045, a 14% increase from 2020 demands (1,013.49 mgd). Demands under 1-in-10-year drought conditions are approximately 17% higher than those for average rainfall conditions in 2045.

Table 2-11 provides 5-year incremental summaries of gross demands for all water use categories in the LWC 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 35%, from 163.03 mgd in 2020 to 220.03 mgd in 2045. PS will remain the third largest water use category in the LWC Planning Area.
- AG gross demands are projected to increase modestly from 592.02 mgd in 2020 to 621.40 mgd in 2045. AG will remain the largest water use category in the LWC Planning Area.
- CII gross demands are projected to increase 10.50 mgd over the planning period. The projected demand growth is related to regional population growth.
- L/R gross demands are projected to increase by 70.06 mgd by 2045. L/R will remain the second largest water use category in the LWC Planning Area.
- PG gross demands are projected to experience a slight increase over the planning period with 2.03 mgd expected in 2045.

Table 2-11. Summary of gross water demands under average rainfall and 1-in-10-year drought conditions in the LWC Planning Area, by water use category.

Water Use Category	2020	2025	2030	2035	2040	2045
Demand – Average Rainfall Conditions (mgd)						
PS	138.50	148.78	159.19	167.56	175.75	186.02
DSS	24.53	29.09	30.94	33.08	34.13	34.01
AG	592.02	587.62	591.71	600.43	610.04	621.40
CII	37.73	40.63	43.03	45.01	46.78	48.23
L/R	219.17	238.82	253.64	266.80	278.77	289.23
PG	1.54	1.61	1.69	2.03	2.03	2.03
Total	**1,013.49**	**1,046.55**	**1,080.20**	**1,114.91**	**1,147.50**	**1,180.92**
Demand – 1-in-10-Year Drought Conditions (mgd)						
PS	147.01	157.89	168.91	177.78	186.46	197.30
DSS	26.13	30.98	32.95	35.23	36.35	36.24
AG	700.18	694.63	701.90	714.11	723.30	731.42
CII	37.73	40.63	43.03	45.01	46.78	48.23
L/R	279.01	303.76	322.45	339.03	354.11	367.29
PG	1.54	1.61	1.69	2.03	2.03	2.03
Total	**1,191.60**	**1,229.50**	**1,270.93**	**1,313.19**	**1,349.03**	**1,382.51**

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

DEMAND PROJECTIONS IN PERSPECTIVE

Demand projections presented in this 2022 LWC Plan Update are based on the best available information. **Table 2-12** shows the 2040 average gross demands projected in the previous 2017 LWC Plan Update compared to the 2045 demands projected in this 2022 LWC Plan Update. The projections reflect trends, economic circumstances, and industry intentions that change over time, including a revised methodology of projection computations. Like any predictive tool based on past assumptions, there is uncertainty and a margin for error. The total demand projection for 2045 in this 2022 LWC Plan Update is 3% less than the estimated 2040 demand projected in the 2017 LWC Plan Update.

Table 2-12. Comparison of gross water demands under average rainfall conditions at the end of respective planning horizons in the 2017 LWC Plan Update and this 2022 LWC Plan Update.

Water Use Category	2017 LWC Plan Update	2022 LWC Plan Update	Percent Difference
	2040 Demand (mgd)	2045 Demand (mgd)	
Public Supply	199.88	186.02	-7%
Domestic Self-Supply	33.18	34.01	3%
Agriculture	678.83	621.40	-8%
Commercial/Industrial/Institutional	29.07	48.23	66%
Landscape/Recreational	254.32	289.23	14%
Power Generation	15.40	2.03	-86%
Total	**1,210.68**	**1,180.92**	**3%**

LWC = Lower West Coast; mgd = million gallons per day.

REFERENCES

FDACS. 2021. *Florida Statewide Agricultural Irrigation Demand Estimated Agricultural Water Demand, 2019-2045*. Prepared by the Balmoral Group for the Florida Department of Agricultural and Consumer Services, Tallahassee, FL.

Rayer, S. and Y. Wang. (2021). *Projections of Florida Population by County, 2025–2045, with Estimates for 2020*. Florida Population Studies, Bulletin 189. University of Florida, Bureau of Economics and Business Research, Gainesville, FL.

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

SFWMD. 2022. *South Florida Water Management District 2020 Estimated Water Use Report*. South Florida Water Management District, West Palm Beach, FL.

Smajstrla, A.G. 1990. *Agricultural Field Scale Irrigation Requirements Simulation (AFSIRS) Model, Version 5.5*. Agricultural Engineering Department, University of Florida, Gainesville, FL.

United States Census Bureau. 2020. *2020 Decennial Census Redistricting Data* (Public Law 94-171). United States Department of Commerce, Washington, D.C.

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 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**) are greater than the increase in projected demands for the planning horizon (**Chapter 2**).

Conservation and efficiency measures should be maximized, regardless of the water source, before more costly water supply 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 is comparable with 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 (Chesnutt et al. 2018, Feinglas et al. 2013). Improving water use efficiency can also reduce operational costs for most other users.

This chapter describes water conservation measures and programs and provides an estimate of potential water savings (demand reduction) achievable by 2045 in the Lower West Coast (LWC) Planning Area. 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 (https://www.sfwmd.gov/conserve).

CONSERVATION MEASURES

The average per capita water use rate in the LWC Planning Area has decreased from about 177 gallons per capita per day (gpcd) in 2000 to about 123 gpcd in 2020. However, more recently over the last 5 years, per capita water use has remained relatively stable, between approximately 123 gpcd and 127 gpcd. The leveling off of per capita water use is thought to be mostly due to a reliance on 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, depending solely on passive savings will delay or exclude substantial conservation savings potential. Therefore, additional conservation measures and programs are necessary to encourage the use of high-efficiency equipment or improved water use behaviors that yield water savings, including increased outreach, education, and messaging to water users. 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 to develop goal-based water conservation plans that include development of public education and messaging. 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 outdoor and indoor water use applications.

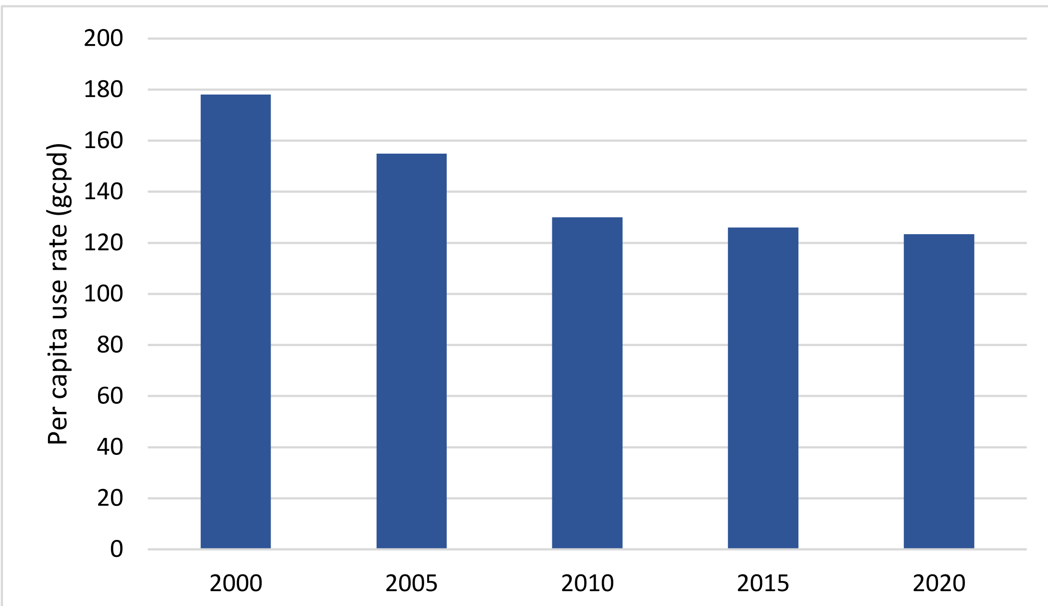


Figure 3-1. Net (finished) water per capita use rate (in gallons per capita per day) within the LWC Planning Area.

Outdoor Water Use (Irrigation)

A significant share of water used outdoors in the LWC Planning Area is for irrigation. Lawns and landscapes are irrigated by residential and commercial property owners, while irrigation of food and other commodity crops is practiced by agricultural water users. Many irrigation efficiency principles are common across these user groups; however, patterns and scales of use, system design, hardware and components, and operator knowledge can vary widely.

Agriculture

Many alternatives for improving irrigation efficiency and conserving water in agricultural operations are available and should be considered for implementation when economically feasible. Typically, 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 irrigation management capabilities of the system; and 3) implementing best management practices. Real-time information on soil moisture and weather conditions, along with remote operation to allow quick irrigation changes in response to changing weather, can help adjust when water is delivered to precisely meet crop needs. Hardware and technology that can improve system management, reduce water quantities required to meet crop 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 South 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 target for conserving water used by 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 systems and timers. Automatic 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 https://www.epa.gov/watersense. All automatic lawn and landscape irrigation systems must be properly equipped with technology that inhibits or interrupts the system's operation during periods of sufficient rainfall (Section 373.62, F.S.).

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 *Best Management Practices for the Enhancement of Environmental Quality on Florida Golf Courses* published by the Golf Course Superintendents Association of America (2021) for golf course managers https://www.gcsaa.org/environment/bmp-planning-guide.

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 https://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, 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), providing consistent and regular messaging.

The SFWMD maintains its commitment to water conservation education through distributing educational materials, conducting speaking engagements, and utilizing social media platforms to raise awareness about the necessity of saving water.

Cost-Share Funding Programs

SFWMD Cooperative Funding Program

SUCCESS STORY

Bonita Springs Utilities received $10,000 (total project cost $25,000) to fund a high-efficiency toilet rebate program that issued 251 rebates targeting older homes in its service area saving over 1.5 million gallons per year of potable water. The cost per 1,000 gallons saved was less than $0.90.

The Water Conservation component of the SFWMD Cooperative Funding Program (CFP) seeks to support projects that improve water use efficiency and conservation. The 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 process. Since the 2017 LWC Plan Update, the SFWMD has provided approximately $3 million in water conservation funding for 60 projects Districtwide. Over the same period (Fiscal Year [FY] 2017 through FY2021), 3 water conservation projects were funded in the LWC Planning Area for a total of $40,000 and 0.08 million gallons per day (mgd) of water saved. 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 (https://www.sfwmd.gov/doing-business-with-us/coop-funding).

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 FY2017 through FY2021, EQIP has provided $469,770 in funding for irrigation projects covering a total of 378 acres. EQIP is expected to continue although future funding levels are uncertain.

Certification and Recognition Programs

> **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.

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 programs, the Florida Department of Environmental Protection's Green Lodging Program, the United States Green Building Council's Leadership in Energy and Environmental Design (LEED), and the Green Building Initiative's Green Globes Certification. 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.

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. More information on these programs can be found on their individual program webpages and on the SFWMD's website (https://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. As of March 2022, there are 534,966 acres within the LWC Planning Area enrolled in the FDACS BMP program. All agricultural water users are encouraged to enroll in the FDACS BMP program and also to learn about the FDACS Agricultural-Environmental Leadership Award which recognizes environmentally innovative farming practices. 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 Lower West Coast MIL) serves Charlotte, Collier, Glades, Hendry, and Lee 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 2022). Currently, there are three FAWN stations (Palmdale, Clewiston, and Immokalee) supported by the SFWMD in the LWC Planning Area. Additional information for these stations is available at http://www.fawn.ifas.ufl.edu.

REGULATORY INITIATIVES

Regulations are excellent tools to assist in the implementation of better practices and more efficient devices. The SFWMD requires that water conservation measures and programs be considered for users with water use permits. For a proposed use of water to be deemed reasonable-beneficial, water users that require a permit must include a water conservation plan 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 landscape irrigation (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 comport with Chapter 40E-24, F.A.C. and associated outreach and education to residents, 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 March 2022, 11 of 17 local governments within the LWC Planning Area had adopted a year-round irrigation ordinance. **Table 3-1** presents the list of governments in the LWC Planning Area and their ordinance adoption status. Additional information and example documents for local implementation are available on the SFWMD's website (https://www.sfwmd.gov/conserve).

Table 3-1. List of local governments in the LWC Planning Area and their irrigation ordinance adoption status.

Local Governments in the LWC Planning Area	Adopted Irrigation Ordinance	
	YES	NO
Bonita Springs, City of	×	
Cape Coral, City of	×	
Charlotte County*	×	
Clewiston, City of		×
Collier County	×	
Estero, Village of	×	
Everglades, City of	×	
Ft. Myers, City of	×	
Ft. Myers Beach, Town of		×
Glades County		×
Hendry County		×
LaBelle, City of		×
Lee County	×	
Marco Island, City of	×	
Moore Haven, City of		×
Naples, City of	×	
Sanibel, City of	×	

*Charlotte County follows the Southwest Florida Water Management District's irrigation restrictions.

POTENTIAL FOR WATER CONSERVATION SAVINGS

Potential water savings of 44.81 mgd for the LWC Planning Area were estimated for the following water use categories: Agriculture (AG), Public Supply (PS), Domestic Self-Supply (DSS), and Landscape/Recreational (L/R). **Table 3-2** summarizes prospective savings for each category. 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. The methods used to estimate the savings for each category are discussed in each subsection.

Agriculture

AG is the largest water use category in the LWC Planning Area, accounting for 62% (592 mgd) of the total demand in 2020 and is expected to rise to 621 mgd in 2045. In addition, irrigated AG acreage is projected to increase approximately 5% (from 291,765 acres in 2020 to 307,062 acres in 2045), suggesting that AG will continue to be the largest water use sector.

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 LWC 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 VIII report (FDACS 2021), 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 (2020 to 2045), projected savings also change and may be nonlinear. The estimated conservation potential for the AG water use category in the LWC Planning Area in 2045 is 15.64 mgd (**Table 3-2**).

Public Supply and Domestic Self-Supply

PS is the third largest water use category in the LWC Planning Area and is projected to increase through the planning horizon. PS accounted for an estimated 120 mgd of finished water demand in 2020 and 162 mgd in 2045 projected demands (**Chapter 2**). DSS is estimated to have demands of 25 mgd in 2020 and projected to have 34 mgd in 2045. Historical conservation efforts in PS are reflected in the per capita use rate, which has declined approximately 30% between 2000 and 2020. 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. Local and tribal governments are encouraged to conduct educational outreach to promote and incentivize water conservation among DSS users.

Estimates of active and passive water conservation potential for each county in the LWC Planning Area were made for residential and non-residential users (in both PS service areas and DSS areas) using the Alliance for Water Efficiency Conservation Tracking Tool (AWE Tool), Version 4.0 (AWE 2021). 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, University of Florida 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.

For this 2022 LWC Plan Update, seven frequently implemented measures were selected and quantified to generate the potential water savings for PS and DSS. Conservation measures included in the estimates for residential users supplied by PS utilities and DSS users were limited to the following measures: high-efficiency toilets, showerheads, clothes washers, irrigation audits, landscape evaluations, advanced irrigation controllers, and water use audits. 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.

For all measures, 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 (2020 to 2045), which is thought to be an achievable participation rate for most conservation measures. The combined estimated conservation potential by PS and DSS (active and passive savings) in the LWC Planning Area in 2045 is 16.46 mgd (**Table 3-2**).

Landscape/Recreational

The L/R use category is the second largest and 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.

There are approximately 3,717 active landscape irrigation water use permits in the LWC Planning Area. Landscape irrigation is projected to use a total of 289 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 7% savings. Assuming an average per permit use for each county, the estimated conservation potential for landscape irrigation in 2045 is 8.31 mgd.

Golf Courses

There are 128 active water use permits in the LWC Planning Area (58 in Collier County, 69 in Lee County, and 1 in Glades County) for golf course irrigation. Indoor potable water use at golf courses is assumed to be provided by a PS utility. There are no active golf course permits in the portions of Charlotte and Hendry counties within the LWC Planning Area boundary.

Irrigation demands for golf courses in the LWC Planning Area are projected to decrease by 13% as acreage devoted to golf courses is projected to go from 13,367 acres in 2020 to 13,170 acres in 2045. 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 128 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 4.40 mgd and combined with the potential savings for landscape irrigation (8.31 mgd) is a total savings of 12.71 mgd for the L/R use category (**Table 3-2**).

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).

CONCLUSIONS

Table 3-2 summarizes potential water savings for the LWC Planning Area in all use categories using common water conservation measures. Greater conservation savings may be possible if additional measures are implemented or if increased participation rates are realized. Participation rates can be influenced by ineffective marketing and high implementation costs. The estimates presented in this report are conservative and not intended to represent the full conservation potential utilizing all measures available. Studies have found adoption of demand-side water conservation is highly variable (Rasoulkhani et al. 2018). A comprehensive list of conservation measures and applicable water use categories can be found in the *Support Document for the 2021-2024 Water Supply Plan Updates* (2021-2024 Support Document; SFWMD 2021a).

Table 3-2. Potential water saved (in mgd) in the LWC Planning Area based on demand reduction estimates achievable by 2045.

Use Category	County					2045 Total by Sector
	Charlotte[1]	Collier	Glades	Hendry	Lee	
Agriculture	1.35	5.51	2.02	4.72	2.04	15.64
Public Supply[2]	0.05	3.62	0.10	0.27	8.37	12.39
Domestic Self-Supply[2]	0.07	2.45	0.08	0.11	1.34	4.07
Landscape/Recreational[3]	0.17	5.25	0.02	0.06	7.21	12.71
Total	**1.70**	**14.80**	**2.21**	**5.17**	**19.63**	**44.81**

mgd = million gallons per day; LWC = Lower West Coast.

[1] Values listed are only for the area within the LWC Planning Area boundary. There is only one public supply utility located in the portion of Charlotte County within the LWC Planning Area.

[2] Includes passive savings.

[3] Includes golf and landscape/recreational savings

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

REFERENCES

Alliance for Water Efficiency. 2021. Water Conservation Tracking Tool, Version 4.0 [Excel spreadsheet tool]. Alliance for Water Efficiency, Chicago, IL.

Chesnutt, T.W., D. Pekelney, and J.M. Spacht. 2018. *Lower Water Bills: The City of Los Angeles Shows How Water Conservation and Efficient Water Rates Produce Affordable and Sustainable Use*. California Water Efficiency Partnership, Sacramento, CA, and Alliance for Water Efficiency, Chicago, IL.

FDACS. 2021. *Florida Statewide Agricultural Irrigation Demand Estimated Agricultural Water Demand, 2019-2045*. Prepared by the Balmoral Group for the Florida Department of Agricultural and Consumer Services, Tallahassee, FL.

Feinglas, S., C. Gray, and P. Mayer. 2013. *Conservation Limits Rate Increases for a Colorado Utility*. Alliance for Water Efficiency, Chicago, IL.

Golf Course Superintendents Association of America. 2021. *Best Management Practices for the Enhancement of Environmental Quality on Florida Golf Courses.* Published in association with the University of Florida and the Florida Department of Environment Protection. Florida Chapter of the Golf Course Superintendents Association of America, Jensen Beach, FL.

Irwin, D. and R. Wanvestraut. 2020. *Golf Course Survey on Water Conservation 2019*. St. Johns River Water Management District, Palatka, FL, and South Florida Water Management District, West Palm Beach, FL.

Rasoulkhani K., B. Logasa, M. Presa Reyes, and A. Mostafavi. 2018. Understanding fundamental phenomena affecting the water conservation technology adoption of residential consumers using agent-based modeling. *Water* 10(8):993.

SFWMD. 2008. *Water Conservation: A Comprehensive Program for South Florida*. South Florida Water Management District, West Palm Beach, FL.

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

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

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

UF/IFAS. 2022. *Florida Automated Weather Network*. University of Florida, Institute of Food and Agricultural Sciences Extension, Gainesville, FL. http://www.fawn.ifas.ufl.edu.

4

Water Resource Protection

This chapter provides an overview and update of protections afforded to water resources within the Lower West Coast (LWC) 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

Past analyses indicated groundwater from the surficial and intermediate aquifers as well as surface water from Lake Okeechobee and canals were insufficient to meet the growing needs of the LWC Planning Area during 1-in-10-year drought conditions. Potential impacts on wetlands, the possibility of exacerbating saltwater intrusion, and other factors limit the use of these water bodies as water sources. In 2003, the South Florida Water Management District (SFWMD or District) adopted maximum developable limit criteria for surficial and intermediate aquifers within the LWC Planning Area. Additionally, restricted allocation area (RAA) rules were adopted for the Lower East Coast Everglades Waterbodies in 2007 and for the Lake Okeechobee Basin (Lake Okeechobee and Lake Okeechobee Service Area) in 2008 to address lower lake management levels and storage under the United States Army Corps of Engineers' (USACE's) Lake Okeechobee Regulation Schedule (LORS2008).

NOTE

MFLs and recovery strategies for Lake Okeechobee and the Everglades affect portions of the LWC Planning Area but are included in the Lower East Coast water supply plan updates.

To further protect water resources in the LWC Planning Area, minimum flows and minimum water levels (MFLs) were adopted in 2001 for the Caloosahatchee River, LWC Aquifers, Lake Okeechobee, and the Everglades (**Figure 4-1**). In addition, water reservations for the protection of fish and wildlife were adopted for Picayune Strand and Fakahatchee Estuary in 2009 and the Caloosahatchee River (C-43) West Basin Storage Reservoir in 2014.

This chapter discusses water use permitting criteria as well as MFLs, water reservations, and RAAs adopted in the LWC 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 2021). Water resource development projects that 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 the LWC 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 pursuant to 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 2021).

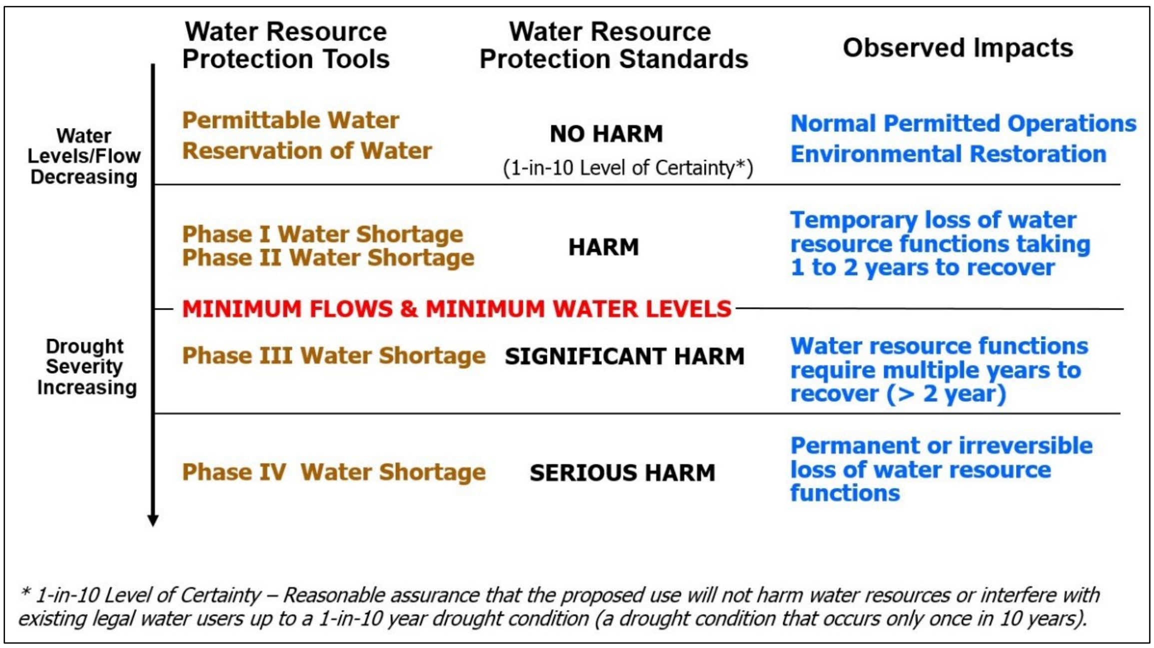


Figure 4-2. Conceptual relationship among water resource protection standards at various levels of water resource harm (Modified from Rule 40E-8.421, F.A.C.).

REGULATORY PROTECTION OF WATER RESOURCES

Water Use Permitting

> **INFO**
>
> The Seminole Tribe of Florida has surface water entitlement pursuant to the 1987 Water Rights Compact among the Seminole Tribe of Florida, the State of Florida, and the SFWMD (Public Law 100-228, 101 Statute 1566, and Chapter 87-292, Laws of Florida, as codified in Section 285.165, F.S.).

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 as required by 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 2022]), 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 2021).

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 reevaluated or revised. The SFWMD fulfills its statutory obligation to identify key water bodies for which MFLs should be developed or reevaluated by providing a Priority Water Body List and Schedule in Chapter 3 of the annual updates to the *South Florida Environmental Report – Volume II* per 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 2021). Additional information about MFLs can be found on the SFWMD website (http://www.sfwmd.gov/mfls) and in Chapter 40E-8, F.A.C.

Within the LWC Planning Area, MFLs have been adopted for the Caloosahatchee River and LWC Aquifers (**Figure 4-1**). Brief summaries of the MFLs are provided here; additional information, including recovery and prevention strategies, can be found in **Appendix C**. The Lake Okeechobee and Everglades MFLs and their associated recovery strategies affect portions of the LWC Planning Area but are included in the Lower East Coast water supply plan updates.

Caloosahatchee River

The SFWMD adopted an MFL for the Caloosahatchee River in 2001 in accordance with Subsection 40E-8.221(2), F.A.C. A recovery strategy was adopted simultaneously with MFL adoption. The original MFL criterion for the Caloosahatchee River was a minimum mean monthly flow of 300 cubic feet per second (cfs) at the S-79 structure, which, at the time of MFL adoption, was determined necessary to maintain a balanced and healthy salinity regime in order to prevent an MFL exceedance (when the MFL is not met) and sustain submerged aquatic vegetation in the Caloosahatchee River Estuary. The MFL was reevaluated between 2013 and 2019. The result of that reevaluation was a change in the criterion in 2019 to a 30-day moving average flow of 457 cfs at the S-79 structure. Additional details about the MFL, the reevaluation, and the revised recovery strategy are provided in **Appendix C**.

Caloosahatchee River

Lower West Coast Aquifers

The LWC Aquifers MFL includes the Lower Tamiami, Sandstone, and Mid-Hawthorn aquifers. In 2001, the SFWMD adopted an MFL specifying the minimum water levels for the LWC Aquifers must equal the elevation of the structural top of the aquifers (Rule 40E-8.331, F.A.C.). A prevention strategy was adopted simultaneously with MFL adoption. 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 to their construction, as required by the Water Resources Development Act of 2000 and Section 373.470(3)(c), F.S. Additionally, a water reservation 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 2021).

Water reservations have been adopted in the LWC Planning Area for the Caloosahatchee River (C-43) West Basin Storage Reservoir (2014), Picayune Strand (2009), and Fakahatchee Estuary (2009) (**Figure 4-1**). Information about all water reservations adopted throughout the District can be found on the SFWMD website (http://www.sfwmd.gov/reservations) and in Chapter 40E-10, F.A.C.

Caloosahatchee River (C-43) West Basin Storage Reservoir

CERP identifies restoration of the Caloosahatchee River Estuary as an integral step in achieving systemwide benefits in the South Florida ecosystem. Promoting a balanced and healthy salinity regime in the Caloosahatchee River Estuary is essential for maintaining the ecological integrity and associated economic benefits of this unique habitat on Florida's southwest coast.

In 2014, the SFWMD adopted a water reservation rule pursuant to Subsection 40E-10.041(3), F.A.C., for the Caloosahatchee River (C-43) West Basin Storage Reservoir, a CERP project being constructed through an SFWMD/USACE cost-share agreement to support the USACE's efforts to restore the Caloosahatchee River Estuary. The reservoir and water reservation rule serve as key components of the recovery strategy for the Caloosahatchee River MFL. It is a prospective reservation, meaning the water will be protected when the reservoir is built and operational. The water reservation reserves from consumptive use all water contained within and released from the reservoir, which will cover 10,700 acres and provide 170,000 acre-feet of water storage when completed (for further details, including a site map, see **Chapter 7**). Capture, storage, and release of surface water runoff and a portion of Lake Okeechobee regulatory releases will reduce the freshwater flows to the Caloosahatchee River Estuary during wet periods and help maintain a desirable minimum flow of fresh water to the estuary during dry periods. Moderating flows in this manner is anticipated to achieve a more balanced salinity regime in the Caloosahatchee River Estuary. Site preparation for the reservoir and construction began in 2015. Construction is expected to be completed in 2023, followed by 2 years of operational testing and monitoring.

Picayune Strand

Picayune Strand is located in the southwestern corner of Florida between Alligator Alley (Interstate 75) and Tamiami Trail (U.S. 41), and north of Fakahatchee Estuary in the Ten Thousand Islands and the Everglades (**Figure 4-3**). Picayune Strand occupies a 55,000-acre area that was disturbed by partial development in the 1960s, including construction of canals, levees, and roads, that altered the natural hydrology of the site.

The CERP Picayune Strand Restoration Project was developed to restore and protect native wetlands and uplands in Picayune Strand (**Figure 4-4**). Substantial progress has been made towards restoring the site's hydrology, and project construction is anticipated to be completed in 2025 (**Chapter 7**). The project will also improve freshwater flows to the southern coastal wetlands of the Ten Thousand Islands region collectively known as

Fakahatchee Estuary. When complete, the project will support a more natural fire regime, increase aquifer recharge, provide manatee refugia, and maintain existing levels of flood protection.

The Picayune Strand water reservation was adopted in 2009 to support the Picayune Strand Restoration Project and to protect fish and wildlife per Subsection 40E-10.041(1), F.A.C. The water reservation includes all surface water contained within Picayune Strand; all surface water flowing into Picayune Strand simulated at weirs Miller2 (Miller Canal), FU3 (Faka Union Canal), and Lucky LA (Merritt Canal) (**Figure 4-5**); and all groundwater in the water table and unconfined portions of the Lower Tamiami aquifer underlying Picayune Strand.

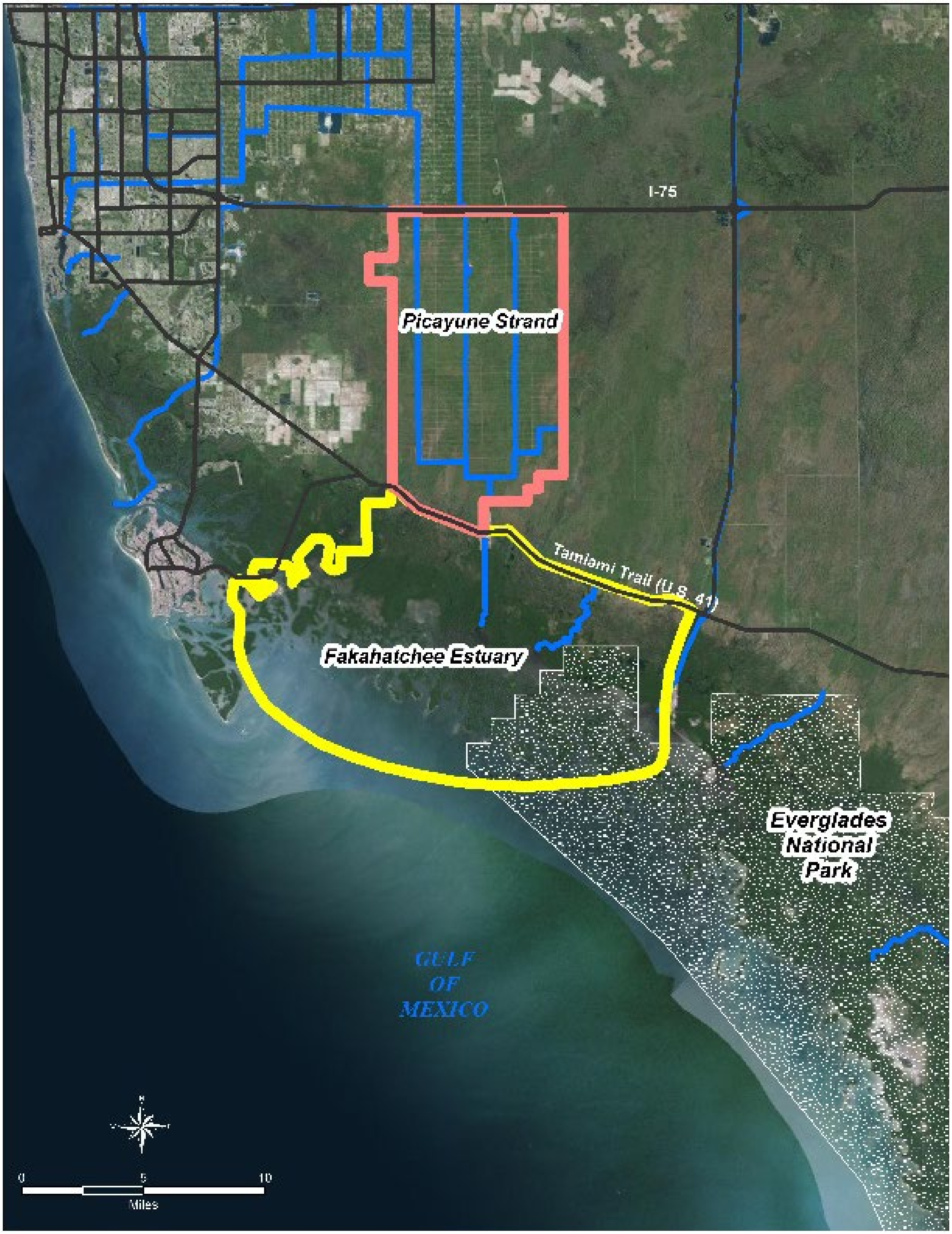


Figure 4-3. Location of Picayune Strand and Fakahatchee Estuary water reservations.

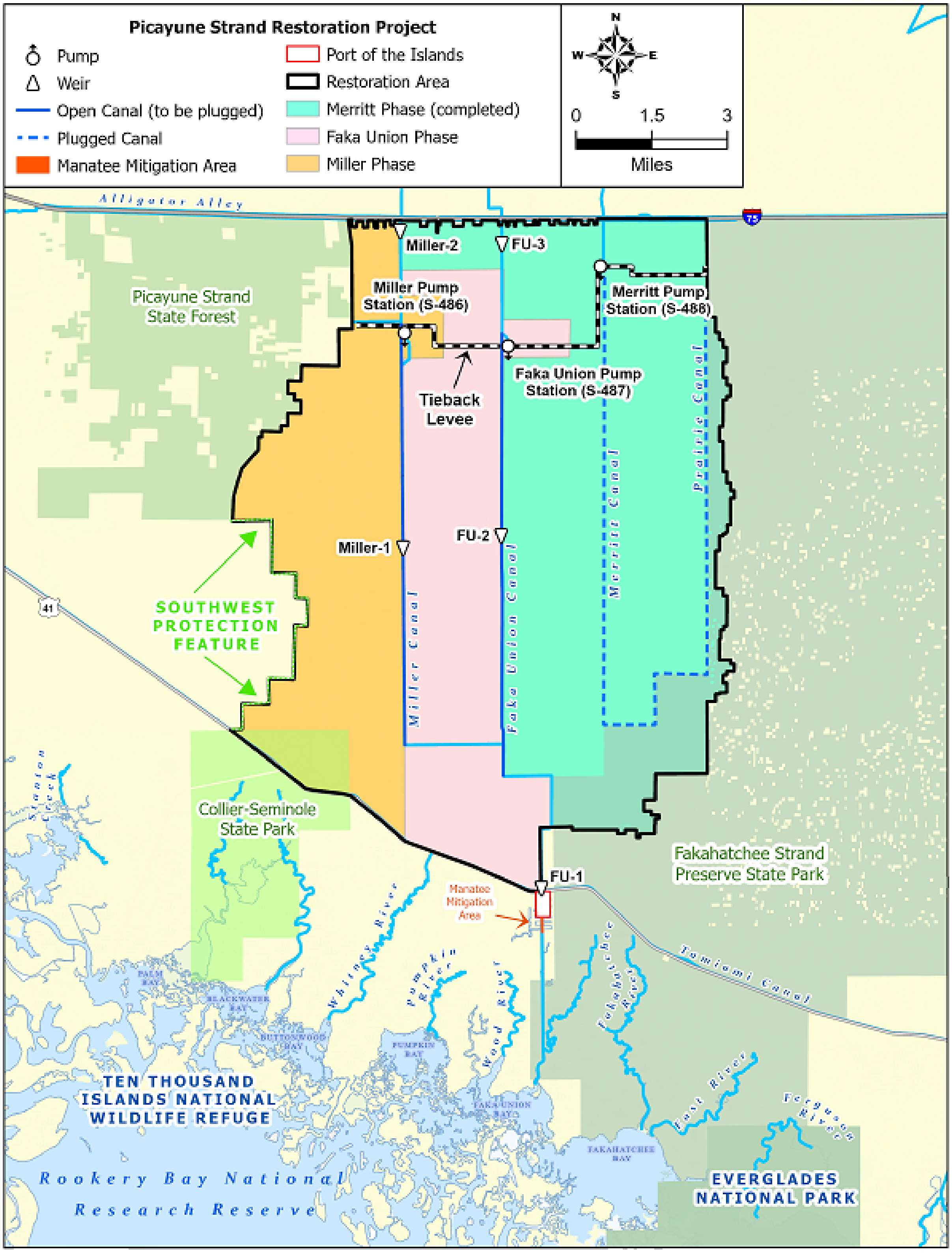


Figure 4-4. Comprehensive Everglades Restoration Plan (CERP) Picayune Strand Restoration Project site (From USACE 2021).

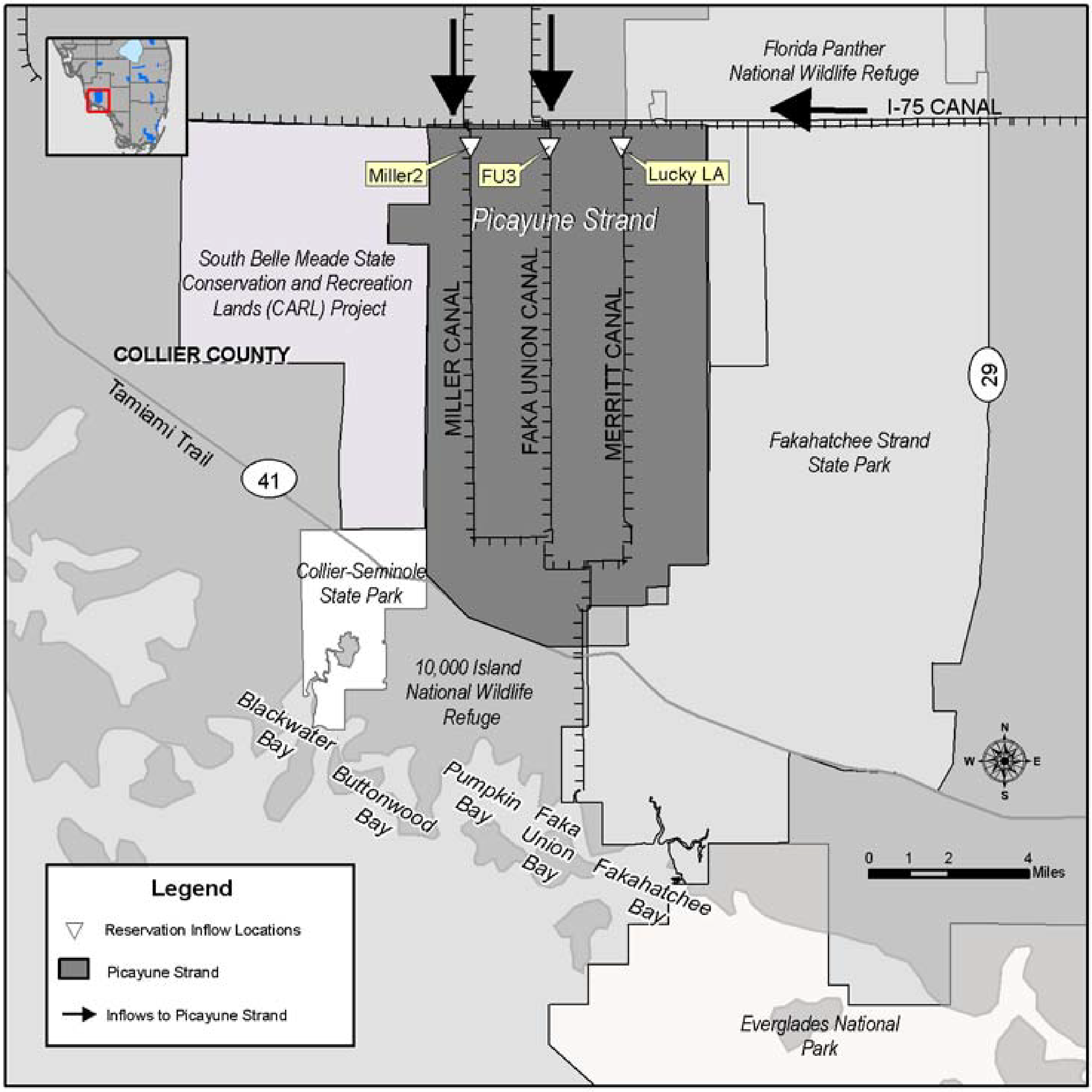


Figure 4-5. Historical water inflow locations into Picayune Strand from Miller, Faka Union, and Merritt canals.

Fakahatchee Estuary

Subsection 40E-10.021(1), F.A.C., defines Fakahatchee Estuary as the area within the Ten Thousand Islands region including the river/bay systems known as Blackwater River/Blackwater Bay, Whitney River/Buttonwood Bay, Pumpkin River/Pumpkin Bay, Wood River, Little Wood River, Faka Union Canal/Faka Union Bay, and Fakahatchee Bay (**Figure 4-5**). Covering almost 100,000 acres, Fakahatchee Estuary is part of the largest expanse of mangrove forest in North America and is home to a rich diversity of native wildlife, including several endangered species (United States Fish and Wildlife Service 2017).

In 2009, a water reservation for Fakahatchee Estuary was adopted pursuant to Subsection 40E-10.041(2), F.A.C., simultaneously with adoption of the Picayune Strand water reservation. The reservation protects water made available to the Fakahatchee Estuary through the Picayune Strand Restoration Project, which has a main objective to improve flows to the southern coastal estuaries. The Fakahatchee Estuary water reservation rule identifies and reserves from consumptive use the water needed to protect fish and wildlife in the estuary. The water reserved for Fakahatchee Estuary includes all surface water flowing into Fakahatchee Estuary simulated at weir FU1 (Faka Union Canal) and transects Miller@41, FU@41, Merrit@41, and Fakahatchee@41 (**Figure 4-6**) as well as all groundwater in the water table and unconfined portions of the Lower Tamiami aquifer underlying Fakahatchee Estuary.

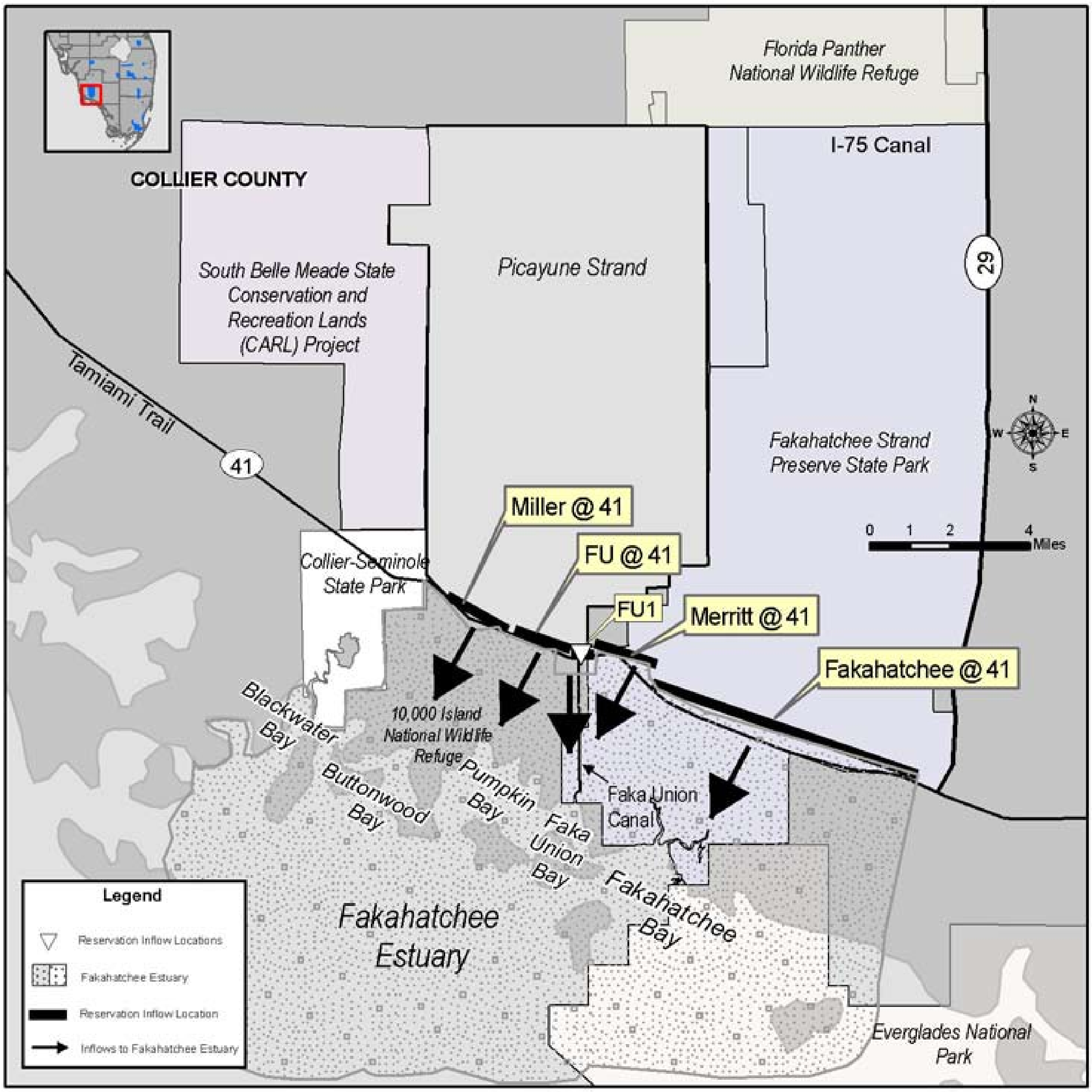


Figure 4-6. Historical inflow locations into Fakahatchee Estuary from Picayune Strand.

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. RAA criteria are listed in Section 3.2.1 of the Applicant's Handbook (SFWMD 2022), 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.

Two RAAs extend into the LWC Planning Area (**Figure 4-1**): 1) Lower East Coast Everglades Waterbodies (Section 3.2.1.E of the Applicant's Handbook [SFWMD 2022]), adopted in 2007; and 2) Lake Okeechobee and Lake Okeechobee Service Area (Section 3.2.1.F of the Applicant's Handbook [SFWMD 2022]), adopted in 2008. The Lower East Coast Everglades Waterbodies RAA was adopted as part of the Everglades MFL recovery strategy, and the Lake Okeechobee and Lake Okeechobee Service Area RAA was adopted as part of the Lake Okeechobee MFL recovery strategy. These RAAs are discussed with their associated MFLs in the Lower East Coast water supply plan updates.

SUMMARY OF WATER RESOURCE PROTECTION

- The LWC Planning Area has the following resource protections in place:
  - Water use permitting criteria
  - MFLs for the Caloosahatchee River and LWC aquifers
  - Water reservations for the Caloosahatchee River (C-43) West Basin Storage Reservoir, Picayune Strand, and Fakahatchee Estuary
  - RAAs for the Lower East Coast Everglades Waterbodies and Lake Okeechobee and Lake Okeechobee Service Area
- MFL, water reservation, and RAA criteria continue to be implemented in the LWC Planning Area and have not been modified since the 2017 LWC Plan Update, except for the MFL and associated recovery strategy for the Caloosahatchee River, as discussed in **Appendix C**.
- Water shortage and water use permitting rules and criteria have not changed for the LWC Planning Area since the 2017 LWC Plan Update. Further information on water shortage management and water use permitting is available in the 2021-2024 Support Document (SFWMD 2021).

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 2022), which can be accessed through the SFWMD website at http://www.sfwmd.gov/raas.

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 2021) and **Appendix C**.

REFERENCES

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

SFWMD. 2022. *Applicant's Handbook for Water Use Permit Applications within the South Florida Water Management District*. South Florida Water Management District, West Palm Beach, FL. June 2022.

United States Fish and Wildlife Service. 2017. *Ten Thousand Islands National Wildlife Refuge*. United States Fish and Wildlife Service, Washington, DC. Available online at https://www.fws.gov/refuges/profiles/index.cfm?id=41555.

USACE. 2021. *Picayune Strand Restoration Project Fact Sheet*. United States Army Corps of Engineers, Jacksonville, FL. September 2021. Available online at https://usace.contentdm.oclc.org/utils/getfile/collection/p16021coll11/id/5369.

5

Water Source Options

This chapter presents water source options that could be available through 2045 to accommodate urban and agricultural demands in the Lower West Coast (LWC) 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 LWC Planning Area, fresh groundwater from the surficial aquifer system (SAS) and freshwater portions of the intermediate aquifer system (IAS) as well as surface water from canals and lakes are considered traditional water sources. Alternative water supply (AWS) or nontraditional water source options include brackish groundwater from the Floridan aquifer system (FAS) and brackish portions of the IAS, 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 fresh groundwater and surface water (**Figures 5-1** and **5-2**). However, withdrawals from these sources have approached sustainable limits because of aquifer productivity, environmental concerns, resource protection criteria, and regulatory limitations (**Chapter 4**). As a result, over the last two decades, brackish groundwater from the FAS and reclaimed water have become vital to urbanized areas to meet increased demands. Use of such AWS sources is an integral part of current and future water supply strategies in the LWC Planning Area. Most of the increased Public Supply (PS) demands will be met with proposed AWS projects using brackish groundwater. New surface water withdrawals are limited by restricted allocation area (RAA), minimum flow and minimum water level (MFL), and water reservation criteria. Groundwater withdrawals from the Water Table aquifer, Lower Tamiami aquifer, Sandstone aquifer, and Mid-Hawthorn aquifer are limited by resource constraints and MFL criteria (**Chapter 4**).

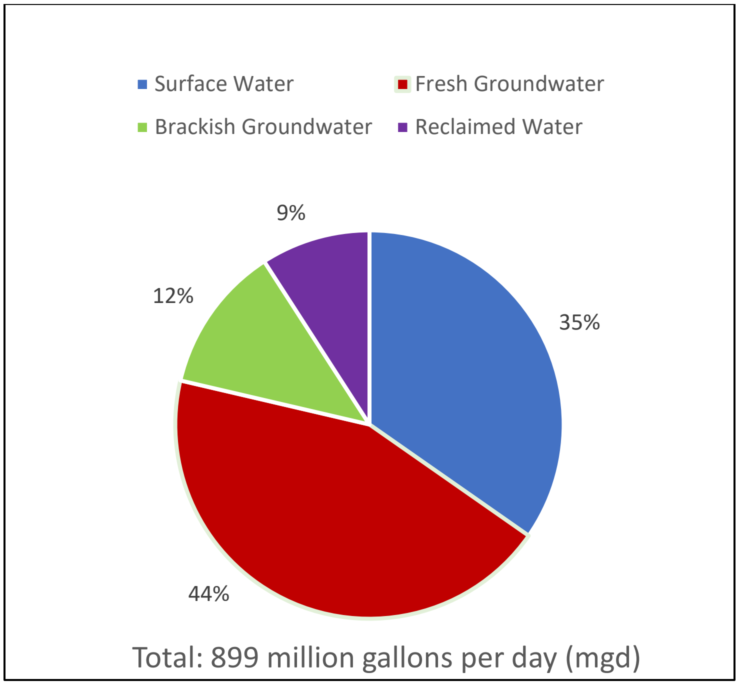


Figure 5-1. Water use percentage of the estimated total use of 899 mgd in the LWC Planning Area in 2020 by source (Data from SFWMD 2022).

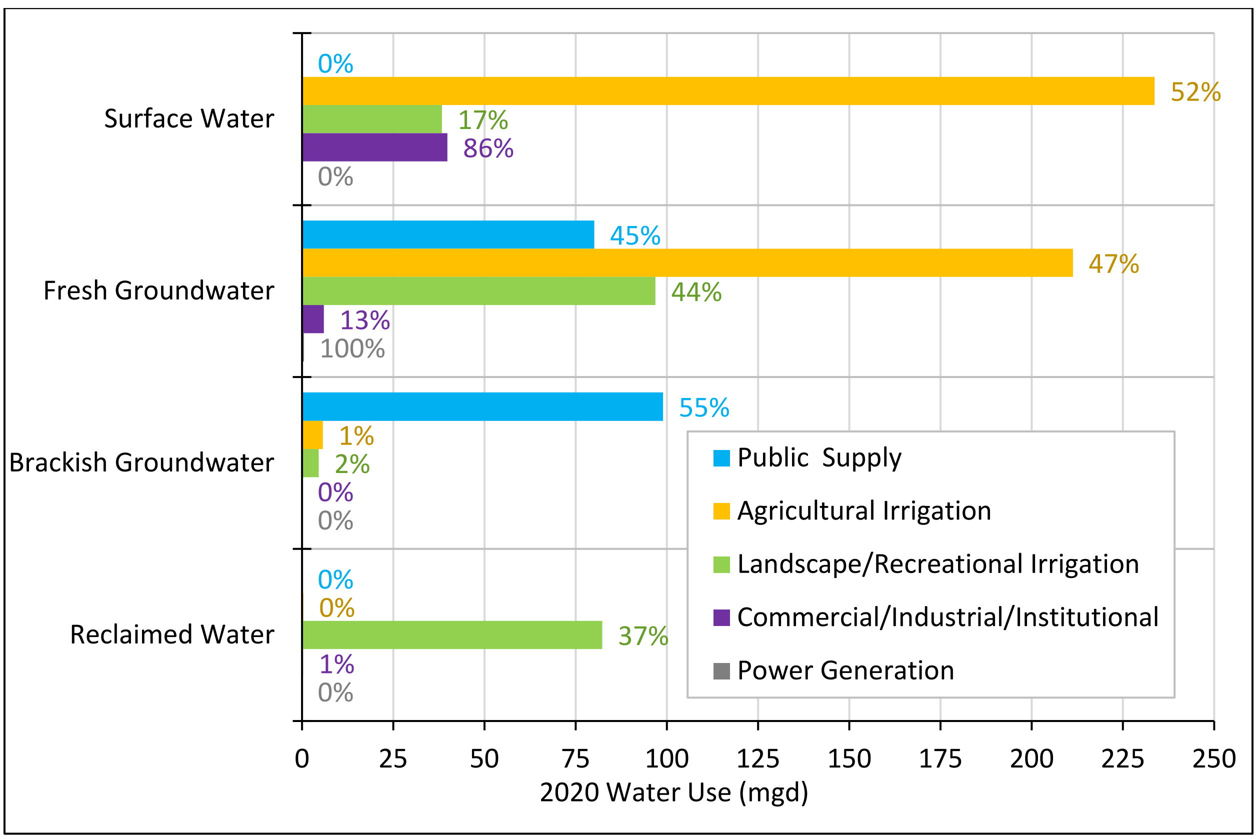


Figure 5-2. Estimated water use in the LWC Planning Area in 2020 by source and use type (Data from SFWMD 2022). (Notes: Fresh groundwater supplies 100% of Domestic Self-Supply demand. Percentages may not equal 100% due to rounding.)

SURFACE WATER

Surface water sources, primarily used for urban and agricultural irrigation, include rivers, canals, lakes, and reservoirs. Although the LWC Planning Area has multiple surface water sources, most are limited by regulatory protections (**Chapter 4**). A primary surface water source is Lake Okeechobee via the C-43 Canal and its connected canals as well as diversion and impoundment systems. The Cape Coral and Big Cypress Basin canal systems also provide surface water supply, and to a lesser extent, local irrigation needs are met using stormwater ponds.

Caloosahatchee River (C-43 Canal)/ Lake Okeechobee

The C-43 Canal was constructed as a navigable waterway and flood control outlet for Lake Okeechobee by straightening and deepening the freshwater portion of the Caloosahatchee River beginning in 1880. The C-43 Canal receives inflow from outside the basin via Lake Okeechobee, which is operated and maintained by the United States Army Corps of Engineers. Water is discharged from Lake Okeechobee to the C-43 Canal through the S-77 water control structure and then into the Caloosahatchee River Estuary downstream of the S-79 structure. The Caloosahatchee River Estuary covers approximately 26 miles west towards Shell Point. The C-43 Canal and Caloosahatchee River Estuary also receive surface water runoff from four subwatersheds—S-4, East Caloosahatchee, West Caloosahatchee, and Tidal Caloosahatchee—and a small amount of base groundwater flow from the SAS, in addition to the controlled discharges from Lake Okeechobee. The watershed includes creeks, wetland tributaries, canals, and drainage ditches that provide limited storage and allow conveyance of surface water. AG is the predominant user of surface water from the C-43 Canal and Lake Okeechobee, typically via connected canals and diversion and impoundment systems.

Water availability from Lake Okeechobee and its hydraulically connected water bodies is limited due to implementation of the 2008 Lake Okeechobee Regulation Schedule as well as SFWMD water use permit criteria. Concerns about the integrity of the Herbert Hoover Dike, which surrounds Lake Okeechobee, have resulted in a lowered lake regulation schedule that has reduced the level of certainty of permitted users within the Lake Okeechobee Service Area. Currently, all works associated with the Herbert Hoover Dike rehabilitation project are expected to be completed in 2022 along with a revised lake schedule and Lake Okeechobee System Operating Manual, expected to be completed by 2023.

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 LWC Planning Area (**Figure 5-3**). Stormwater from the interconnected lakes and canals can be held within the water control district canal systems for irrigation. Some water control districts divert water from the C-43 Canal and Lake Okeechobee 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.

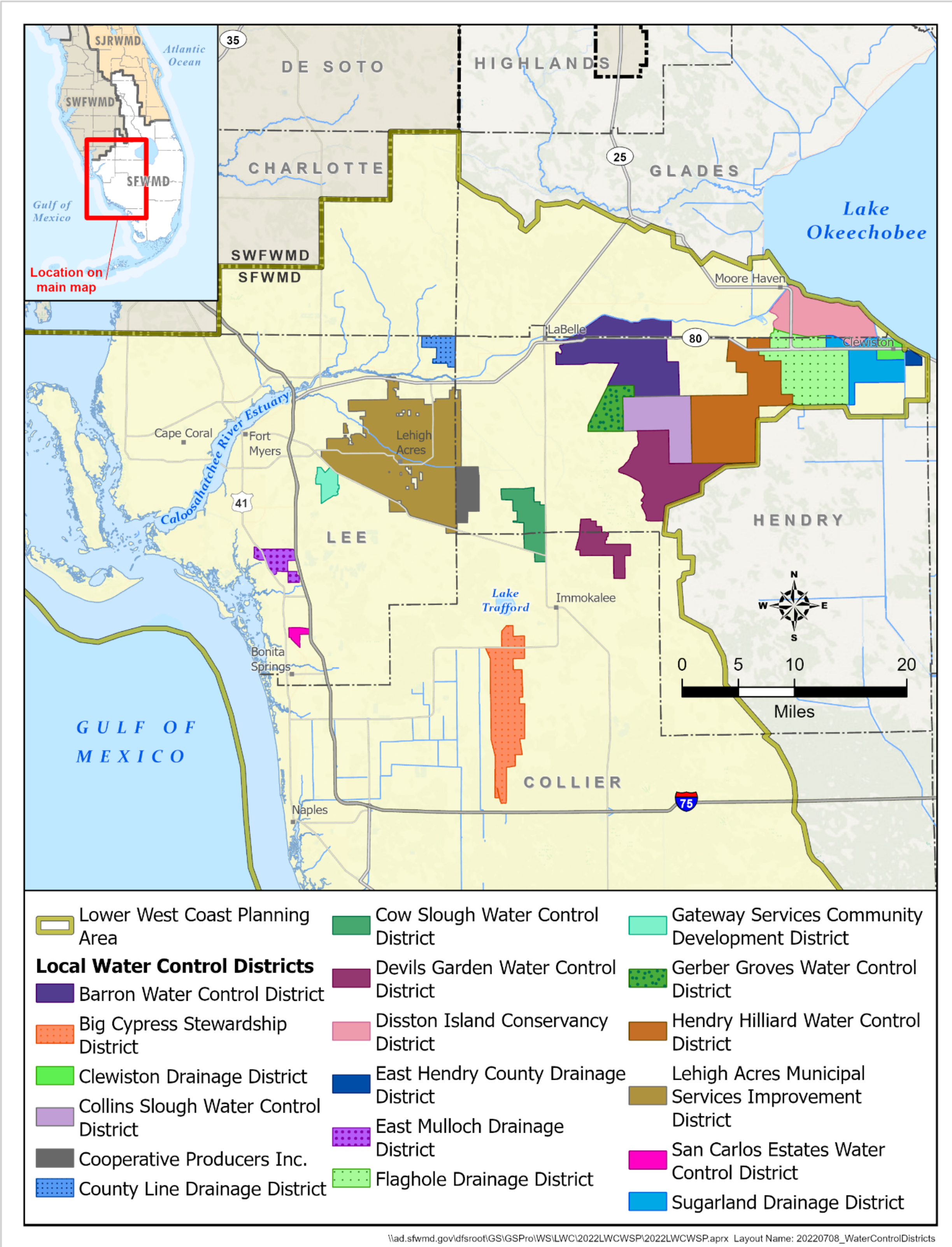


Figure 5-3. Water control districts in the LWC Planning Area.

Existing and Future Use of Surface Water

AG is the largest user of surface water in the LWC Planning Area. In 2020, approximately 52% of AG demands were met with surface water (**Figure 5-2**), and this percentage is expected to remain the same through 2045. However, irrigated agricultural acreage and associated demands are projected to increase approximately 5% from 2020 to 2045 (**Chapter 2**).

Approximately 17% of L/R demands in the LWC Planning Area, including golf courses, were met with surface water in 2020 (**Figure 5-2**). Withdrawals for L/R irrigation are primarily from on-site ponds or adjacent local canals. L/R use is expected to increase 34% by 2045; however, surface water withdrawals may decrease as new demands, and some existing demands, are met with reclaimed water. Permitted AG and L/R surface water irrigation withdrawal locations are shown in **Figure 5-4**, with L/R withdrawals typically from surface water management lakes in the western urban areas and AG withdrawals from surface water systems located primarily in the eastern rural portions of the LWC Planning Area.

In 2020, surface water was used to meet 86% of Commercial/Industrial/Institutional (CII) demands in the LWC Planning Area (**Figure 5-2**). CII demands will increase 28% by 2045, with most of the projected increase being supplied by fresh groundwater.

The Florida Power & Light (FPL) Fort Myers Power Plant withdraws water from the tidal portion of the Caloosahatchee Estuary, downstream of salinity control structure S-79. This is the only Power Generation (PG) facility using surface water for cooling 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 the revised demand projections for this plan update, which are 4% lower than the previously projected 2040 demands, surface water sources appear sufficient to meet the projected 2045 demands.

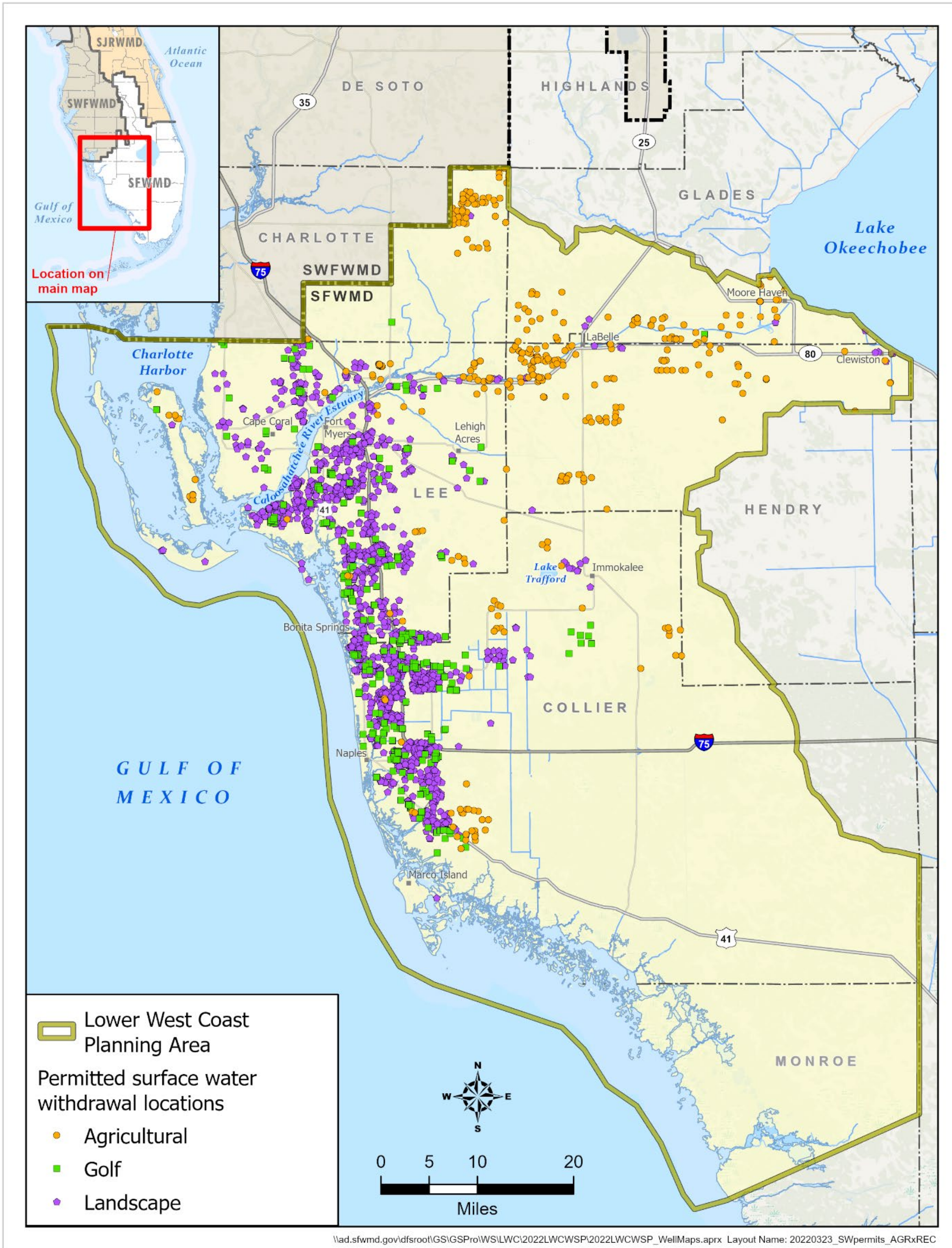


Figure 5-4. Permitted surface water withdrawal locations for irrigation within the LWC Planning Area.

GROUNDWATER

Groundwater is produced from three major aquifer systems in the LWC Planning Area: the SAS, IAS, and FAS (**Figure 5-5**). The SAS and portions of the IAS provide fresh groundwater, while other portions of the IAS and upper portion of the FAS provide brackish groundwater. For a detailed description of the geology within the LWC Planning Area, including mapping of the hydrostratigraphic unit, see Geddes et al. (2015).

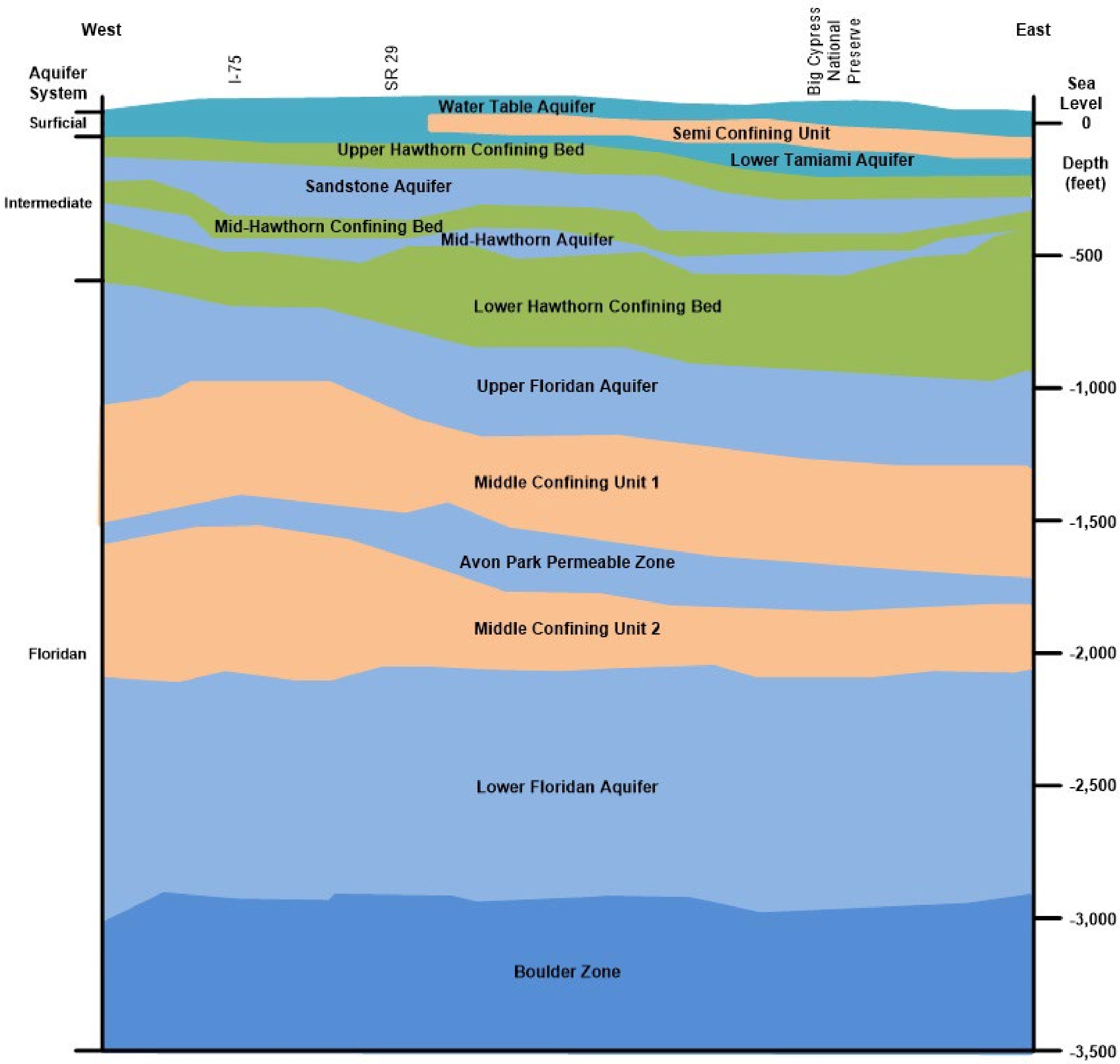


Figure 5-5. Generalized hydrogeologic cross section of the LWC Planning Area.

Fresh Groundwater

Surficial Aquifer System

In the LWC Planning Area, the SAS is composed of two water-bearing zones: the Water Table aquifer and the Lower Tamiami aquifer, which usually are separated by a semiconfining unit. The SAS is 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, low 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.

The SAS produces fresh water from relatively shallow wells in most of the LWC 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 2022). All water use categories rely on some 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. **Figures 5-6** and **5-7** show the permitted withdrawal wells completed in the SAS.

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. Water availability from the SAS is further discussed in **Chapter 6** and in a groundwater modeling discussion within **Appendix D**.

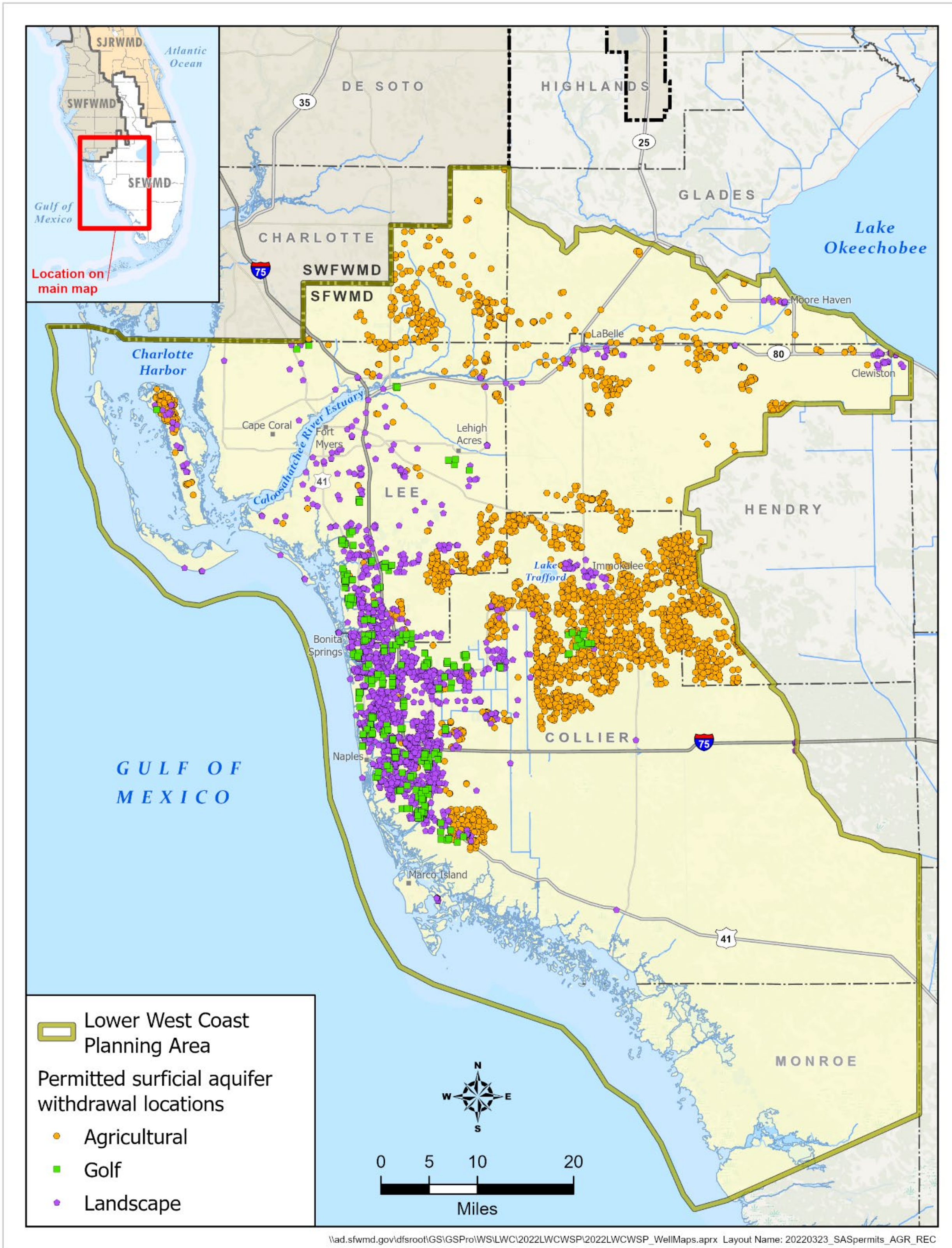


Figure 5-6. Permitted surficial aquifer system withdrawal locations for irrigation within the LWC Planning Area.

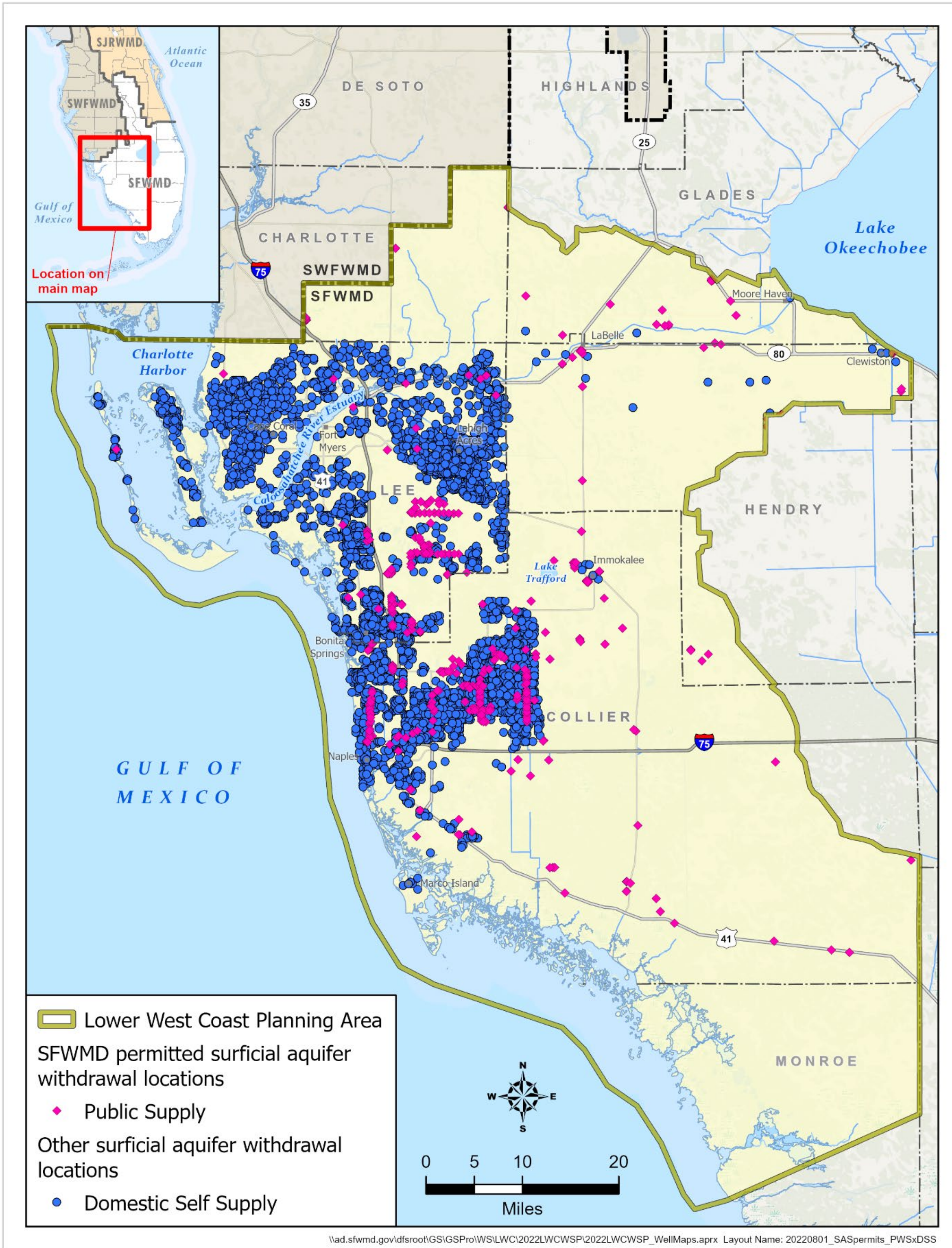


Figure 5-7. Permitted surficial aquifer system withdrawal locations for Public Supply and Domestic Self-Supply within the LWC Planning Area.

Intermediate Aquifer System

The IAS also is composed of two water-bearing zones: the Sandstone aquifer and the Mid-Hawthorn aquifer, which are separated by the Mid-Hawthorn confining unit. The Lower Hawthorn confining unit separates the IAS from the deeper FAS. The IAS is composed of relatively thin, discontinuous beds of sand, sandstone, and limestone that provide moderate quantities of water when present. Several confining sequences divide the water bearing units in this aquifer system. The IAS provides fresh groundwater throughout most of the region; however, there are locations that have been impacted by lateral saltwater intrusion from coastal seawater or by upward vertical intrusion from older or improperly constructed wells in the underlying brackish aquifers. In 2020, the IAS provided approximately 17% of water to the PS utilities in the LWC Planning Area. Permitted withdrawal locations from the IAS for AG, L/R, PS, and Domestic Self-Supply (DSS) are shown in **Figures 5-8** and **5-9**.

Sandstone Aquifer

The Sandstone aquifer typically occurs as two distinct permeable units, an upper clastic zone and a lower carbonate zone and is recharged by leakage downward through the upper confining unit and lateral recharge from the north. The Sandstone aquifer is composed of sandstone, sandy limestones, dolostones, and calcareous sands. These two units may be contiguous or separated by varying thicknesses of low-permeability silt and clay. The Sandstone aquifer is separated from the underlying Mid-Hawthorn aquifer by low-permeability clays and marls of the basal Peace River Formation, which is present throughout the LWC Planning Area. The Sandstone aquifer is used predominantly for AG and DSS. Intensive use of groundwater from the Sandstone aquifer in the Lehigh Acres area has resulted in a localized lowering of the groundwater level towards maximum developable limits (MDLs), as described in **Chapter 6** and **Appendix C**.

Mid-Hawthorn Aquifer

The Mid-Hawthorn aquifer, where present, is composed of limestone, phosphate, shell, and lime mud and is recharged by leakage downward from the overlying confining unit and laterally from areas north and outside the planning area. Where the Sandstone aquifer is absent or insignificant, the entire thickness of the Peace River Formation isolates the Mid-Hawthorn aquifer from the overlying SAS. The confinement from the underlying Lower Hawthorn producing zone consists of carbonate muds and terrigenous clays of the upper Arcadia Formation and is present throughout the LWC Planning Area. Use of the Mid-Hawthorn aquifer primarily occurs in the western part of the LWC Planning Area as a water supply source for DSS, L/R, and PS. Intensive DSS use of groundwater from the Mid-Hawthorn aquifer in northern Cape Coral has resulted in a localized lowering of the groundwater level towards MDLs, as described within **Chapter 6** and **Appendix C**.

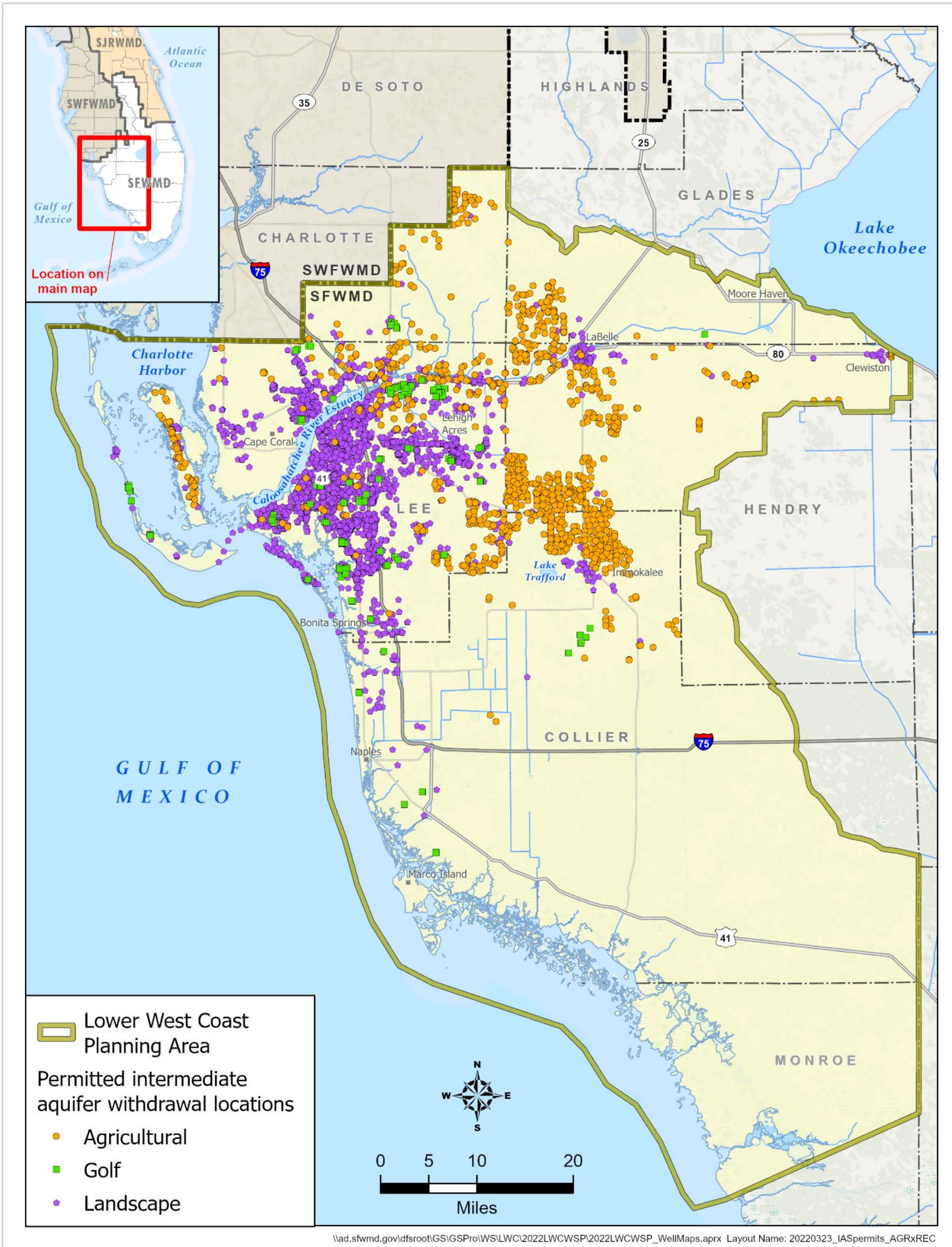


Figure 5-8. Permitted intermediate aquifer system withdrawal locations for irrigation within the LWC Planning Area.

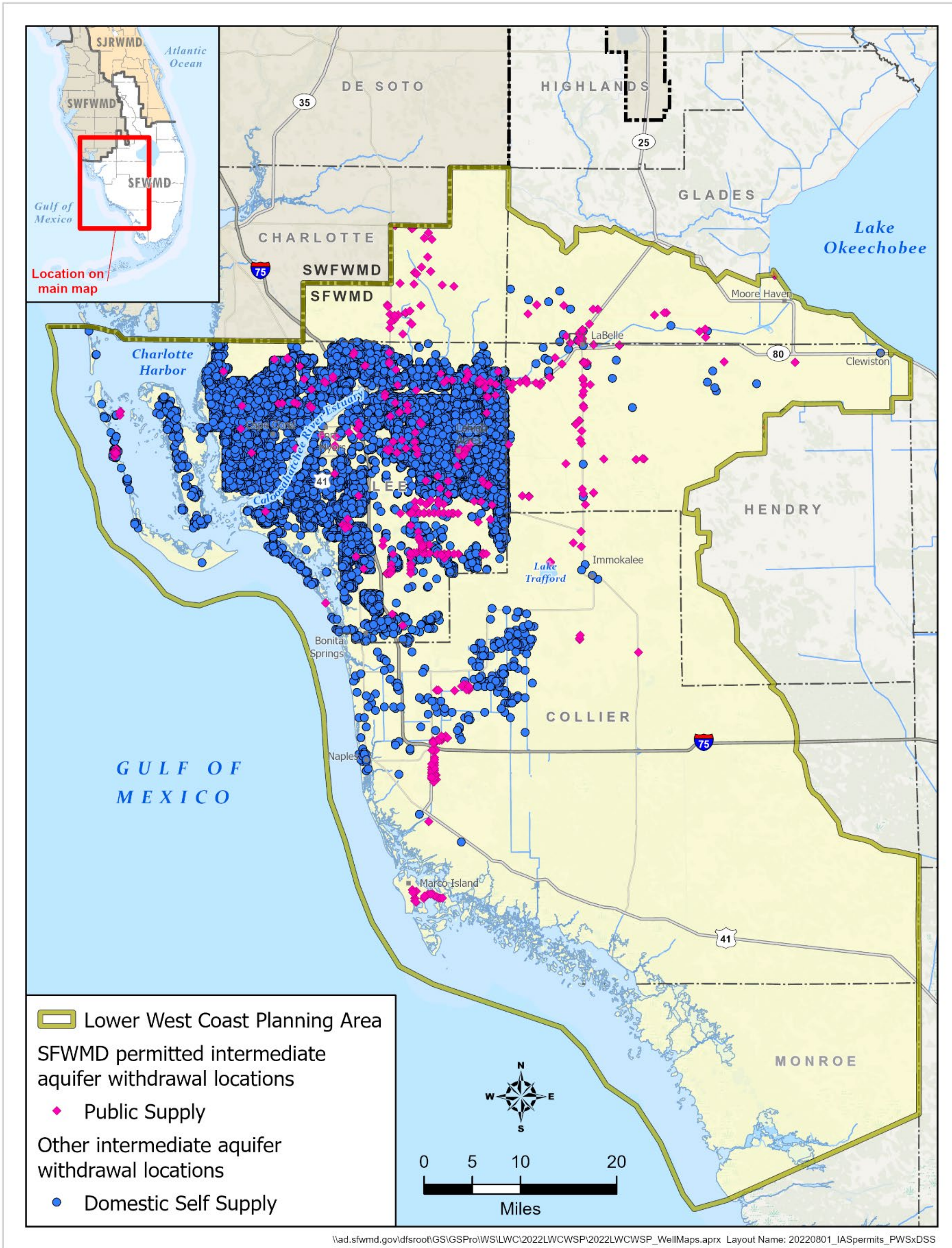


Figure 5-9. Permitted intermediate aquifer system withdrawal locations for Public Supply and Domestic Self-Supply within the LWC Planning Area.

Existing and Future Use of Groundwater

AG primarily depends on surface water but is also the largest user of fresh groundwater in the LWC Planning Area (**Figure 5-2**). In 2020, 278 million gallons per day (mgd) of the region's AG demand was met with fresh groundwater from the SAS and IAS. Use of fresh groundwater for AG irrigation is projected to increase slightly over the planning period.

The second largest user of fresh groundwater is L/R. In 2020, approximately 44% of L/R demand, including golf courses, was met with fresh groundwater (**Figure 5-2**). L/R demands are expected to increase 34% by 2045, based on population growth. Fresh groundwater is expected to meet approximately 37% of the increased demand, depending on availability at specific locations. For the L/R category, some fresh groundwater withdrawals may be replaced with reclaimed water if available.

Of the 24 PS utilities in the LWC Planning Area, 10 utilities use fresh groundwater to meet all their potable water demand, and the remaining 14 utilities use brackish groundwater for all or a portion of their current demands. Brackish groundwater supplies the majority of water for PS demands, while fresh groundwater supplies the remaining 45% (**Figure 5-2**). Total groundwater withdrawals for PS have slightly increased over the past 15 years (**Figure 5-10**). PS use of the FAS has increased in volume since 2005, while the volume of fresh groundwater withdrawn from the SAS has reduced. In 2005, the SAS provided approximately 55% of the water for PS, and the FAS provided approximately 34%. By 2020, only about 38% of PS demand was met with water from the SAS due to increased use of water from the FAS (45%). 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.

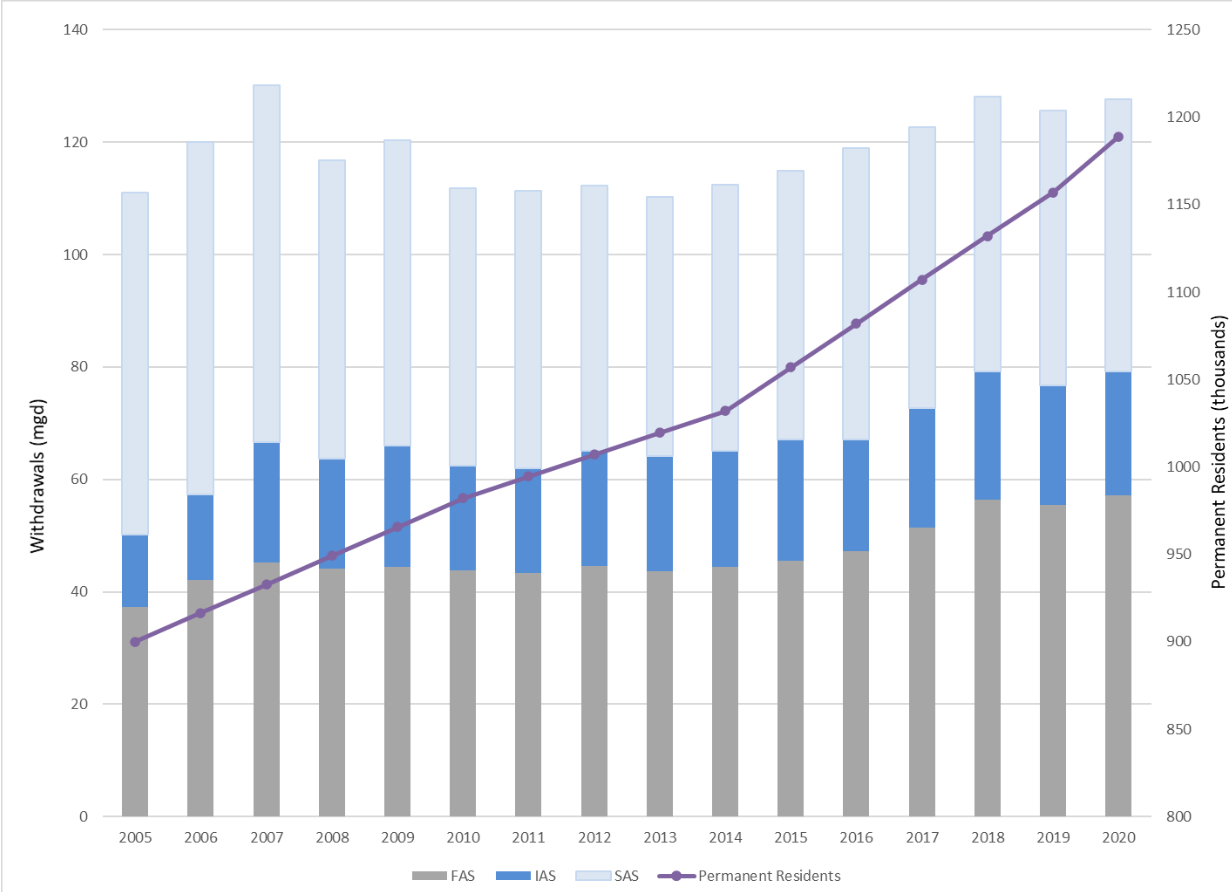


Figure 5-10. Public Supply withdrawals from the surficial, intermediate and Floridan aquifer systems in the LWC Planning Area (2005 to 2020).

In 2020, fresh groundwater from the SAS and IAS supplied 100% of the estimated 24.53 mgd of demand for DSS. By 2045, DSS demand is expected to increase to 34.01 mgd, depending upon the rate of expansion of potable water distribution lines to self-supplied areas. Water levels within the Mid-Hawthorn aquifer have risen substantially in southern Cape Coral where DSS use has been replaced with expansion of PS distribution lines. However, areas not served by PS in northern Cape Coral and the southern portion of Fort Myers, continue to observe declining water levels in the Mid-Hawthorn aquifer due to DSS withdrawals. Monitoring wells in the Sandstone aquifer also indicate declining water levels in the area of Lehigh Acres, as discussed further in **Chapter 6**. In 2020, fresh groundwater was used to meet 13% of CII demands in the LWC Planning Area (**Figure 5-2**). CII demands will increase 26% by 2045, with most of the projected increase being supplied by fresh groundwater.

Increased withdrawals from the SAS and the freshwater portion of the IAS are generally limited due to potential impacts on wetlands and existing legal water uses, including DSS; the potential for saltwater intrusion; and the possibility of reaching aquifer MDLs. Therefore, traditional freshwater sources in the LWC Planning Area may not be sufficient to meet 2045 projected water use demands and alternative sources need to be developed to meet increased demands. The Lower West Coast Surficial and Intermediate Aquifer Systems Model (LWCSIM) was developed and used to evaluate changes in water levels in the SAS and IAS for the 2014 and 2040 withdrawal scenarios. The model was completed and simulations were conducted during 2020. **Chapter 6** and **Appendix D** provide information about the modeling effort for this plan update.

Brackish Groundwater

Surficial Aquifer System/Intermediate Aquifer System

Brackish water has a chloride concentration between 250 and 19,000 mg/L (seawater). In the LWC Planning Area, portions of the SAS and IAS contain brackish groundwater in locations that have been impacted by lateral saltwater intrusion from coastal seawater or by upward vertical intrusion from older or improperly constructed wells that tap underlying brackish aquifers. Brackish groundwater from the SAS and IAS is used for PS after membrane treatment to meet drinking water standards and for AG and L/R irrigation, after blending with freshwater sources.

Floridan Aquifer System

In the LWC 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 LWC Planning Area; however, use of this brackish water source is limited by water quality concerns (**Chapter 6**).

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 and IAS in the region. The top of the FAS is separated from the IAS by the low-permeability sediments of the intermediate confining unit. The FAS has several discrete aquifers separated by low-permeability confining units, including a unit defined (when present) as the "Lower Hawthorn aquifer," the Upper Floridan aquifer, Avon Park permeable zone, and Lower Floridan aquifer (**Figure 5-5**). Though generally not considered useful as a water supply source in the LWC Planning Area due to high salinity, the Lower Floridan aquifer 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 [FDEP]). 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 LWC Planning Area that use the Upper Floridan aquifer have had one or more production wells experience degraded (increasing salinity) water quality. **Chapter 6** and **Appendix D** contain monitor well location information and data from the regional FAS network as well as water quality graphs from several PS utility wellfields.

Existing and Future Use of Brackish Groundwater

Brackish groundwater is used primary by PS utilities to supply a majority of the demand (55%), and in some cases by AG (1%) and L/R (2%), as an alternative water supply (**Figure 5-1**). Permitted withdrawal locations from the FAS for AG, L/R, and PS are shown in **Figure 5-11.** PS withdrawals from the FAS have increased from approximately 37.36 to 57.18 mgd between 2005 and 2020 (**Figure 5-10)** and are expected to increase to 112.55 mgd by 2045. In the LWC Planning Area, 10 PS utilities have FAS permit allocations totaling 96.44 mgd. In addition, 5 PS utilities are using saline groundwater from the IAS or SAS with allocations totaling 16.11 mgd.

PS utilities use RO and membrane softening treatment technologies to remove or reduce excess salinity to 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 14 PS utilities using RO or membrane softening water treatment plants with a combined treatment capacity of 138.17 mgd. To some extent, saline groundwater can be blended with fresh water from other sources 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 saline source and other treated water produced by the utility.

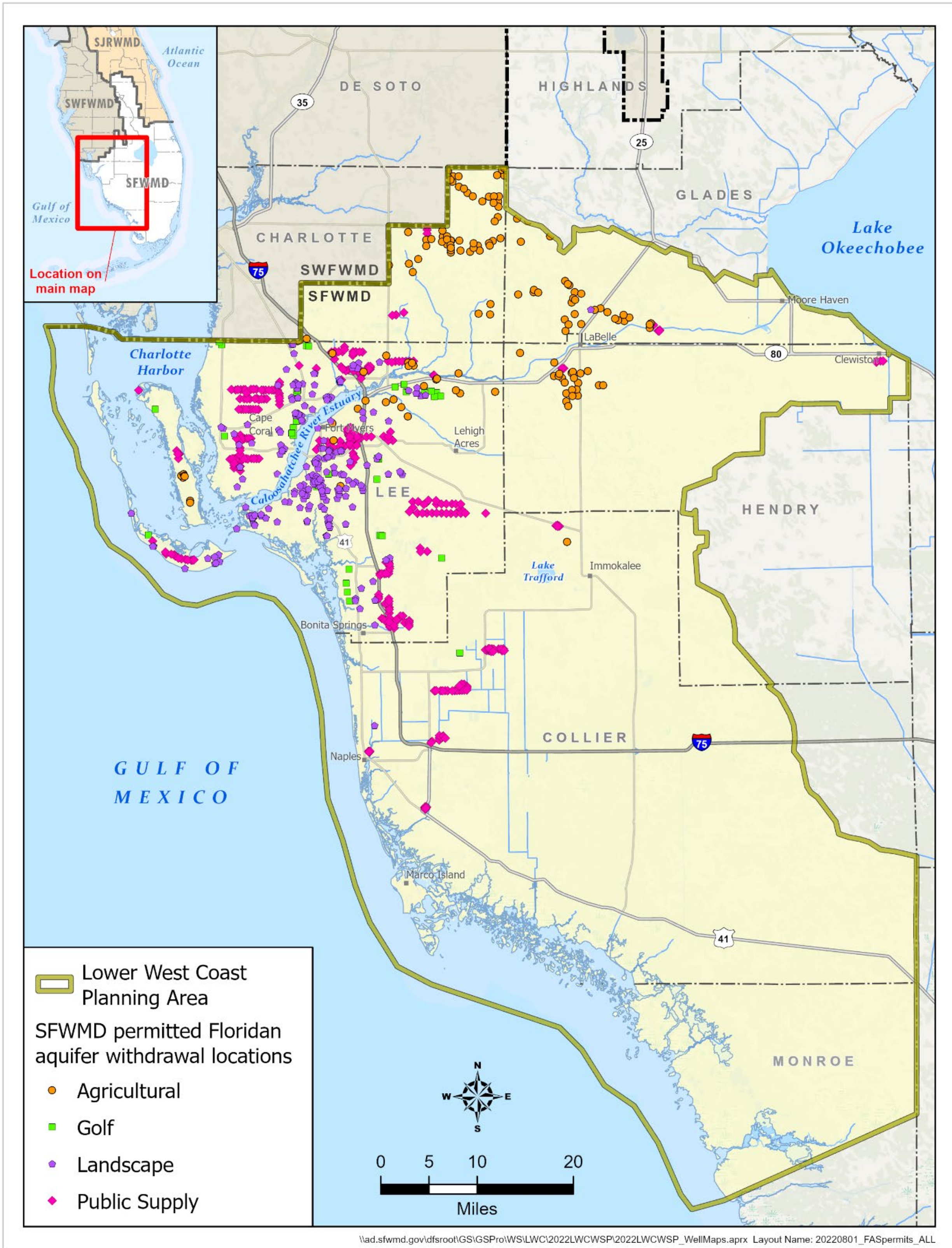


Figure 5-11. Permitted Floridan aquifer system wells in the LWC Planning Area.

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) in accordance with 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.

Florida Statute 373.250 identifies reclaimed water as an AWS, including declaring reclaimed water supply projects as eligible for AWS funding. The Water Resource Implementation Rule (Chapter 62-40, F.A.C.) requires the FDEP 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 LWC Planning Area for a beneficial purpose (e.g., landscape irrigation, golf course irrigation, cooling water, and other industrial uses) increased from 32.30 mgd in 1994 to 84.65 mgd in 2020 (**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. The individual reuse inventory reports for the year 2020 (unless otherwise noted for individual facilities) filed by each wastewater utility to the FDEP (FDEP 2021) were analyzed for the presentation in the following sections.

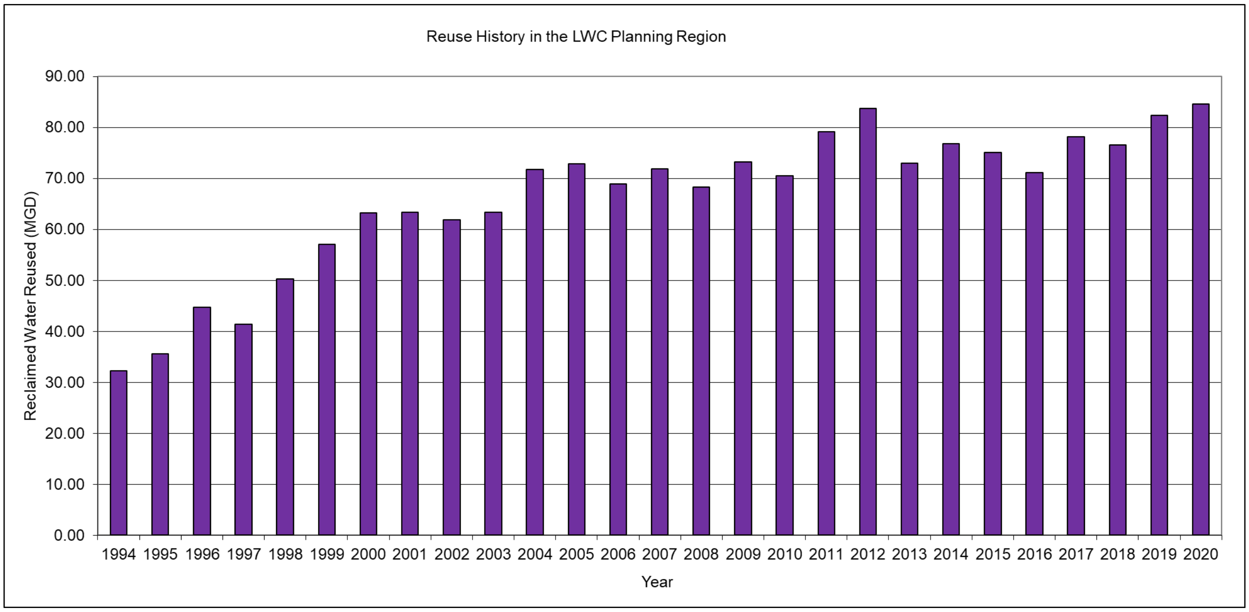


Figure 5-12. Annual average reclaimed water reuse in the LWC Planning Area from 1994 to 2020.

As of 2020, there are 40 domestic WWTFs in the LWC Planning Area with a capacity of 0.10 mgd or greater (**Appendix E**). In 2020, those facilities treated an average wastewater flow of 83.78 mgd. An additional 23.97 mgd of supplemental water was added by utilities. In total, 84.65 mgd was reused, which calculates to 78.6% total potential water reused including supplemental water. The county data indicated 98.0% of wastewater generated in Charlotte, 79.0% in Collier, 100% in Glades, 100% in Hendry, and 77.3% in Lee was reused (including supplemental flows). Reuse was primarily for irrigation of golf courses, parks, schools, and residential lots, accounting for 79.09 mgd (or 93.4%) of the total 84.65 mgd reused.

The remainder was reused for groundwater recharge through percolation ponds (2.29 mgd) irrigation of sprayfields (1.83 mgd), and other uses such as processes at the treatment facility, cooling water, and toilet flushing (1.44 mgd). However, 23.42 mgd of potentially reusable water was disposed of through deep well injection and surface water discharge in 2020, while 23.97 mgd of supplemental flows were required by reuse facilities to reliably meet their demands during dry conditions.

Supplemental Sources to Meet Reuse Demand

The use of supplemental water supplies to meet peak demands for reclaimed water may enable a wastewater 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 and water shortage restrictions by the SFWMD.

During 2020, the following facilities cumulatively added 23.97 mgd of supplemental water to their reclaimed water supplies.

- Ave Maria
- Bonita Springs – East and West
- Collier County – North and South
- Cape Coral – Everest and Southwest
- Hunter's Ridge
- Lee County – Gateway
- Lee County – Three Oaks
- Marco Island
- Naples
- Port of the Islands – South
- Town and Country (Babcock Ranch)

Supplemental sources included surface water (16.33 mgd), followed by groundwater (7.43 mgd), with the remainder (0.21 mgd) being met with drinking water, demineralized concentrate, and ASR recovery. LWC utilities anticipate a cumulative demand of 83.92 mgd from supplemental sources to meet their 2045 reuse demands.

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 2020, in the LWC Planning Area, interconnections existed between the following facilities: Collier County – North and Collier County – South; Bonita Springs – East and Bonita Springs West; Cape Coral – Everest, Cape Coral – Southwest, and Del Prado; and Lee County – Fiesta Village and Lee County – Fort Myers Beach.

The Fort Myers – South Facility does not currently provide reclaimed water service but will provide reclaimed water to Cape Coral's facilities by 2023. In addition, Fort Myers expects to interconnect its South facility to the Fort Myers – Central facility by 2040. Finally, Cape Coral plans to add a new North Phase I Water Reclamation Facility by 2035 which will connect to the Everest – South system.

Future Reuse

Based on information from wastewater utilities operating in the LWC, wastewater flows are projected to increase from 83.78 mgd in 2020 to 170.89 mgd by 2045. As stated previously, 23.42 mgd of potentially reusable wastewater effluent was disposed of in the LWC Planning Area in 2020. Combined, the projected 2045 wastewater and disposals flows represent 197.86 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 and have begun or anticipate constructing the required treatment facilities to produce public access irrigation in anticipation of increasing reuse by 2045. In many cases, future reuse will occur in new residential developments, negating the use of potable water for irrigation, thereby reducing PS demands from the FAS compared to current projections.

Table 5-1 shows 2020 documented flows and 2045 projected flows, as estimated using utility-provided data, for average daily wastewater, total reuse, total discharges and supplemental flows, and the changes expected over the planning horizon by county.

Table 5-1. Documented 2020 and estimated 2045 reuse and related flows by county.

County	Wastewater Flows (mgd)		Total Disposal Flows (mgd)		Supplemental Flows (mgd)		Total Reuse (mgd)	
	2020	2045	2020	2045	2020	2045	2020	2045
Charlotte County	0.41	8.05	0.00	0.00	0.67	23.33	1.06	31.44
Collier County	30.71	53.85	7.06	9.93	3.95	13.86	27.39	57.84
Glades County	0.23	0.23	0.00	0.00	0.00	0.00	0.23	0.23
Hendry County	2.01	3.81	0.00	1.71	0.00	0.00	2.01	2.59
Lee County	50.42	104.95	16.36	15.50	19.35	46.73	53.97	135.94
LWC Planning Area Totals	**83.78**	**170.89**	**23.42**	**27.14**	**23.97**	**83.92**	**84.65**	**228.03**

mgd = million gallons per day.

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 78.6% to projected wastewater flows results in 50.45 mgd of additional reuse (for a total of 134.24 mgd) by 2045. However, utilities in the LWC Planning Area predict a cumulative increase in reuse of 143.38 mgd (for a total of 228.03 mgd) by 2045.

Currently, there are 17 proposed potable and nonpotable PS development projects in the LWC Planning Area that would potentially increase reclaimed water flows by 39.70 mgd, which, when combined to the cumulative current permitted wastewater capacity of all LWC reclaimed water facilities, total to 201.80 mgd. The full listing of these proposed projects can be seen in (**Chapter 8**).

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 LWC 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. 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**.

Figure 5-13 shows the locations of ASR projects constructed in the LWC Planning Area and the water source type. To date, ASR systems have been built by Cape Coral, Collier County Utilities, Lee County Utilities, Marco Island, and Naples.

- Cape Coral ASR Program – The Everest water reclamation facility ASR system is a proposed project that will use up to four ASR wells to store excess reclaimed water flows from the City of Fort Myers within the Upper Floridan aquifer. Cape Coral also has constructed six exploratory ASR wells that may be used in the future for storing excess storm water. Once operational and permitted by the FDEP, water recovered from the proposed ASR systems could be used to supplement irrigation withdrawals from the Cape Coral freshwater canal system.
- Collier County Utilities ASR Program – The Livingston Road ASR system was developed to enhance Collier County's irrigation-quality water program by enabling the storage of excess reclaimed water in the Lower Floridan aquifer. Two ASR wells have been constructed and cycle testing has begun. Collier County also has considered ASR systems at Manatee Road and Carica Road.
- Lee County Utilities ASR Program – The Corkscrew water treatment plant (WTP) ASR system consists of five ASR wells that store potable treated water. The Olga WTP ASR system, constructed to store treated surface water from the C-43 Canal for potable use, has been inactive since 2006. The Lee County North ASR system is also inactive.
- Marco Island ASR Program – The Marco Lakes ASR system consists of seven ASR wells that store surface water captured annually from Henderson Creek and Marco Lakes in the Upper Floridan aquifer. Recovered water is routed to a WTP on the island via pipeline to supplement PS demand.
- Naples ASR Program – The Golden Gate ASR system uses four ASR wells to store excess surface water from the Golden Gate Canal to supplement to the city's on-site reclaimed water system during periods of high irrigation demand in the dry season.

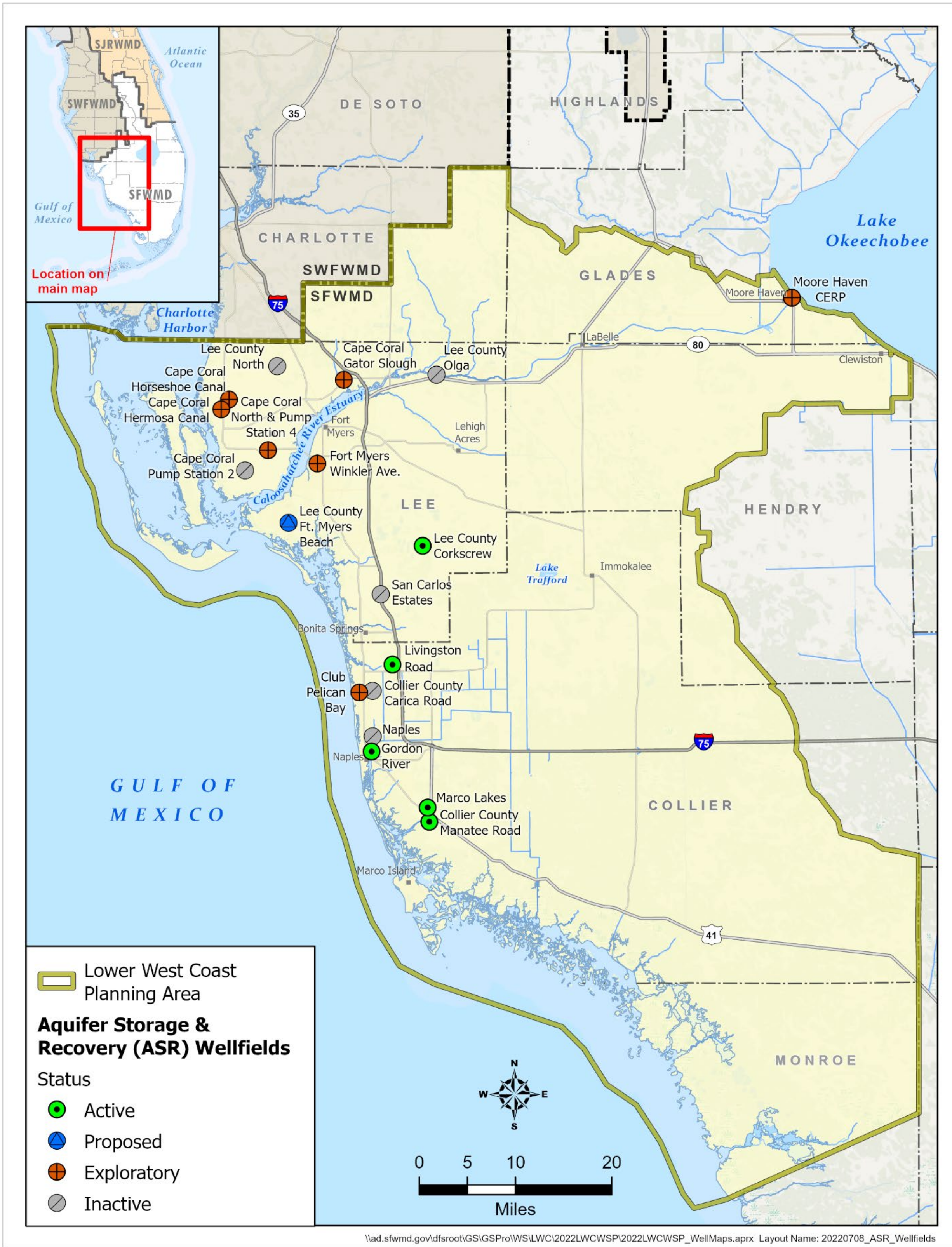


Figure 5-13. ASR wellfields in the LWC Planning Area.

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. Excess stormwater 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 and collect stormwater runoff. These reservoirs also may provide water quality treatment before off-site discharge. The C-43 West Basin Storage Reservoir is a CERP project currently under construction and one example of a large-scale, off-stream regional reservoir in the LWC Planning Area. 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 CERP (**Chapter 7**), may enhance surface water availability.

SEAWATER

The use of desalinated seawater from the Gulf of Mexico is an AWS option. The SFWMD does not require water use permits for the use of seawater. 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 LWC Planning Area rely on fresh groundwater and surface water as well as brackish water and reclaimed water for urban, agricultural, and industrial uses. Total gross water demands under average rainfall conditions are projected to increase 17% between 2020 and 2045. Additionally, the total demand projection for 2045 in this 2022 LWC Plan Update is 4% lower than the estimated 2040 demand projected in the 2017 LWC Plan Update. As concluded in previous LWC 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.

Saline groundwater has recently become the primary source of water to meet increasing PS demands in the LWC Planning Area. Large-scale expansion of SAS and IAS withdrawals is limited by the rate of groundwater recharge, low aquifer productivity, potential impacts to existing legal users and wetlands, possible saltwater intrusion, and proximity to contamination sources. Therefore, the FAS will continue to provide an increasing portion of the water needed to meet 2045 PS demands. The West Coast Floridan Model results indicate the FAS will be able to meet demands, in terms of volume and water quality. Model results are discussed in **Appendix D**.

Traditional fresh surface water and groundwater sources 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, several utilities are proposing to expand reclaimed water distribution systems for landscape and golf course irrigation.

The LWC Planning Area receives an average of 53 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 LWC Planning Area.

REFERENCES

Carollo Engineers, Inc. 2009. *Water Desalination Concentrate Management and Piloting*. Prepared by Carollo Engineers, Inc., Sunrise, FL, for the South Florida Water Management District, West Palm Beach, FL. December 2009.

FDEP. 2021. *OCULUS Electronic Document Management System*. Florida Department of Environmental Protection, Tallahassee, FL. Available online at https://depedms.dep.state.fl.us/Oculus/servlet/login.

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

SFWMD. 2022. *South Florida Water Management District 2020 Estimated Water Use Report*. South Florida Water Management District, West Palm Beach, FL.

United States Environmental Protection Agency. 2022. *Secondary Drinking Water Standards: Guidance for Nuisance Chemicals*. United States Environmental Protection Agency, Washington, DC. Available online at https://www.epa.gov/sdwa/secondary-drinking-water-standards-guidance-nuisance-chemicals.

6

Water Resource Analyses

This chapter provides historical data and analyzes the current and future status of water resources in the Lower West Coast (LWC) 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 surficial aquifer system (SAS), intermediate aquifer system (IAS), and 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

Traditional freshwater sources in the LWC Planning Area are not sufficient to meet 2020 and 2045 projected water use demands. Past analyses indicate that fresh groundwater from the SAS and IAS, and surface water from the Caloosahatchee River Basin are not adequate to meet the growing needs of the LWC Planning Area during 1-in-10-year drought conditions. As stated in **Chapter 5**, because development of the SAS and IAS has been maximized in many areas, most utilities have already tapped the deeper FAS to meet portions of current demands, and most of their increased needs in the future. The following water supply issues continue to influence water supply planning efforts in the LWC Planning Area:

- Increased withdrawals from the SAS and the freshwater portions of the IAS are generally limited due to potential impacts on wetlands and existing legal water uses, including Domestic Self-Supply (DSS); the potential for saltwater intrusion; and the possibility of reaching aquifer maximum developable limits (MDLs). New or increased allocations will be evaluated on an application-by-application basis to determine if a project meets water use permitting criteria.
    - In some areas, such as Cape Coral and Lehigh Acres, cumulative demands are negatively affecting aquifer water levels.

- Increases in surface water allocations from Lake Okeechobee and hydraulically connected surface waters are limited by the Lake Okeechobee Service Area (LOSA) restricted allocation area (RAA) criteria. Water availability from Lake Okeechobee is discussed comprehensively in the Lower East Coast Water Supply Plan.
- Peak freshwater discharges of surface water during the wet season are affecting the health of the Caloosahatchee River Estuary. Additional storage is required in the basin and in the regional system to attenuate damaging peak flow events.
- During dry conditions, surface water availability and current storage capacity sometimes are insufficient to meet water demands and environmental needs for the C-43 Canal and Caloosahatchee River Estuary.
- 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 availability of freshwater resources in the LWC Planning Area.

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

While the development of fresh groundwater in many areas has been maximized, limited amounts of fresh groundwater may be locally available. As urban growth occurs, some agricultural land is expected to transition to urban community 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.

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 LWC Planning Area, including their availability and ability to meet projected demands considering the issues listed above:

- Input from planning area stakeholders and the public
- Analyses and results from previous LWC water supply plan updates
- Water Supply Facilities Work Plans and capital improvements elements from local governments
- Activities and progress since the 2017 LWC Plan Update, including water supply diversification
- Groundwater modeling results from simulations conducted in 2020 using the Lower West Coast Surficial and Intermediate Aquifer Systems Model and the West Coast Floridan Model
- Water use permits and permit applications

- Water supply demand projections for 2045
- Hydrologic data for the SAS, IAS, and Upper Floridan aquifer (UFA) from monitor wells located in the LWC Planning Area
- Updated 2019 saltwater interface maps for Lee and Collier counties
- Data and information from the Comprehensive Everglades Restoration Plan (CERP), including status of CERP projects such as the Caloosahatchee River (C-43) West Basin Storage Reservoir

Based on information from these sources, issues identified in the 2017 LWC 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 4% less than the projected 2040 demands in the 2017 LWC Plan Update (**Chapter 2**). The decrease in total projected demand is due primarily to decreases in projected 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

Traditionally, surface water from Lake Okeechobee, the C-43 Canal, and the Caloosahatchee River Estuary watershed has been the primary source of water supply for agriculture in the LWC Planning Area. As discussed in the 2017 LWC Plan Update, surface water availability from existing canal and storage networks within the hydraulically connected LOSA is insufficient to meet agricultural water use demands and environmental needs during 1-in-10-year drought conditions. Increases in surface water allocations from Lake Okeechobee and hydraulically connected surface waters are limited by the RAA criteria. Past analyses concluded that additional storage would be beneficial to providing adequate resources to meet existing legal user and natural system needs.

The lack of storage within the C-43 Canal and Caloosahatchee River Estuary watershed contributes to the following:

- The discharge of large volumes of water to tide during major storm events, which adversely impacts estuarine ecosystems due to sudden declines in salinity
- The discharge of water to tide during the wet season, making it unavailable to the ecosystem during the dry season
- The lack of sufficient dry season inflows to the estuary, which causes elevated salinity within the estuary

Construction of the CERP Caloosahatchee River (C-43) West Basin Storage Reservoir (**Chapters 4, 7,** and **Appendix C**) will provide surface water storage as a component of the recovery strategy for the Caloosahatchee River minimum flow and minimum water level (MFL). The main objective of the project is to capture excess wet season flows that will be used to enhance dry season flows to the Caloosahatchee River Estuary. Construction of the reservoir is anticipated to be completed in 2024. Additional reservoirs or water storage solutions to increase water storage capacity have been proposed by agricultural entities.

Lake Okeechobee provides supplemental water to the Caloosahatchee River Estuary via the C-43 Canal during the dry season. However, concerns about the integrity of the Herbert Hoover Dike surrounding Lake Okeechobee resulted in the United States Army Corps of Engineers (USACE) revising the water level operational protocol (the 2008 Lake Okeechobee Regulation Schedule), which limits water availability to the C-43 Canal and its tributaries. The USACE currently is rehabilitating the Herbert Hoover Dike, with an expected completion date by 2022. Concurrently, the USACE initiated in 2019 a re-evaluation of Lake Okeechobee operations to coincide with the completion of Herbert Hoover Dike rehabilitation. The Lake Okeechobee System Operating Manual (LOSOM) planning effort is re-examining the opportunities to balance the congressionally authorized project purposes for flood control, water supply, navigation, recreation, and preservation of fish and wildlife resources. The USACE plans to have a new schedule completed in 2023.

Several factors were considered when evaluating surface water availability to meet current and future demands in the LWC 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, IAS, and FAS are the major groundwater sources in the LWC Planning Area (**Chapter 5**). The following sections provide data and analyses of water levels and water quality in the SAS, IAS, and FAS. The SAS and IAS historically served as the major sources of fresh groundwater for Public Supply (PS), Landscape/Recreational (L/R) irrigation, and Agricultural (AG) irrigation. However, past and present analyses of the SAS and IAS indicate that they are limited sources of groundwater in many areas. The SAS and IAS could not be the primary sources for all projected water demands in the LWC Planning Area without harming the environment or the resource. Alternative sources would need to be developed to meet increased demands. The SFWMD has developed regional groundwater models for the SAS/IAS and the FAS to evaluate current and future conditions within the LWC Planning Area. A summary of the groundwater modeling results for simulations conducted in 2020 can be found in this chapter and in **Appendix D**.

Additional limited groundwater may be developed and permitted from the SAS and IAS depending on local resource conditions, changing land use, and the viability of other supply options. Increases in withdrawals from the SAS and IAS are constrained by saltwater intrusion, wetland impacts, impacts to existing legal users, and other regulatory considerations. Withdrawals from the freshwater portion of the SAS and IAS also are limited due to the regulatory protections provided by aquifer MFLs and MDLs, as discussed in **Chapter 4** and **Appendix C**. MDL elevations are shown below on water level time series plots. Applications for increased withdrawals from the SAS and IAS will be reviewed on a project-specific basis to determine if water use permitting criteria will be met.

Hydrographs for selected SAS, IAS, and FAS monitor wells are presented below using data from the District's DBHYDRO database, United States Geological Survey (USGS) wells database, and the District's regulatory database (for PS facilities and wellfields). In DBHYDRO, monitor wells are identified by a unique DBKey, as listed in each time-series hydrograph.

In addition to the hydrographs, time series plots of chloride concentrations are provided as indicators of water quality on the saltwater interface maps contained in **Appendix D**. Groundwater chloride concentration data for selected PS wellfields are presented herein. 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** and later sections of this chapter.

Surficial Aquifer System Evaluation

Within the SAS, the Water Table and Lower Tamiami aquifers are primary water sources for DSS, L/R, and AG as well as a major source for PS in Collier, Lee, and Hendry counties. As such, the shallow aquifers are critically important to the region. The hydrologic data used in this plan update show a wide range in water levels in the SAS. The SAS (and its associated wetlands) depend on local rainfall and lateral seepage for aquifer recharge. During dry conditions, recharge diminishes, drainage persists, and irrigation and other demands increase, compounding stress on the SAS and wetland systems.

Surficial Aquifer System Water Levels

Permitted withdrawal locations from these aquifers are presented in maps in **Chapter 5**. Throughout the LWC Planning Area, there are no consistent downward or upward trends in SAS water levels; however, individual wells may show temporal trends reflecting local climatic variations. Active SAS monitoring well locations are shown in **Figure 6-1**.

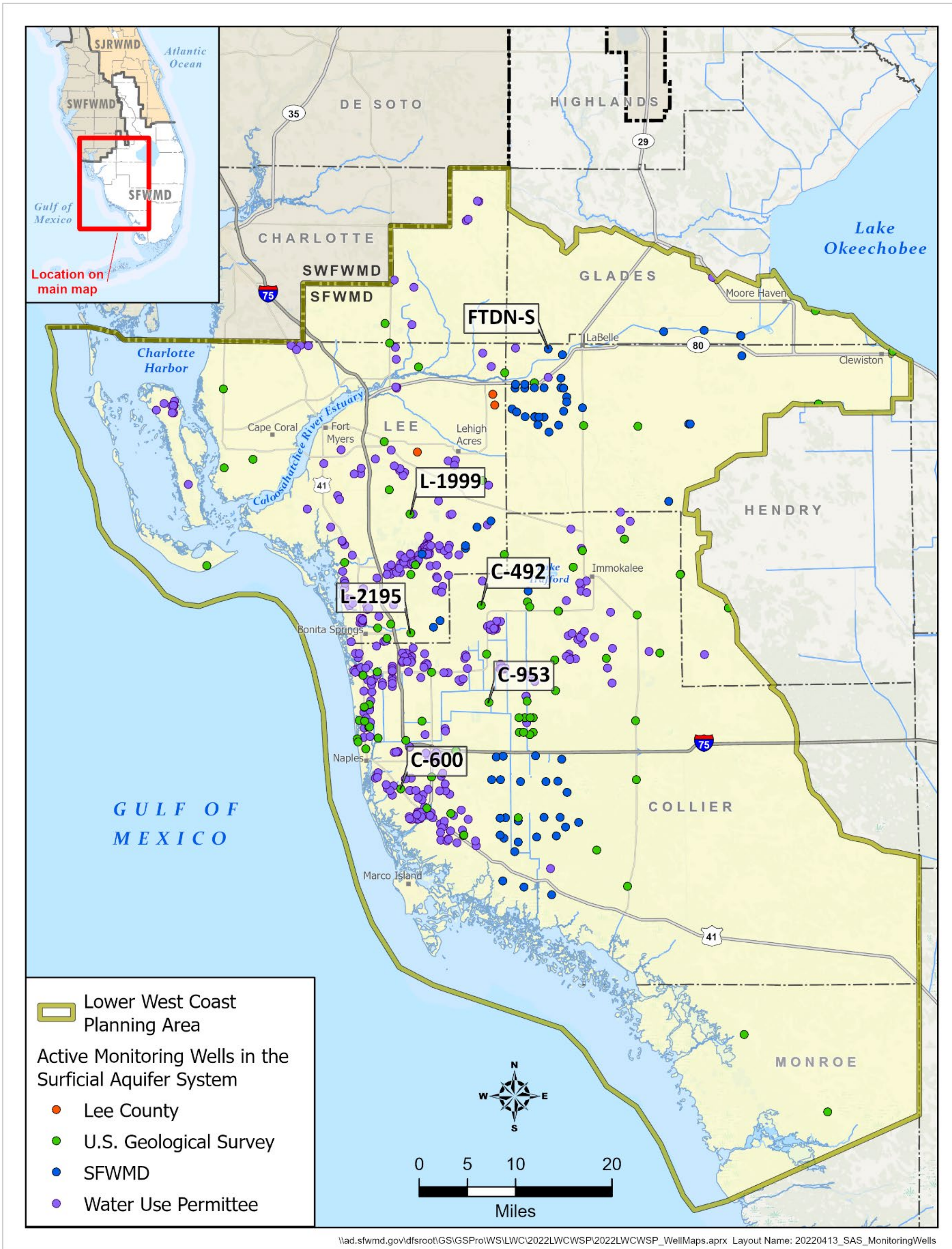


Figure 6-1. Active surficial aquifer system groundwater monitor wells in the LWC Planning Area.

Figures 6-2 through **6-6** are selected time-series plots showing groundwater elevation trends for Collier County SAS monitor wells C-492, C-600, Lee County SAS monitor well L-1999, Hendry County monitor well FTDN-S, and Lee County SAS monitor well L-2195. Wells C-492, L-1999, and L-2195 show approximately 5- to 6-foot variations in water levels between the wet and dry seasons, while the variations in water levels at C-600 are generally around 2 to 2.5 feet and 3.5 to 4 feet at FTDN-S. Seasonal variations in groundwater levels between the wet and dry seasons are typical in rainfall-driven shallow aquifers like the SAS. Well C-492 has shown an overall decreasing trend of about 0.8 feet over the lifetime of the water level records, while L-1999 shows a slight increasing water level trend over the entire period of record. The time-series plot for FTDN-S shows a stable water level trend throughout its 30-year record.

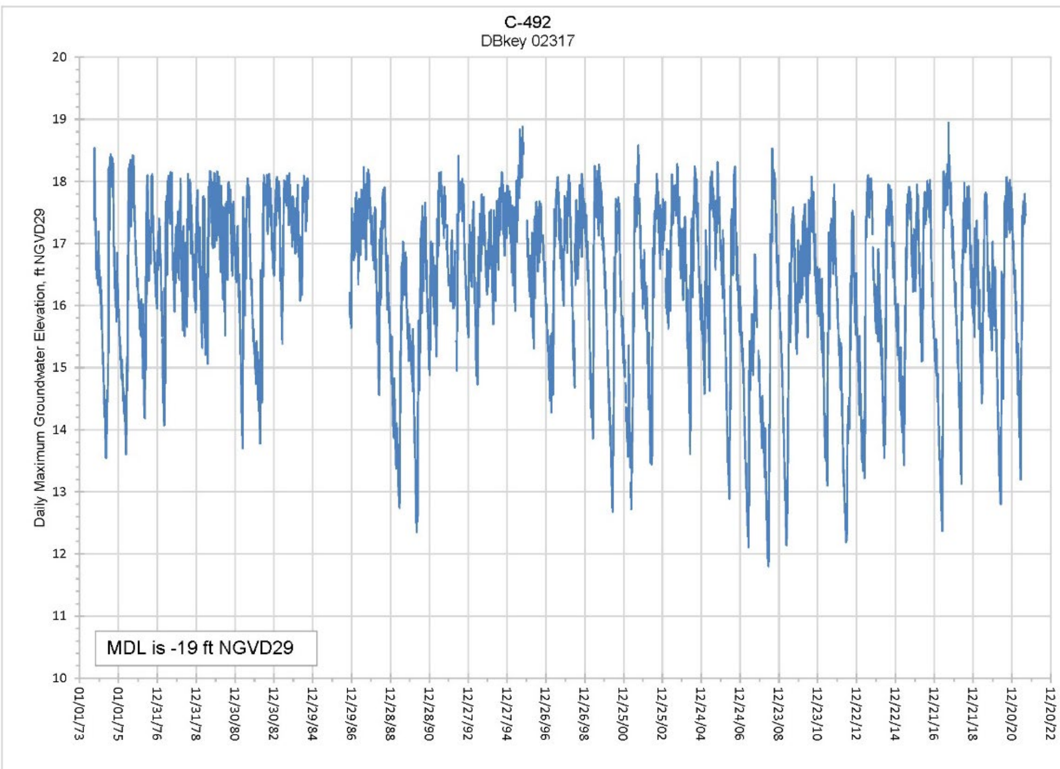


Figure 6-2. Water levels in Lower Tamiami aquifer monitor well C-492, northwestern Collier County.

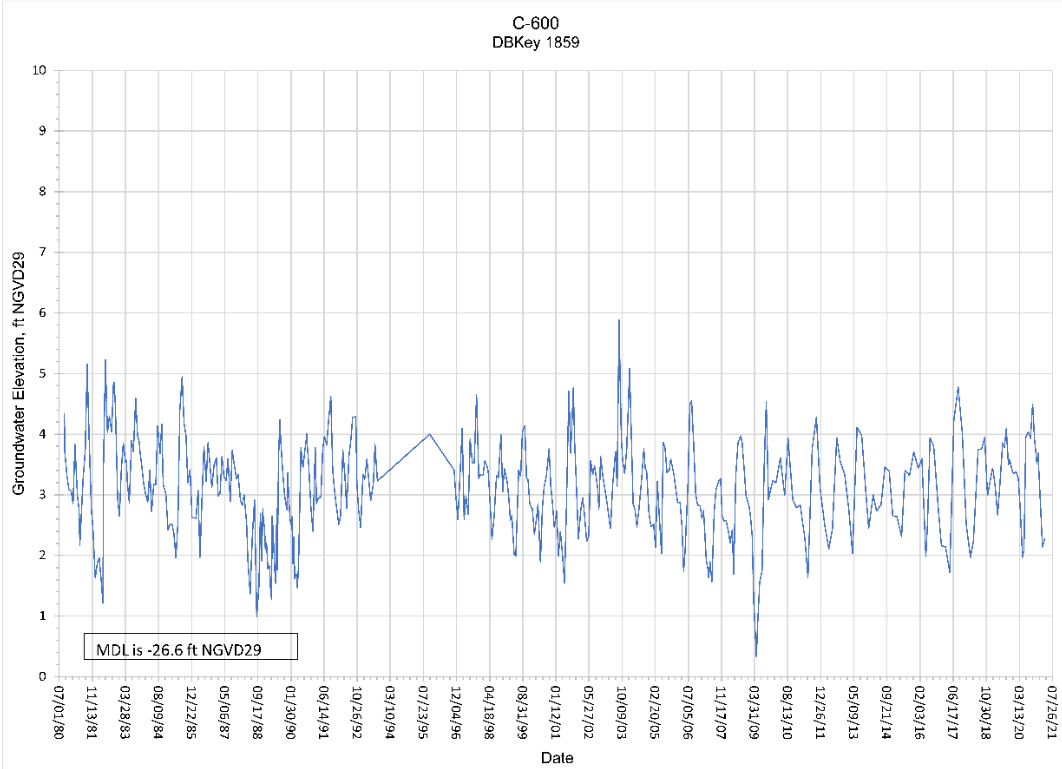


Figure 6-3. Water levels in USGS Lower Tamiami aquifer monitor well C-600, Collier County.

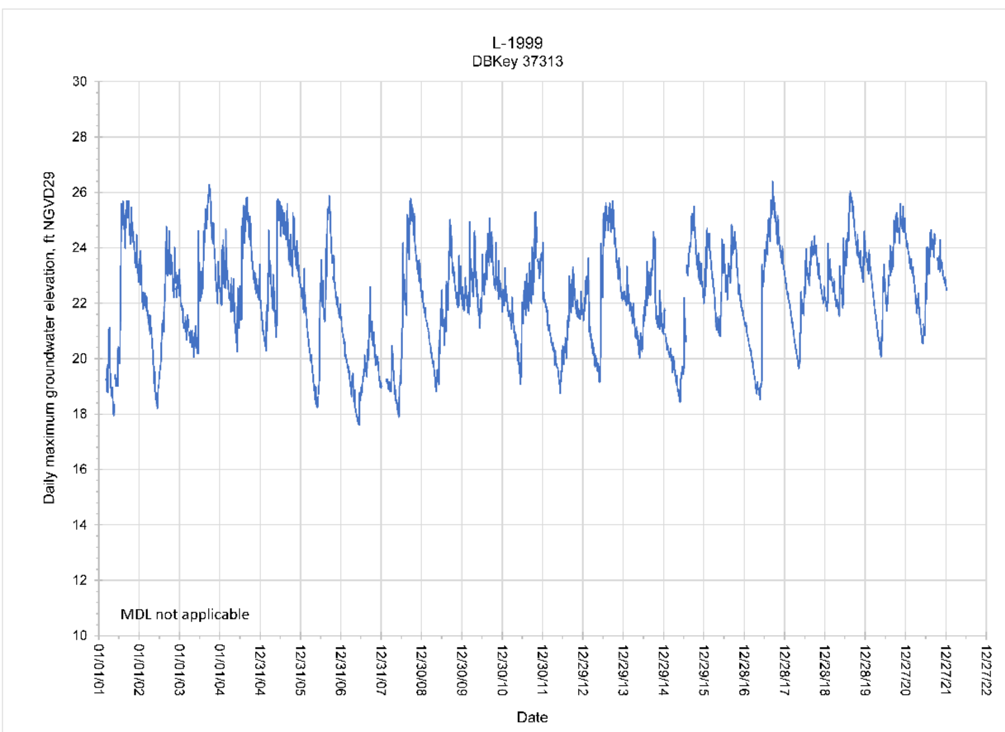


Figure 6-4. Water levels in surficial aquifer system monitor well L-1999, Lee County.

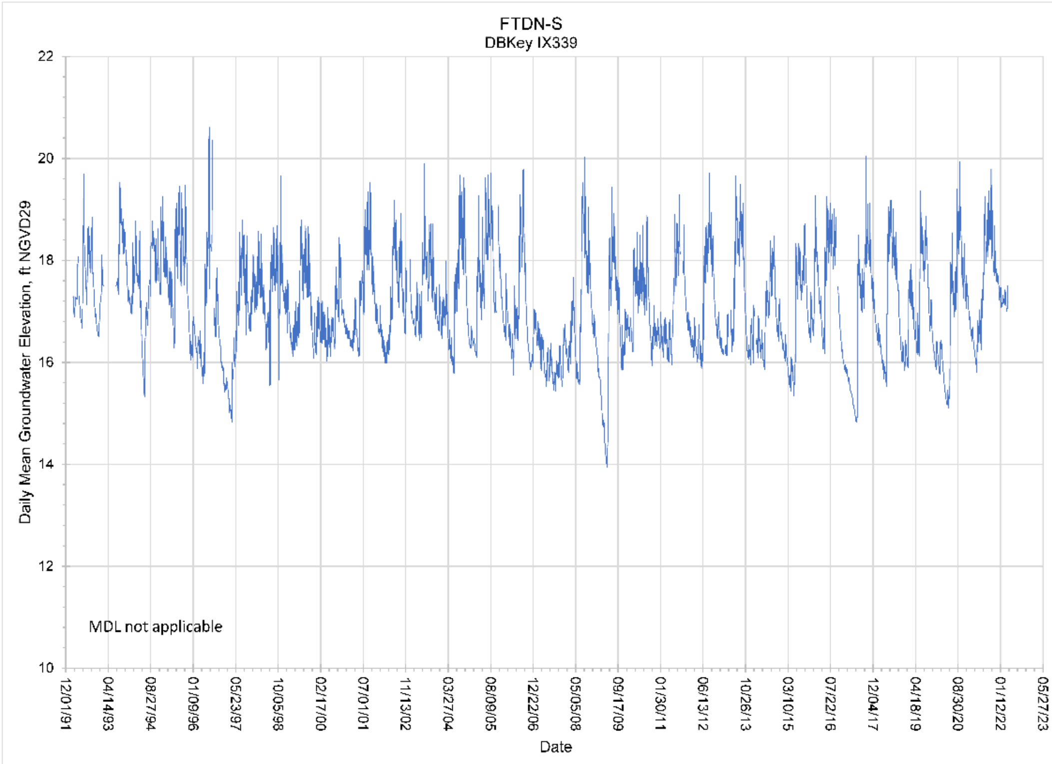


Figure 6-5. Water levels in surficial aquifer system monitor well FTDN-S, Hendry County.

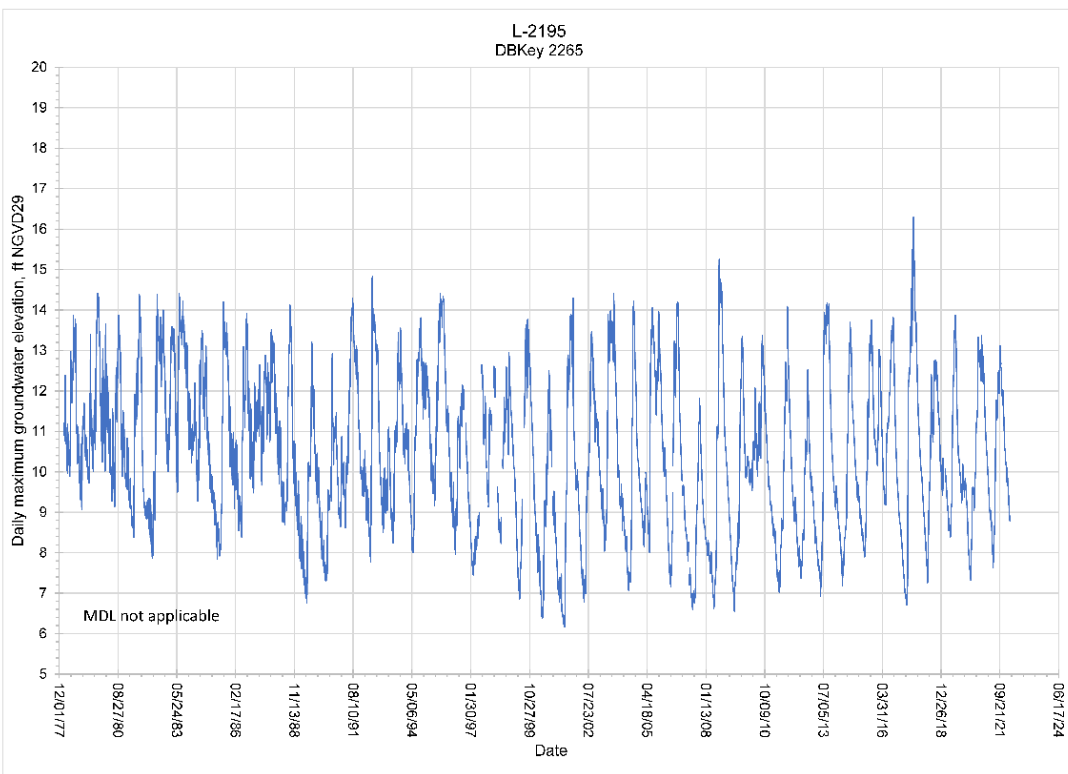


Figure 6-6. Water levels in surficial aquifer system monitor well L-2195, Lee County.

Intermediate Aquifer System Evaluation

In the LWC Planning Area, the IAS includes the Sandstone and Mid-Hawthorn aquifers. The Sandstone aquifer is used predominantly for AG and DSS. The Mid-Hawthorn aquifer is used by DSS and as a supplemental source for L/R and PS. The hydrologic data used in this plan update show a wide range in water levels in the IAS. The IAS is confined/semi-confined in the LWC Planning Area. The Mid-Hawthorn aquifer is recharged outside and north of the planning area, while the Sandstone aquifer receives some recharge locally (dampened because of the semi-confining rock unit above it) and from the north. Active IAS monitoring well locations are shown in **Figure 6-7**.

Intermediate Aquifer System Water Levels

Sandstone Aquifer

The time-series shown in **Figures 6-8** through **6-12** show steadily declining IAS groundwater elevations and relatively large variations in minimum and maximum groundwater elevations in Lehigh Acres. Prior to the 2000s, water level fluctuations between the wet and dry seasons in these wells varied by up to approximately 10 feet. Since about 2000, this variation has increased to approximately 20 feet. The overall declining groundwater elevation trend has caused some DSS wells to become inoperable. During the 2007 drought, 64% of the 526 replacement wells permitted by Lee County were in Lehigh Acres. Sandstone aquifer water levels have recovered near wellfields where withdrawals from this aquifer have been reduced. However, overall groundwater withdrawals from the IAS have increased in the LWC Planning Area.

In 2010, the SFWMD installed two Sandstone aquifer monitor wells (L-729 and L-2186) to help refine the top of the Sandstone aquifer and the MDLs for these two wells in Lehigh Acres (McMillon and Anderson 2015). This project and the results from other drilling in the area demonstrate the variability in the elevations of the top of the Sandstone aquifer.

From March 2017 to present, dry season water levels in well L-2186 have declined to less than 10 feet above (and sometimes less than 5 feet above) the MDL (9.1 feet National Geodetic Vertical Datum of 1929 [NGVD29]). Population in the Lehigh Acres area is expected to increase over the next few decades, and groundwater levels are expected to continue declining toward the MDL, particularly during the dry seasons and times of greater water use.

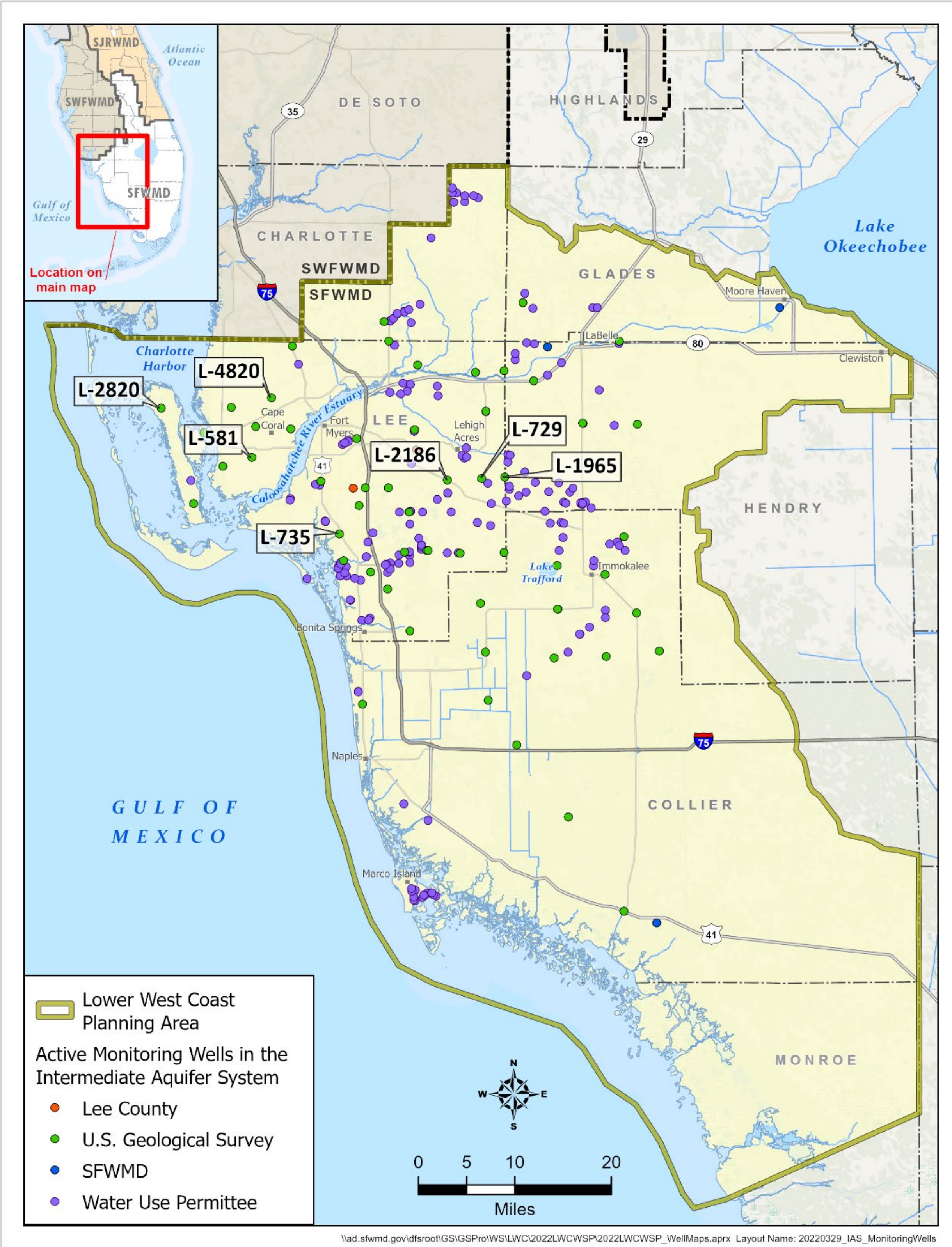


Figure 6-7. Active intermediate aquifer system water level monitor wells in the LWC Planning Area.

As shown in the time series plots for Sandstone aquifer wells L-729, L-2186, and L-1965 (**Figures 6-8** to **6-10**), water levels show declining trends with the usual seasonal variations. Water levels at well L-729 began to show a greater seasonal variation starting around 2001 and continuing into the present, with a slight overall decreasing trend. For approximately the last 15 years, the lowest groundwater elevations at L-729 have come within approximately 12 feet of the MDL elevation of -15 feet NGVD29. Water levels at Sandstone aquifer well L-2186 also show similar trends to well L-729, with increasing seasonal variations and declining water levels starting around 2000. During the dry season at L-2186, the water levels have dropped to within about 3 to 8 feet of the MDL elevation of -9.1 feet NGVD29. At Sandstone aquifer well L-1965, the same declining water level trend is visible. Slightly greater seasonal fluctuations in water levels are seen at L-1965 than those seen in L-729 and L-2186, with numerous MDL violations recorded at L-1965 since late 1999. The time-series plots indicate a long-term decline in available groundwater with increasingly greater seasonal variations and lower groundwater elevations during dry seasons.

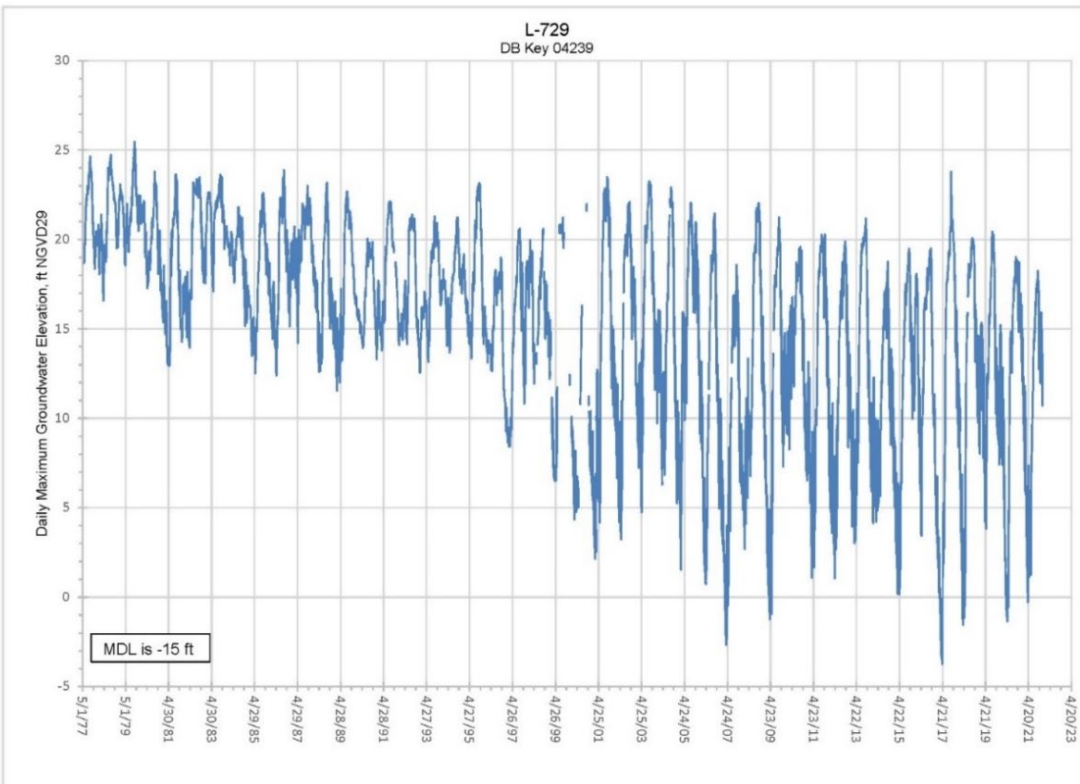


Figure 6-8. Water levels in Sandstone aquifer well L-729 in Lehigh Acres.

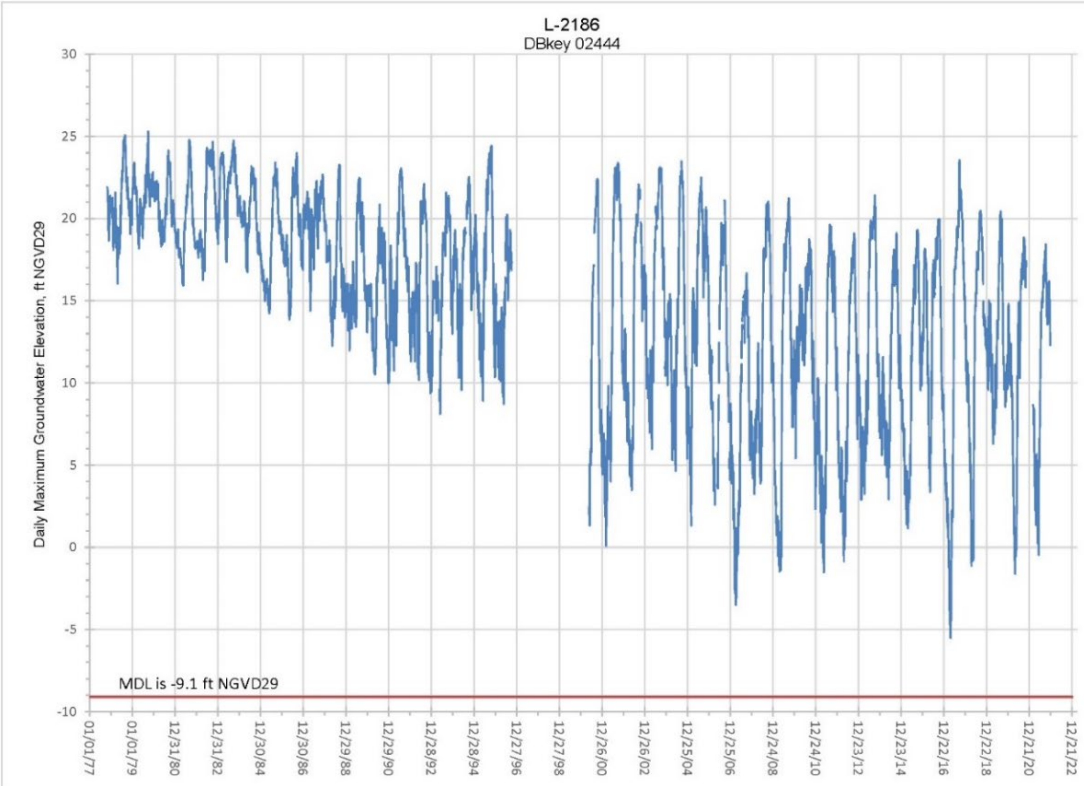


Figure 6-9. Water levels in Sandstone aquifer well L-2186 in Lehigh Acres.

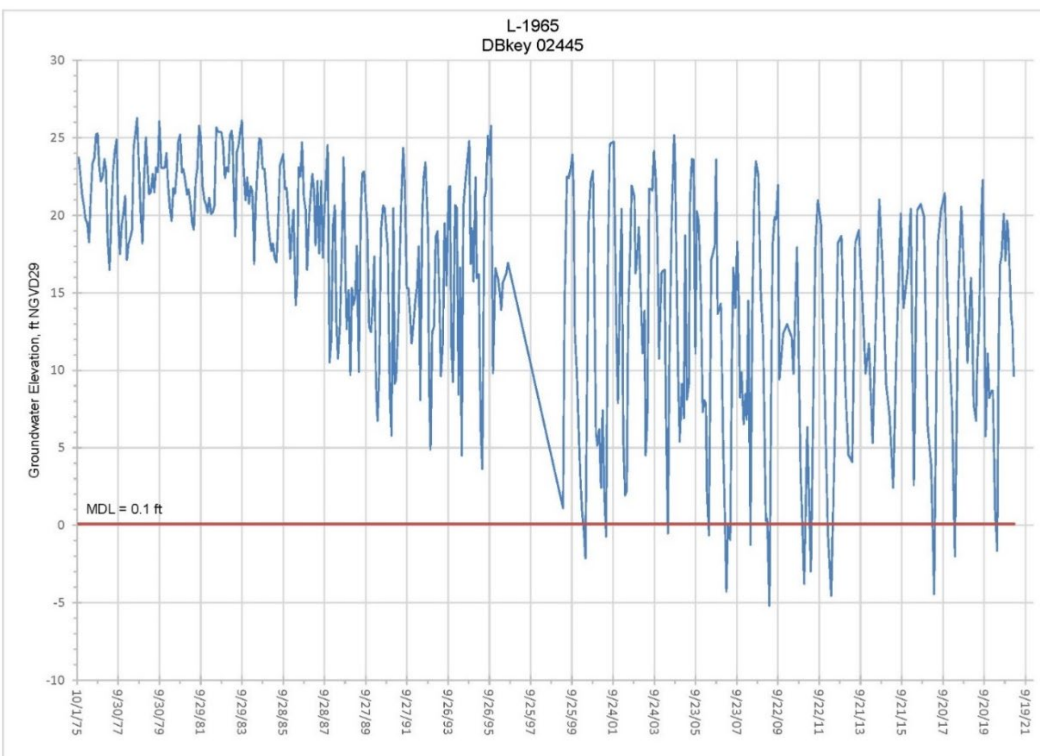


Figure 6-10. Water levels in Sandstone aquifer well L-1965 in Lehigh Acres.

Mid-Hawthorn Aquifer

In contrast to the declining trends observed for the IAS/Sandstone aquifer in Lehigh Acres, water levels within the Mid-Hawthorn aquifer have risen substantially in southern Cape Coral due to PS and reclaimed water service area expansion by the City of Cape Coral, which decreased DSS withdrawals from the Mid-Hawthorn (as shown by the increasing groundwater elevations at L-581 (**Figure 6-11**). PS for this portion of Cape Coral is derived primarily from the FAS, which is hydraulically isolated from the IAS and SAS. Expansion of the southern Cape Coral service area as well as increased use of the FAS and reclaimed water were identified in the 2012 LWC Plan Update as partial solutions to diminishing IAS water availability in the area.

However, in northern Cape Coral not yet served by PS, water levels in the Mid-Hawthorn aquifer have continued to decline as shown in the hydrograph for well L-4820, where groundwater elevations are now approximately 65 feet lower than they were in 2003 (**Figure 6-12**). In addition, the MDL of -81 feet NGVD29 was exceeded twice (from March 27, 2020 to June 1, 2020 and from March 25, 2021 to July 5, 2021). Continued reliance on this IAS aquifer will cause further water level declines, which reinforces the need for AWS development to ensure adequate future water supply.

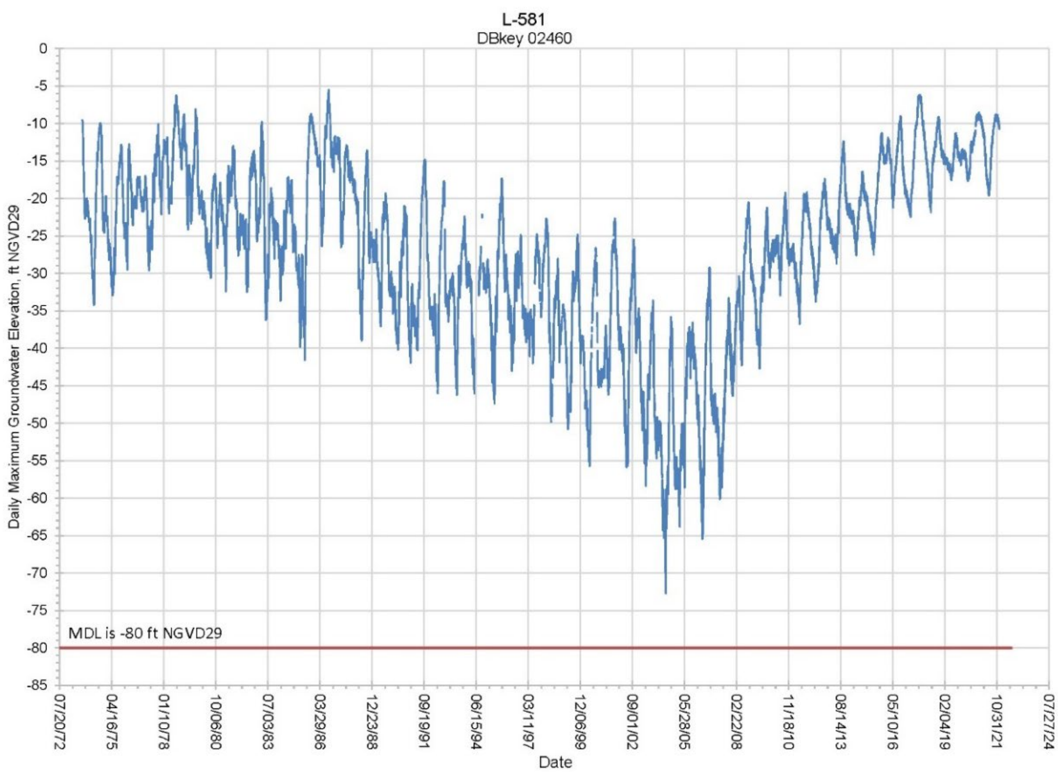


Figure 6-11. Water levels in Mid-Hawthorn aquifer well L-581 in Cape Coral.

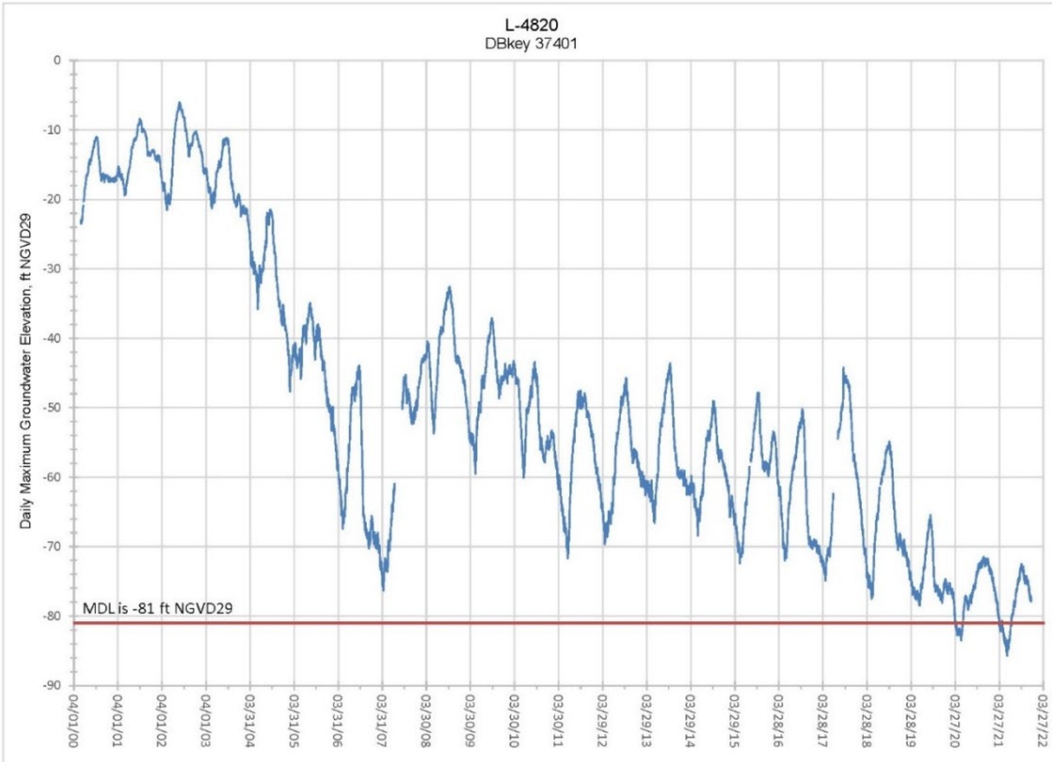


Figure 6-12. Water levels in Mid-Hawthorn aquifer well L-4820 in northern Cape Coral.

Surficial and Intermediate Aquifer System Water Quality

Water quality monitoring is crucial to managing and protecting fresh groundwater sources such as the SAS and IAS. The concentrations of chloride detected in groundwater samples are used as indicators of saltwater intrusion, which can occur due to the inland movement of the saltwater interface, or due to upward movement of saline groundwater (upconing) from underlying geologic units. Upconing and leakage from deeper brackish aquifers can occur through a variety of mechanisms including sustained overpumping, or flow through improperly abandoned or designed wells that are open to multiple aquifers. Chloride concentrations must be below the United States Environmental Protection Agency secondary drinking water standard of 250 milligrams per liter (mg/L) to meet the drinking water standard (United States Environmental Protection Agency 2021).

Saltwater Interface Mapping

The SFWMD periodically develops saltwater interface maps to help visualize and understand the potential degradation of the coastal aquifers and water supply wellfields tapping the SAS and IAS (**Appendix D**). Salinity data from monitor wells were compiled from multiple sources (e.g., USGS, SFWMD, water use permittees) and contoured to estimate the position of the saltwater interface, defined as the isochlor line with a 250 mg/L chloride concentration. 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 saltwater interface maps are available on the SFWMD's website at https://www.sfwmd.gov/documents-by-tag/saltwaterinterface.

In general, the 2019 maps are similar to the 2014 maps; however, relatively small differences indicate that the interface is regionally dynamic, with inland movement in some areas and seaward movement in other areas. Local-scale investigation of the saltwater interface could be warranted in some areas, depending on the network of monitor wells available, the proximity of the saltwater interface to specific wellfields, and groundwater withdrawal rates at these wellfields. The 2019 saltwater interface maps for the Water Table, Lower Tamiami, Sandstone, and Mid-Hawthorn aquifers are presented in **Appendix D**.

Water Quality Data from Selected PS Wellfields in the SAS

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. Several PS utilities in the LWC 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 chloride monitoring to identify possible inland movement of the saltwater interface. This section includes the historical plots of chloride concentrations from a few PS wellfields that withdraw water from the SAS. An additional discussion of the PS utilities that are particularly vulnerable to dry conditions within the LWC Planning Area is included in **Appendix D**.

Naples Coastal Ridge Wellfield

Naples has been utilizing the groundwater from the Lower Tamiami aquifer at the Coastal Ridge wellfield since the 1960s. The city has maintained a vigilant water quality monitoring and wellfield operating regime (in tandem with operation of the East Golden Gate wellfield) that has successfully provided continued withdrawals from the aquifer without causing a significant deterioration of water quality from the production wells (**Figure 6-13**).

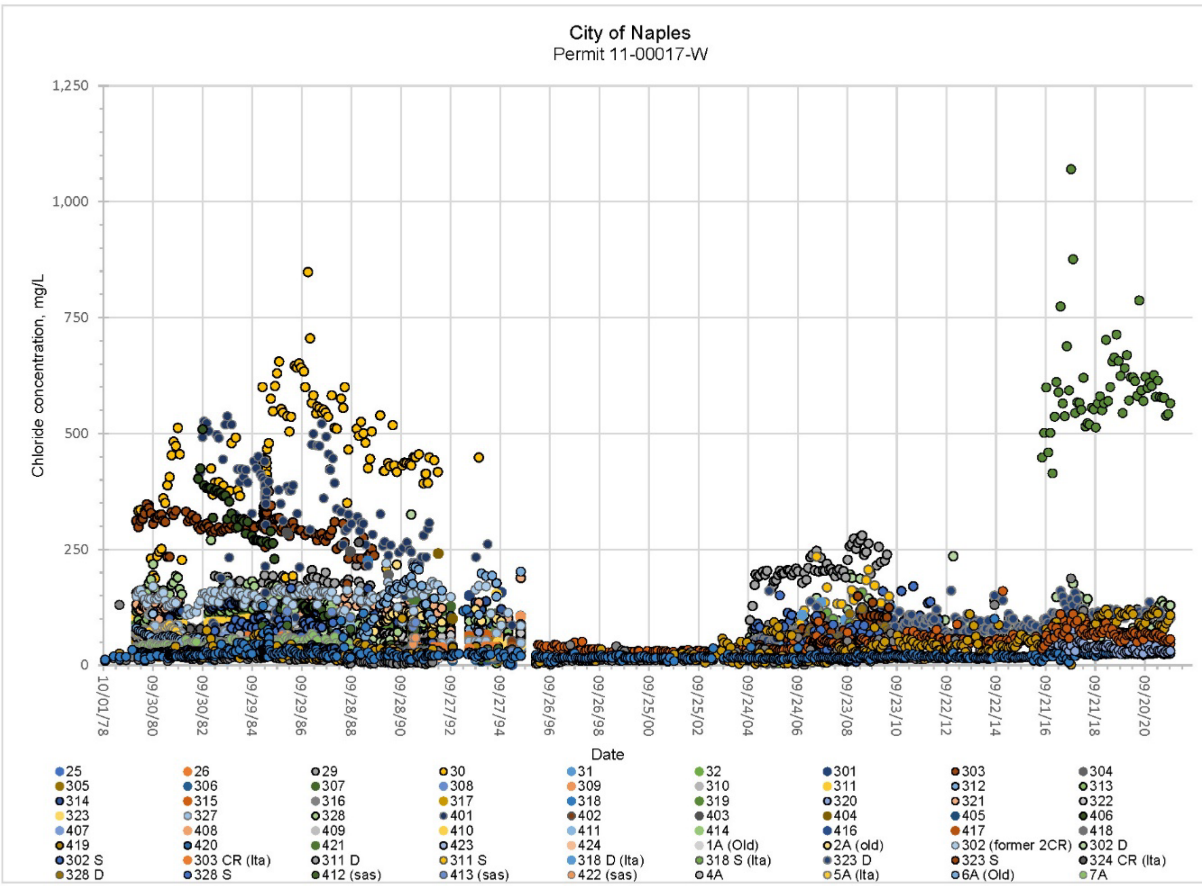


Figure 6-13. Chloride concentrations in the Naples Coastal Ridge wellfield.

Bonita Springs West Wellfield

The Bonita Springs West wellfield has been utilizing the Lower Tamiami aquifer for PS since the early 1980s. Over the last 14 years, all the chloride concentrations are stable with most of the wells containing chloride concentrations below about 150 mg/L, with well MW-1 reporting values around 300 mg/L. Well 1 contained elevated chloride concentrations between 1,200 mg/L and 350 mg/L; however, use of this well was discontinued in 2007 (**Figure 6-14**).

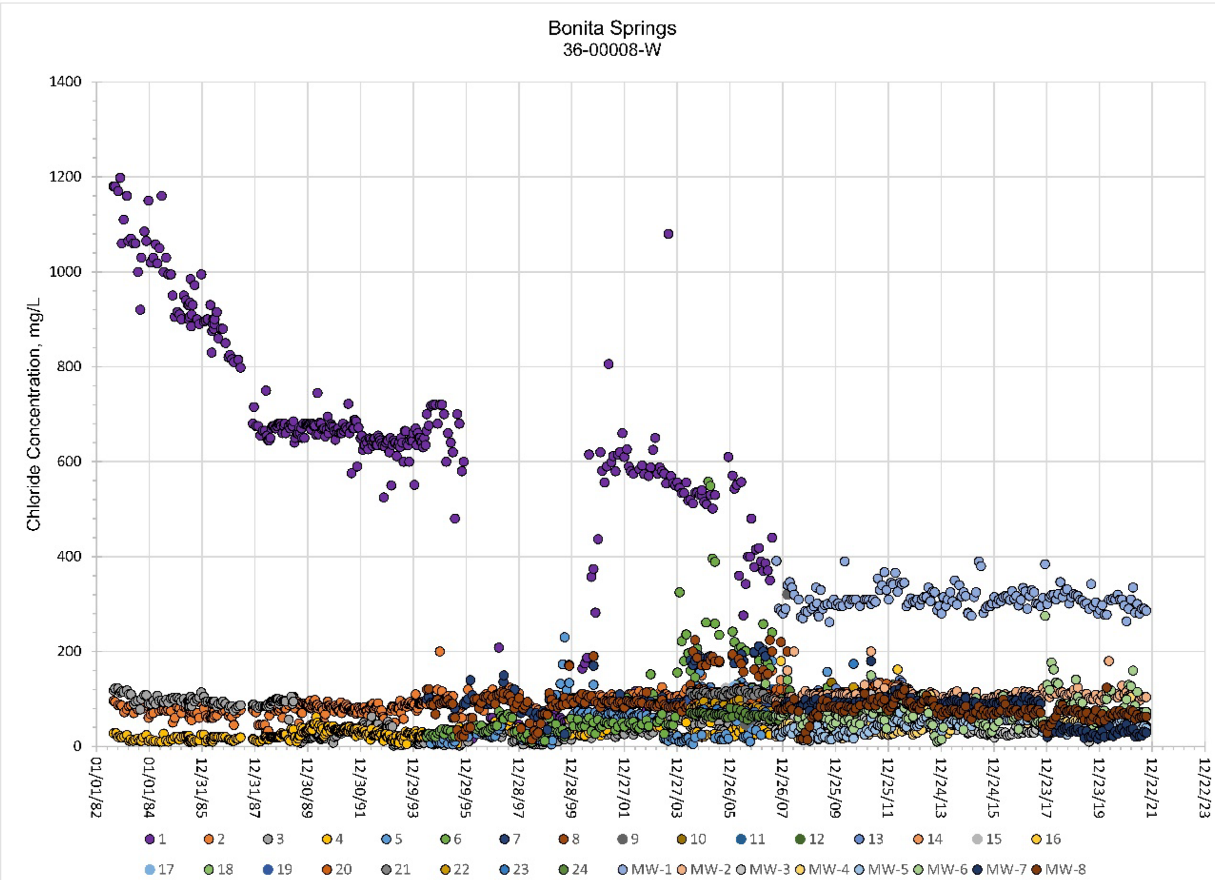


Figure 6-14. Chloride concentrations in the Bonita Springs West wellfield.

Lee County Green Meadows

Lee County Utilities has been utilizing the SAS at the Green Meadows wellfield for PS since 1985. Over the last 10 years, the chloride concentrations have been fairly stable with the majority of the wells containing chloride concentrations below about 80 mg/L, with a number of the wells showing a slight decreasing trend in chloride concentrations (**Figure 6-15**).

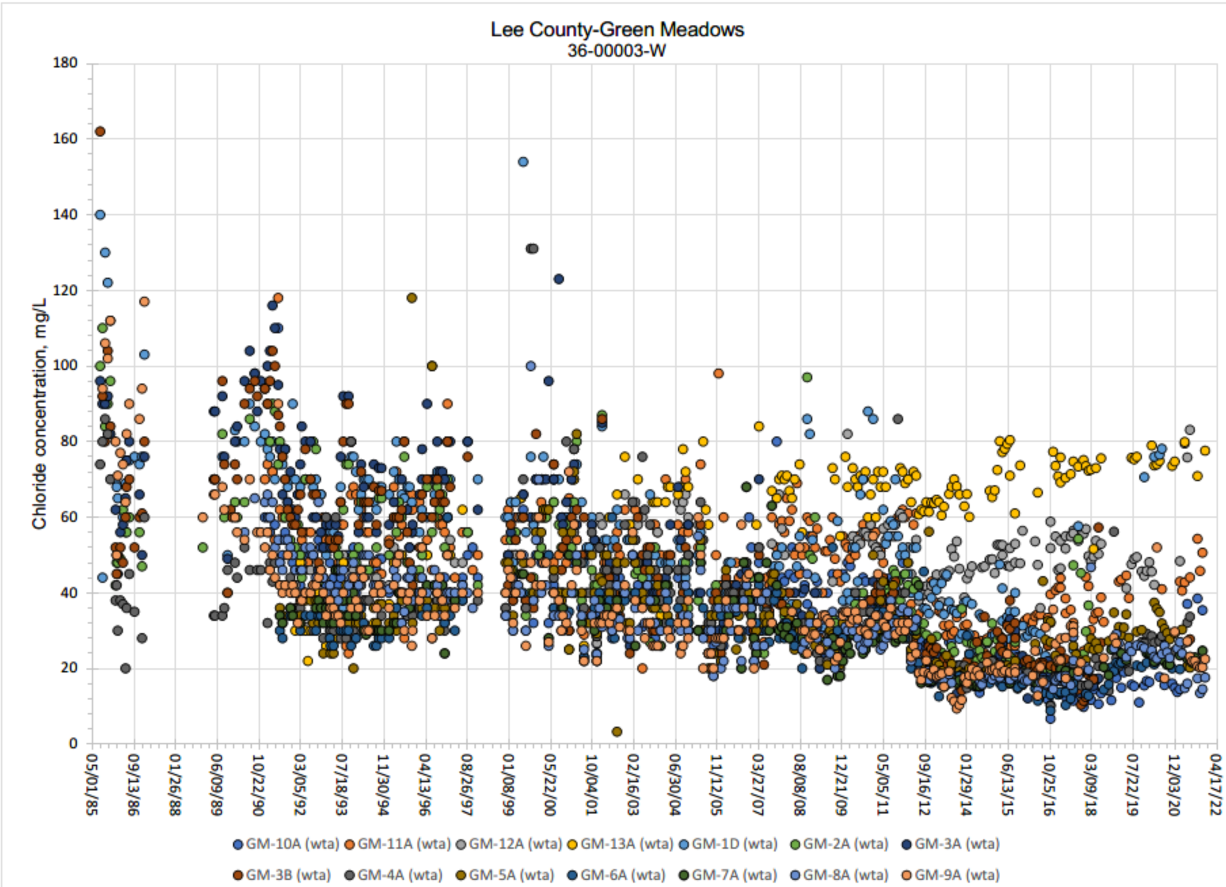


Figure 6-15. Chloride concentrations in the Lee County Green Meadows surficial aquifer system wellfield.

Surficial and Intermediate Aquifer Groundwater Modeling

The Lower West Coast Surficial and Intermediate Aquifer Systems Model (LWCSIM) was designed to evaluate the sustainability of existing and projected future LWC Planning Area demands from the SAS and IAS. The LWCSIM was used to identify areas where cumulative water use withdrawals may harm existing groundwater resources and natural systems (e.g., wetlands). The modeling effort also investigated the potential for increased risk of saltwater intrusion in the SAS and IAS. The results from the model simulations indicated that no widespread impacts are anticipated from groundwater withdrawals through 2040. Although this 2022 LWC Plan Update has demands projected to 2045, the previous 2017 LWC Plan Update demand quantities for 2040 are about 4% greater. Therefore, the modeled results are considered to be representative of the future demands. The LWCSIM indicated a few localized areas that require continued monitoring, additional planning, and adaptive management strategies to prevent harmful impacts to groundwater resources and wetlands in the future. The LWCSIM also indicated that groundwater withdrawals at the projected 2040 demand levels do not pose an increased risk of saltwater intrusion near major public supply wellfields in the coastal portions of the SAS and IAS. **Figures 6-16** and **6-17** present the difference between 2020 and 2040 water levels in the Water Table aquifer (SAS) and the Sandstone aquifer (IAS). Additional graphics and a summary discussion of the LWCSIM results are provided in **Appendix D** and within the complete model application report (Bandara et al. 2020).

Surficial and Intermediate Aquifer System Conclusions

Analyses of the SAS and IAS indicate that water availability for increased water allocations is limited in many areas and cannot be the primary source for all projected water demands in the LWC Planning Area without harming the water resource including related natural systems. Water levels and water quality in the SAS appear to be stable at current withdrawal rates as available from saltwater intrusion monitoring mapping data and PS wellfield information. IAS water levels are declining towards established MDL/MFL elevations in localized areas of Cape Coral and Lehigh Acres. Northern expansion of Cape Coral's water services should address this resource concern; however, a sustainable water strategy needs to be developed for Lehigh Acres. AWS sources such as the FAS and reclaimed water will need to be expanded to meet increasing water demands in many urbanized areas.

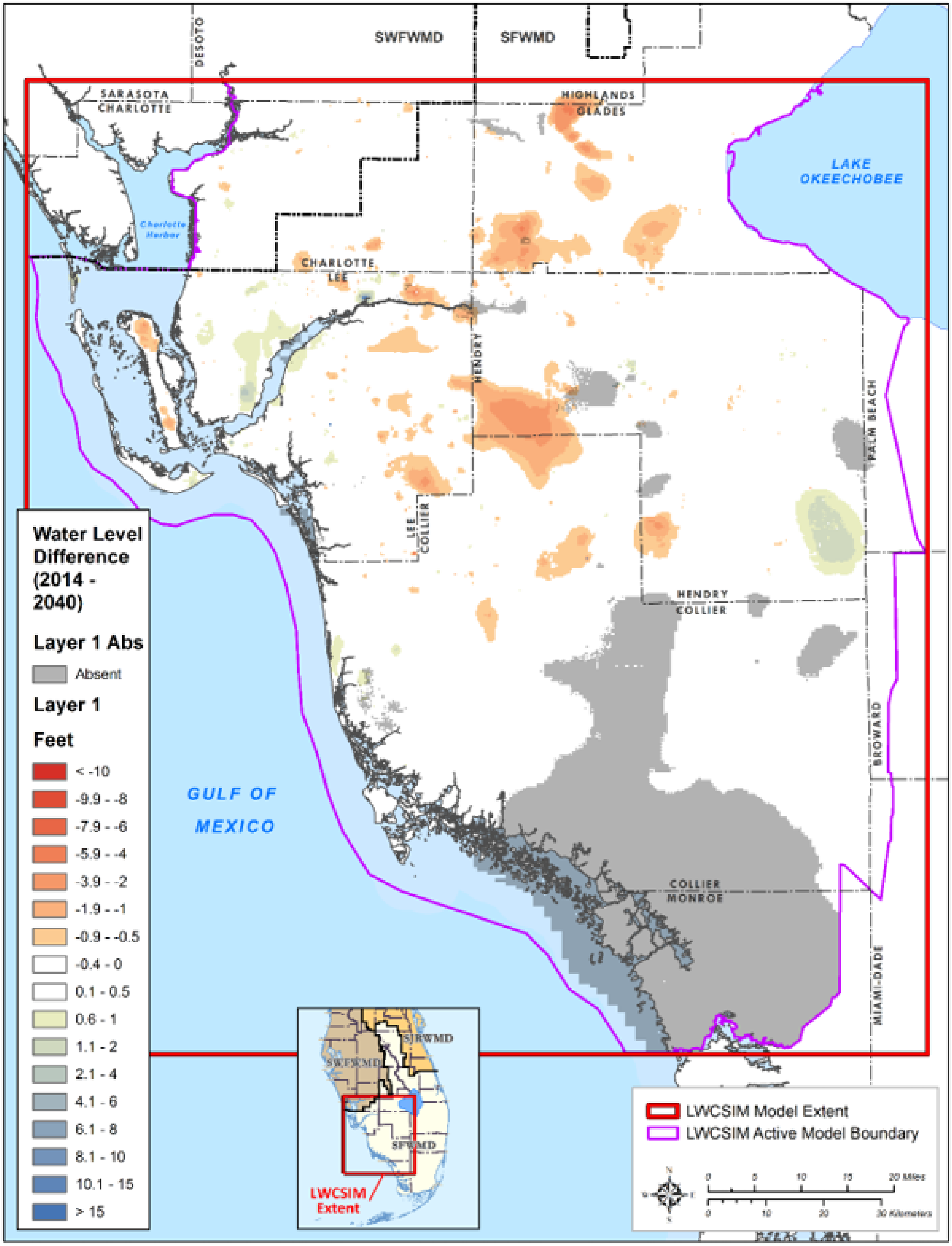


Figure 6-16. 2014 to 2040 water level difference in the Water Table aquifer (SAS).

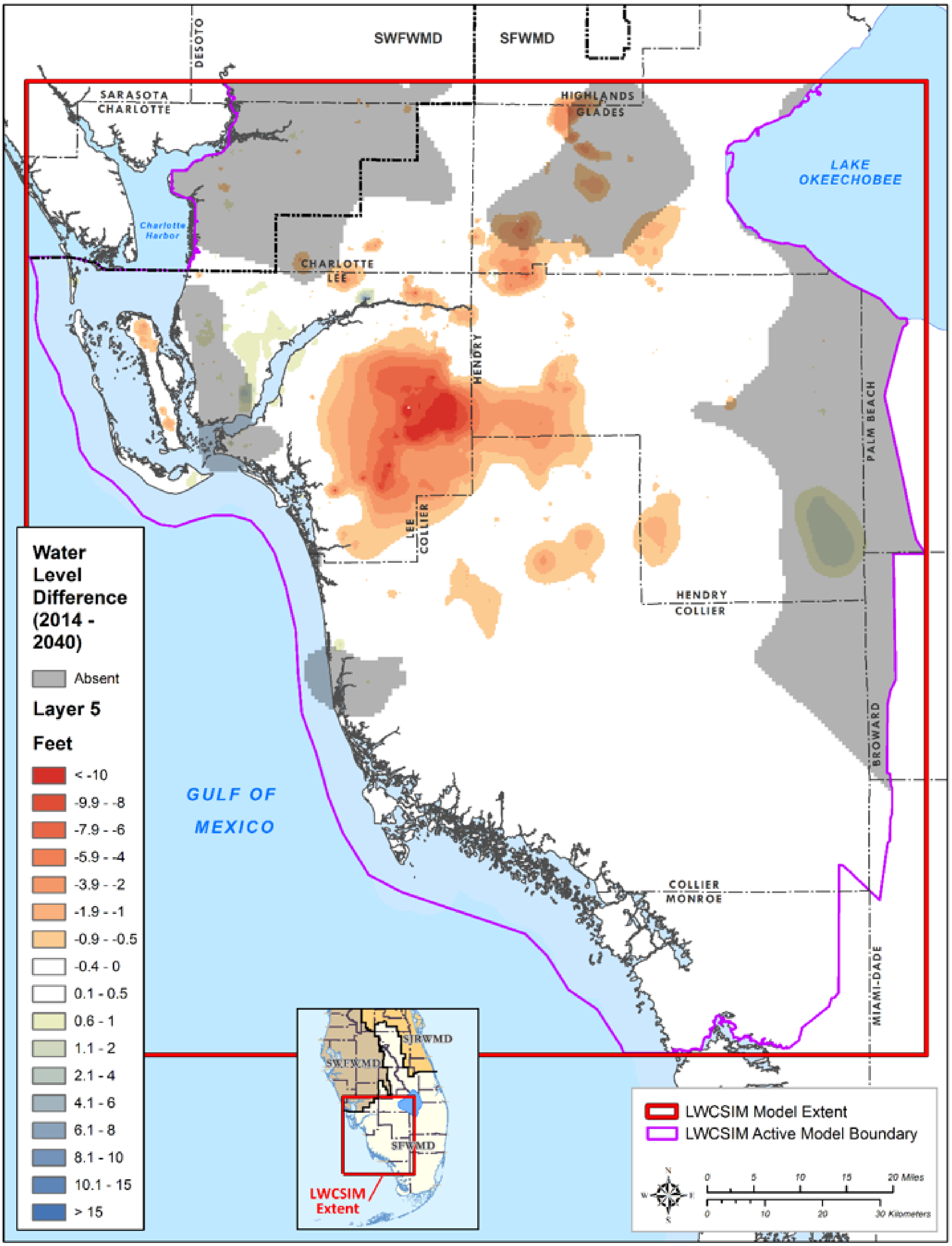


Figure 6-17. 2014 to 2040 water level difference in the Sandstone aquifer (IAS).

Floridan Aquifer System Analysis

The FAS is a productive and important aquifer used primarily by PS utilities as an AWS. As development of the SAS and IAS became maximized without causing harm to the water resources, most utilities have used the FAS to meet a portion of their current demands, and these utilities are anticipating expansion of FAS wellfields to meet future demands (**Chapter 8**). The FAS is brackish in the LWC Planning Area and requires desalination treatment prior to use. FAS wells primarily pump from the brackish UFA. Currently, the Avon Park Permeable Zone (APPZ), and the Lower Floridan aquifer are not used as water sources in the LWC Planning Area.

Water availability from the FAS is affected primarily by water quality degradation, which can be managed through appropriate wellfield design and operating protocols. One of the key objectives is to minimize upconing of saline water from deeper portions of the aquifer. PS utilities can increase well spacing between newly installed wells to minimize interference effects and excessive drawdowns, rotate the operation of individual wells to reduce pumping stress and excessive drawdowns, reduce pumping rates, and plug and abandon wells that have shown an increase in chloride concentrations or that were designed with open intervals intersecting multiple aquifer zones of varying water quality. Most PS utilities are required to monitor water quality at their wellfields as part of their water use permits. Future strategies to address managing withdrawals to minimize water quality degradation are provided in **Chapter 9**.

Groundwater monitoring provides water users with an understanding of the hydrogeologic system through long-term systematic data collection, which is needed to evaluate current and expected future groundwater conditions, detect temporal trends in water levels and water quality, 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 of the FAS (i.e., UFA, APPZ). Data collected from the RFGW program includes lithologic data, groundwater level data, and groundwater quality data, all of which are crucial to evaluating the water supply potential of the FAS.

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. Regional FAS monitor well locations in the LWC Planning Area are shown in **Figure 6-18**. For water supply planning purposes, four FAS monitor wells were chosen as representative of trends in regional water levels. Water level time series plots for these wells are presented in this section.

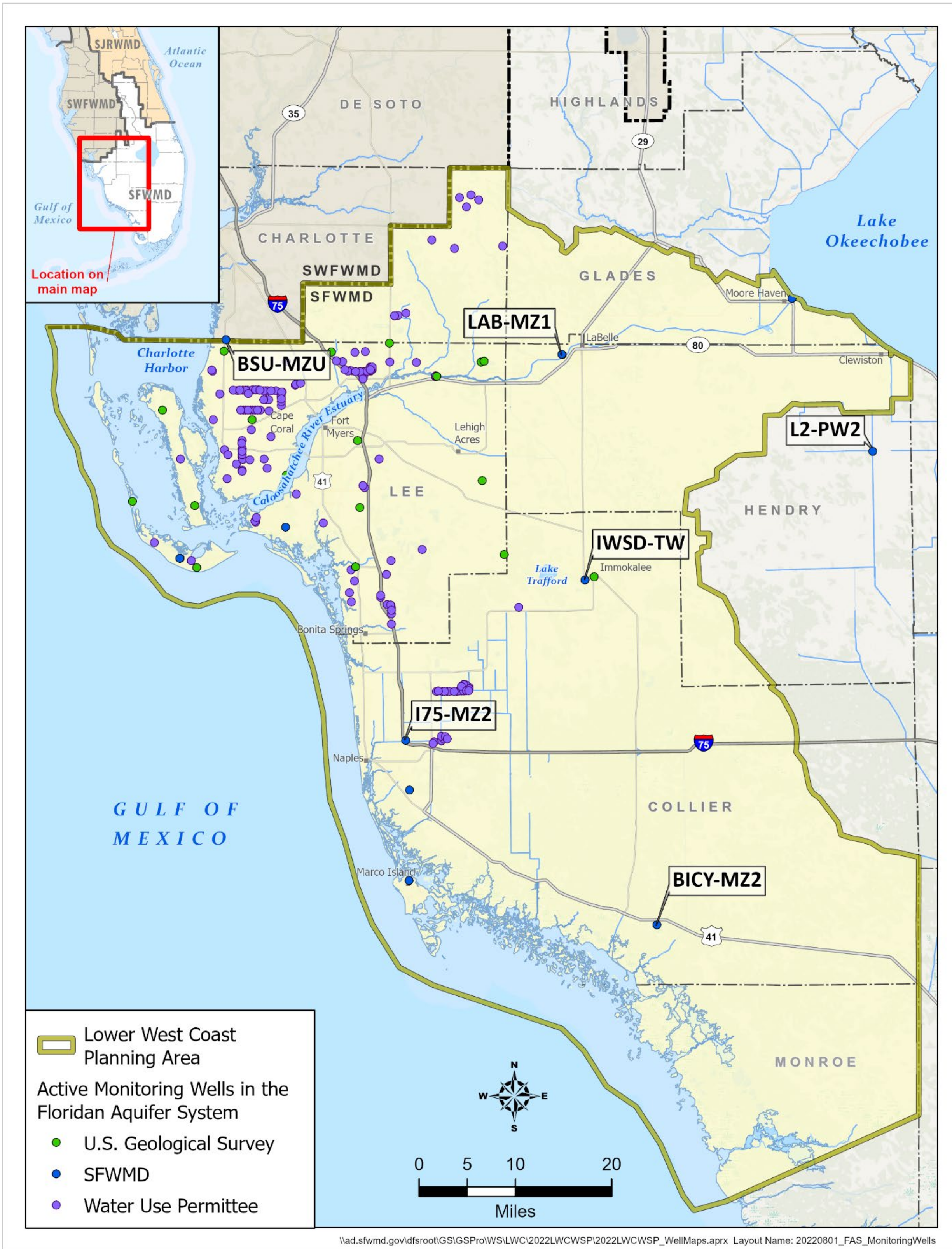


Figure 6-18. Regional Floridan Aquifer Groundwater monitoring wells in the LWC Planning Area.

As shown in **Figure 6-19**, groundwater levels at well BICY-MZ2 (BICY-TW), located in Big Cypress Swamp, show seasonal fluctuations of approximately 1 foot, with variability in the overall water level trend over the entire record. Groundwater elevations reached their highest elevations in 2020.

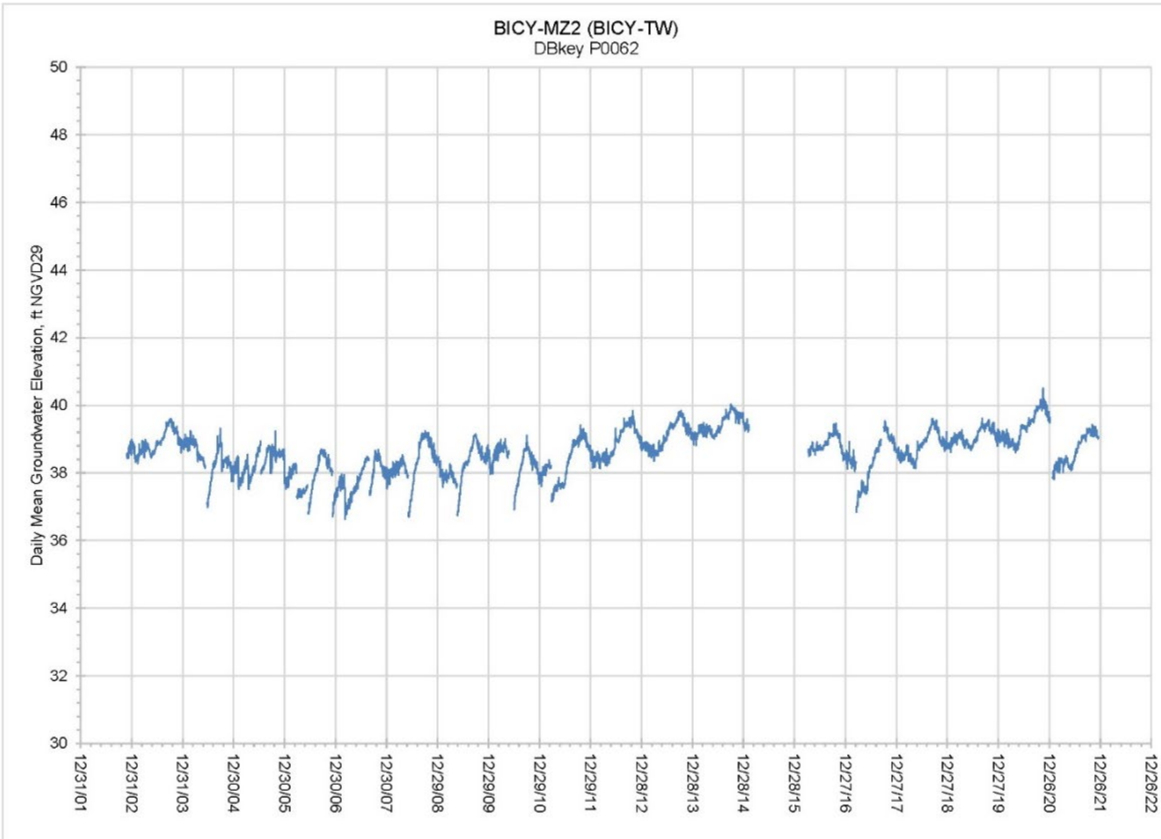


Figure 6-19. Water levels in Floridan aquifer system monitor well BICY-MZ2 (BICY-TW), Big Cypress Swamp, Collier County.

As shown in **Figure 6-20**, water levels at well I75-MZ2 (I75-TW), located near Naples, seasonally fluctuate between 2 to 3 feet. Longer-term trends also can be seen. For example, from a high in 2003 of 36.32 feet NGVD29, a downward trend continued through 2007, when the record low of 30.88 feet NGVD29 was recorded. During the subsequent 10 years, there was a gradual recovery in groundwater elevations throughout each wet-dry season cycle, with a high of +35.75 feet NGVD29 following the 2016 wet season. Since 2016, the water levels appear to be fairly stable.

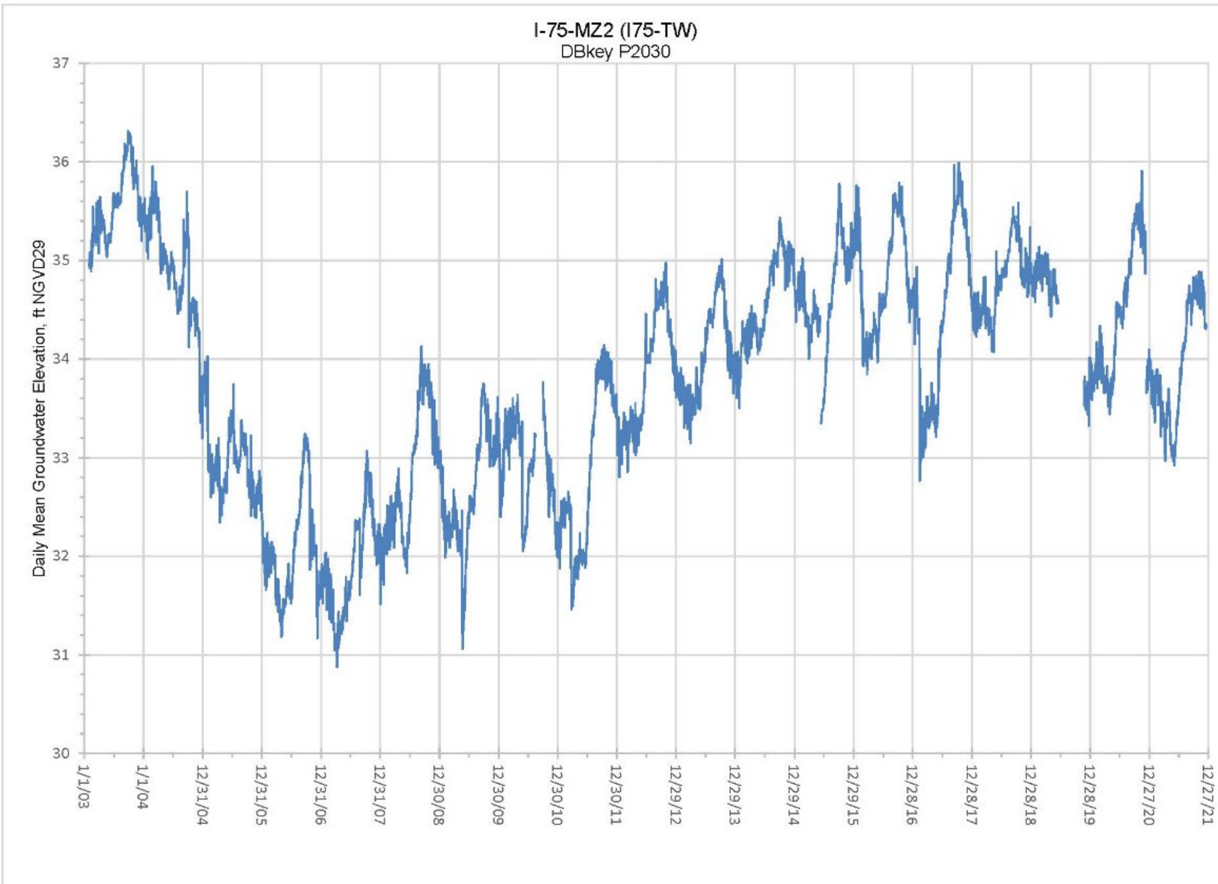


Figure 6-20. Water levels in Floridan aquifer system monitor well I75-MZ2 (I75-TW), Collier County.

As shown in **Figure 6-21**, water levels at well LAB-MZ1 (LAB-PW2), located in LaBelle, seasonally fluctuate approximately 2 to 3 feet. The overall long-term water level trend is stable.

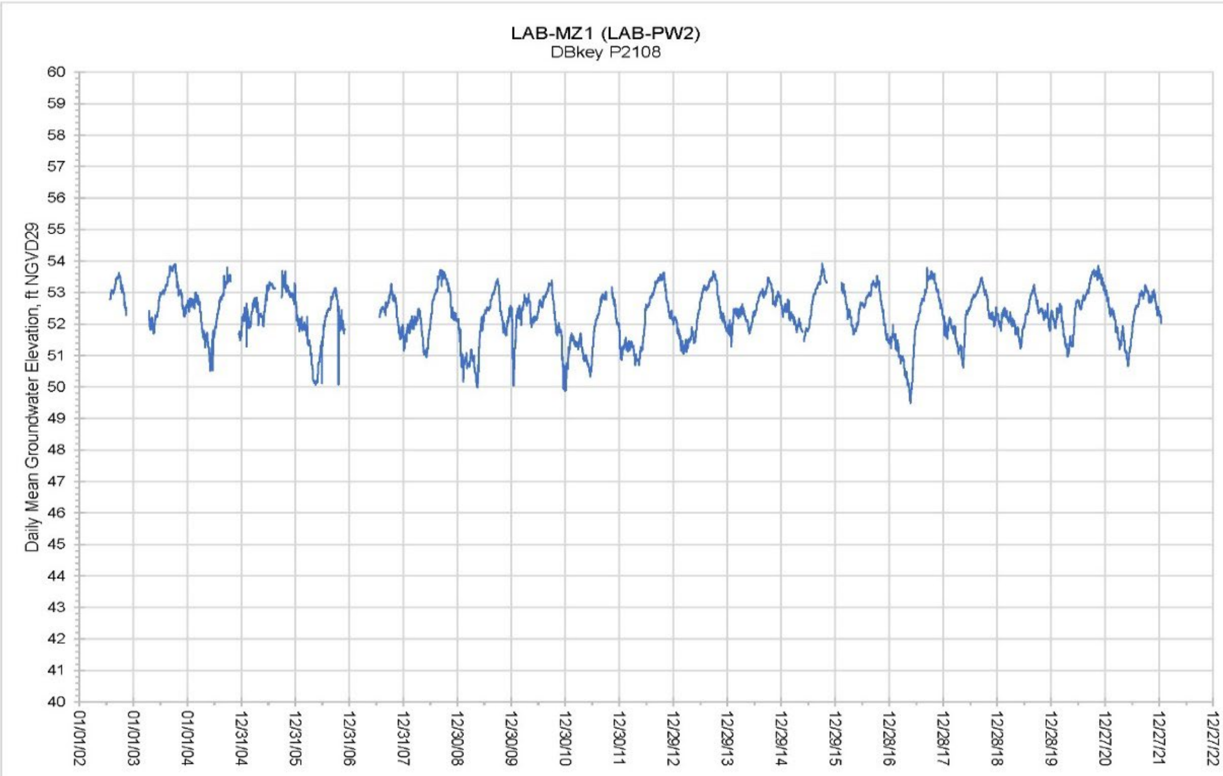


Figure 6-21. Water levels in Upper Floridan aquifer monitor well LAB-MZ1 (LAB-PW2), Glades County.

As shown in **Figure 6-22**, groundwater elevations in well L2-PW2, located in western Hendry County, seasonally fluctuate up to approximately 2 feet. The overall long-term water level trend is stable.

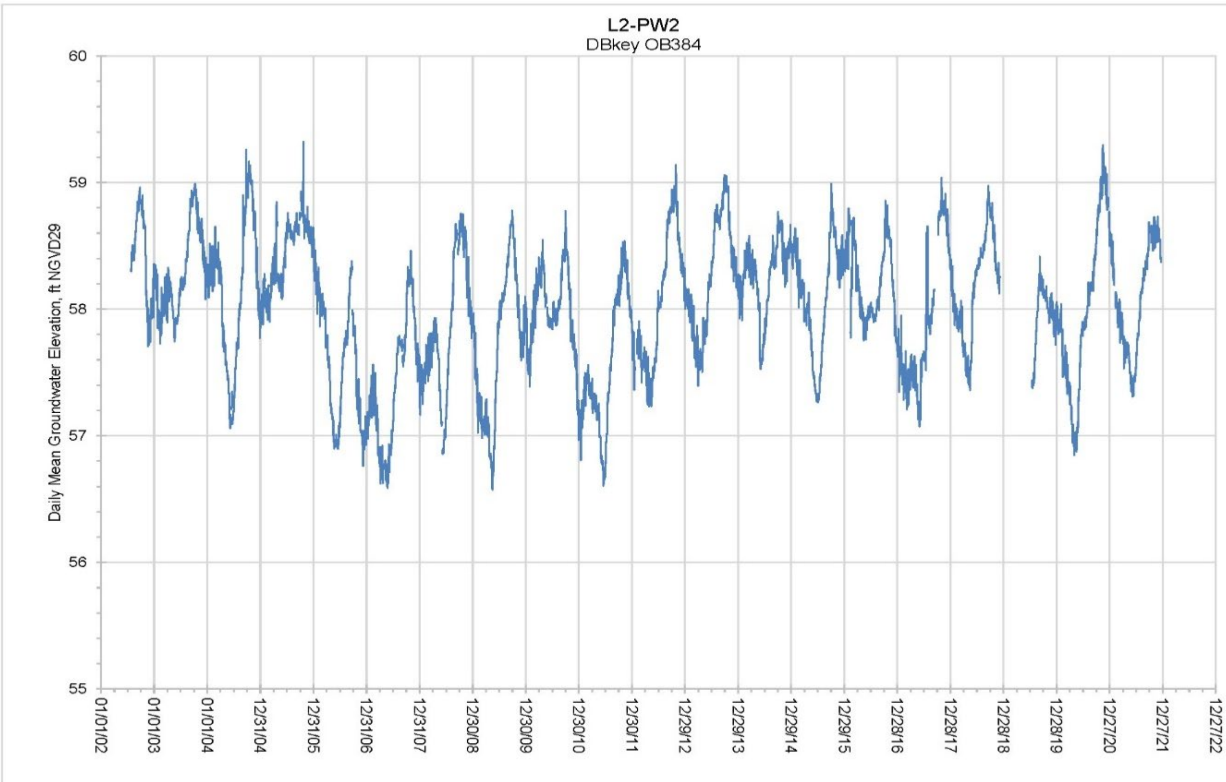


Figure 6-22. Water levels in Upper Floridan aquifer monitor well L2-PW2 in western Hendry County.

In summary, data from these monitoring wells indicate that regional UFA groundwater levels are stable, with expected seasonal fluctuations. While the magnitude of these fluctuations may vary from year to year, no UFA monitor wells show declining trends.

Upper Floridan Aquifer Water Quality

This section discusses chloride concentrations in the UFA at six monitor wells shown in **Figure 6-18**. The chloride concentration results are varied, with maximum historical concentrations ranging from 851 mg/L at L2-PW2 to 4,300 mg/L at I75-MZ2.

As shown in **Figure 6-23**, groundwater samples from well BSU-MZU (BSU-MW), have chloride concentrations that fluctuate by approximately 250 mg/L over the period of record. The minimum chloride concentration (650 mg/L) was in December 2006, and the maximum chloride concentration (900 mg/L) was in October 2020. Since 2008, the sampling frequency has decreased, but the chloride concentrations have increased from 772 mg/L in May 2009 to 807 mg/L in February 2016 and, finally, to the maximum recorded concentration of 900 mg/L in October 2020.

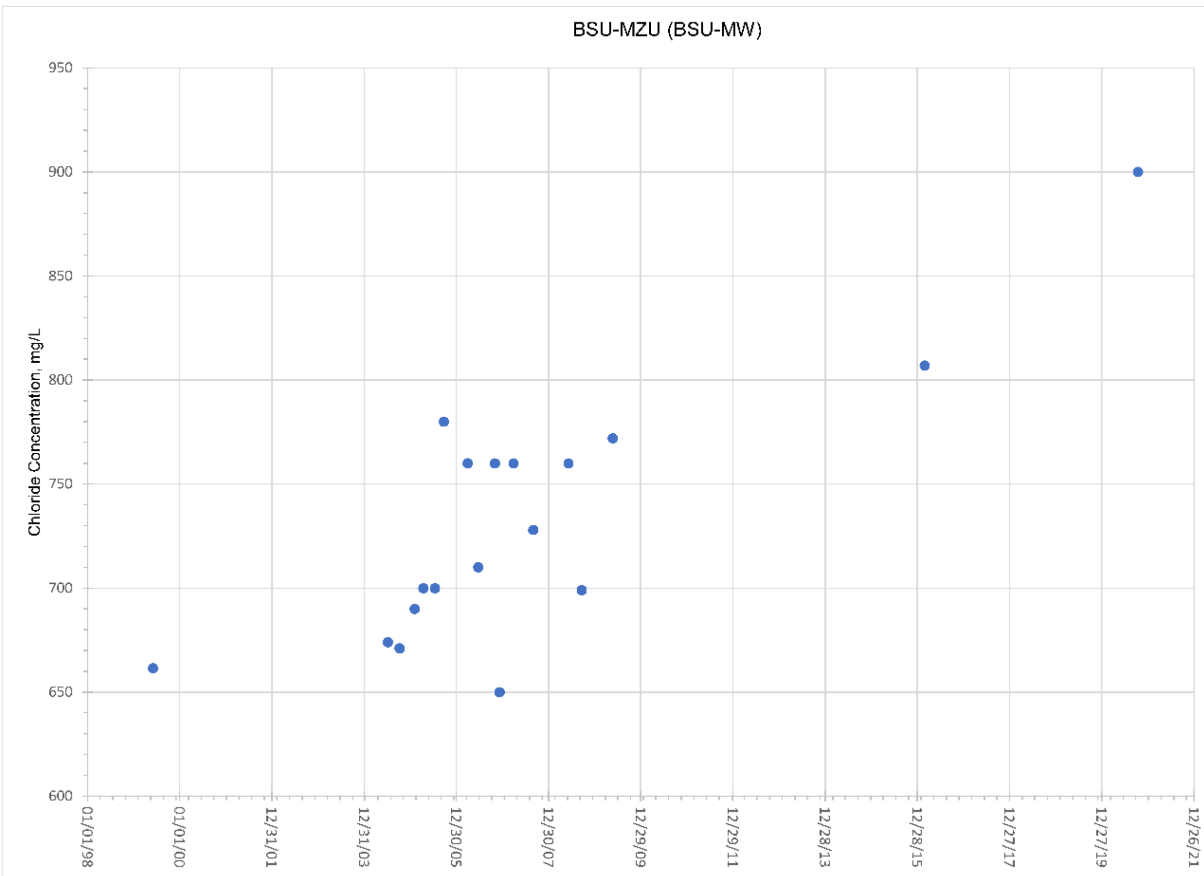


Figure 6-23. Chloride concentrations in Upper Floridan aquifer monitor well BSU-MZU (BSU-MW), southwestern Charlotte County.

As shown in **Figure 6-24**, well BICY-MZ2 (BICY-TW), located in Big Cypress Swamp, has chloride concentrations that generally fluctuate by 500 mg/L over the period of record, except for the approximately 1,300 mg/L variation observed in 2006 and 2008. Overall, and since 2008, chloride concentrations have been consistent and predominantly fall around the average for the period of record (2,628 mg/L). The two most recent samples showed similar chloride concentrations close to 2,750 mg/L.

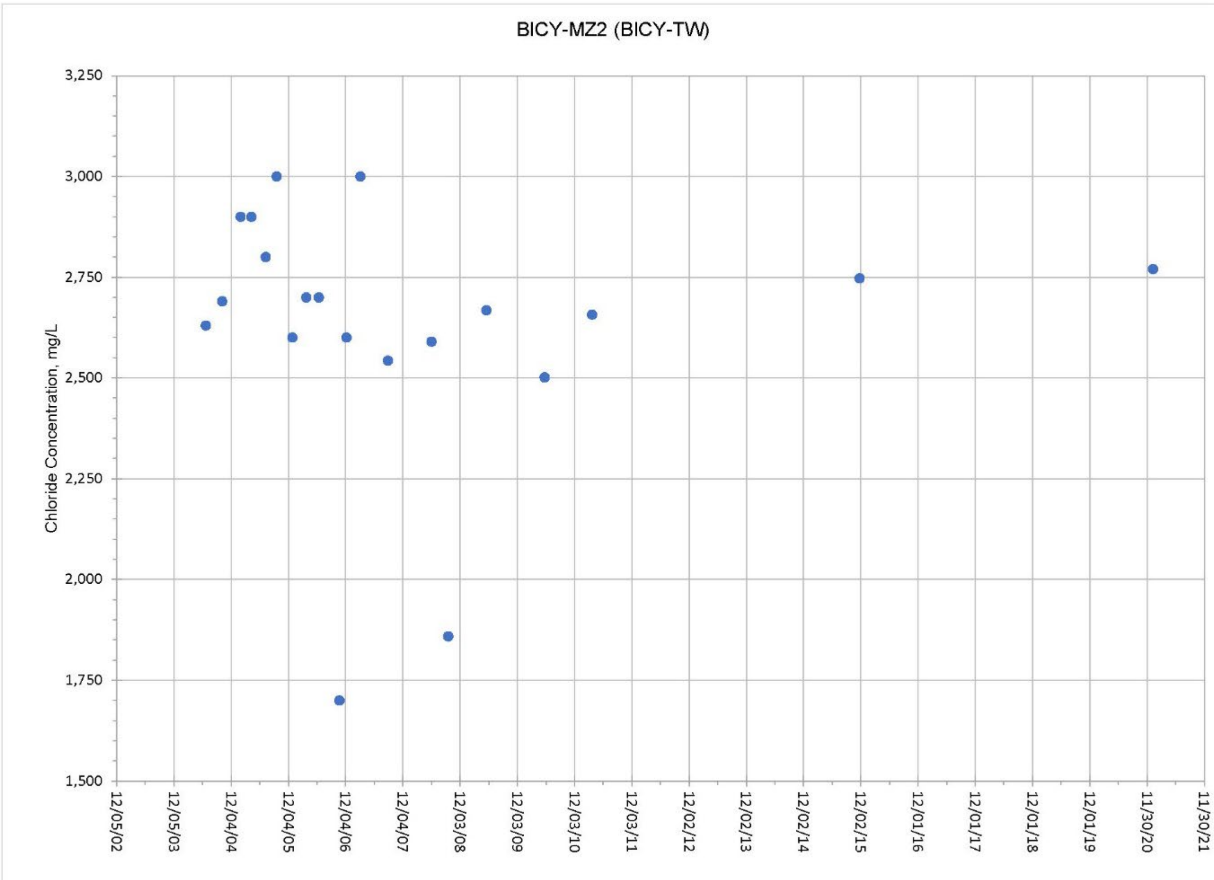


Figure 6-24. Chloride concentrations in Upper Floridan aquifer monitor well BICY-MZ2 (BICY-TW), Big Cypress Swamp.

As shown in **Figure 6-25**, well I75-MZ2 (I75-TW), located near Naples, has chloride concentrations fluctuating approximately 1,300 mg/L over the period of record, with the most recent sample (December 2020) having a chloride concentration of 3,659 mg/L, close to the long-term average chloride concentration of 3,753 mg/L for this well, but 357 mg/L higher than the last sample collected on February 23, 2016.

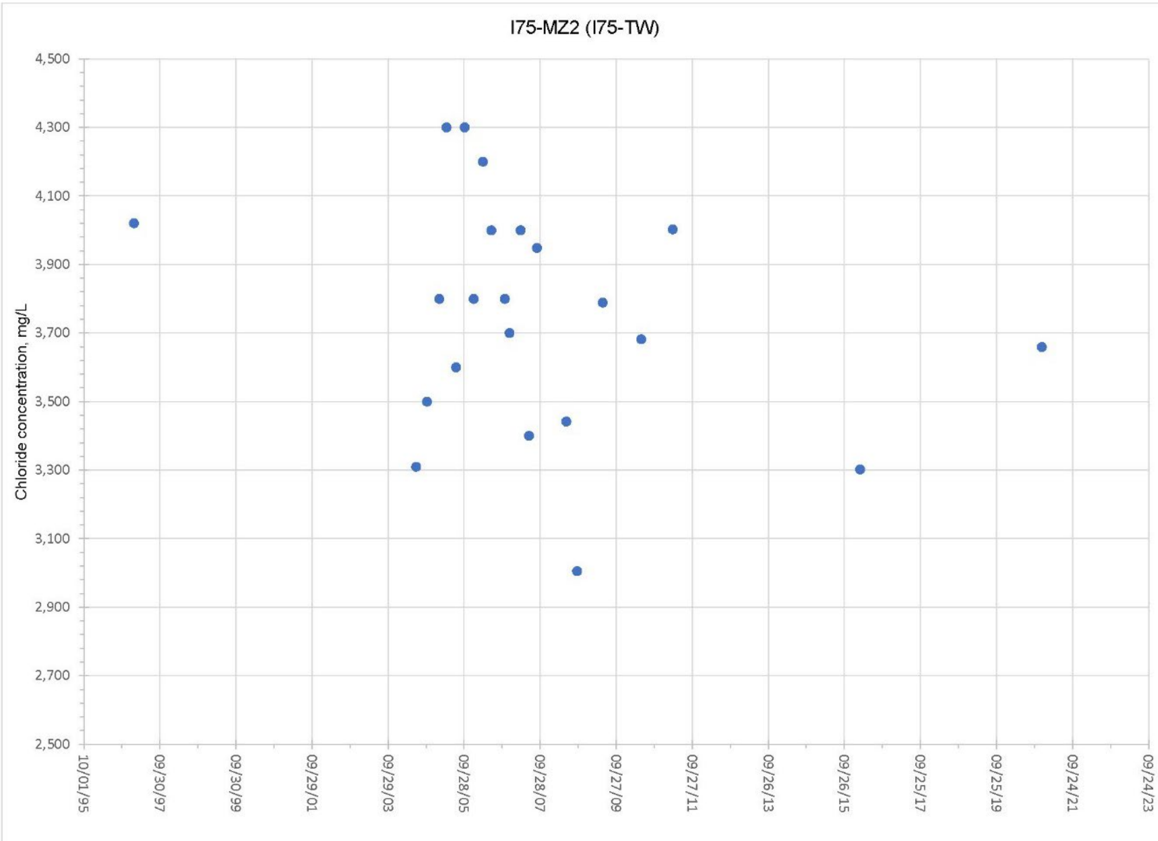


Figure 6-25. Chloride concentrations in Upper Floridan aquifer monitor well I75-MZ2 (I75-TW), Naples.

As shown in **Figure 6-26**, UFA well ISWD-TW (IWSD-MZ2), located in Immokalee, has chloride concentrations that generally fluctuate by approximately 200 mg/L over the period of record. Both the minimum and maximum chloride concentrations occurred in 2005 (September and February, respectively). The two most recent samples (January 2016 and October 2020) had chloride concentrations close to the average value for the entire period of record. Chloride concentrations appear to be stable at this well although gaps of 4 to 6 years exist between the last three samples.

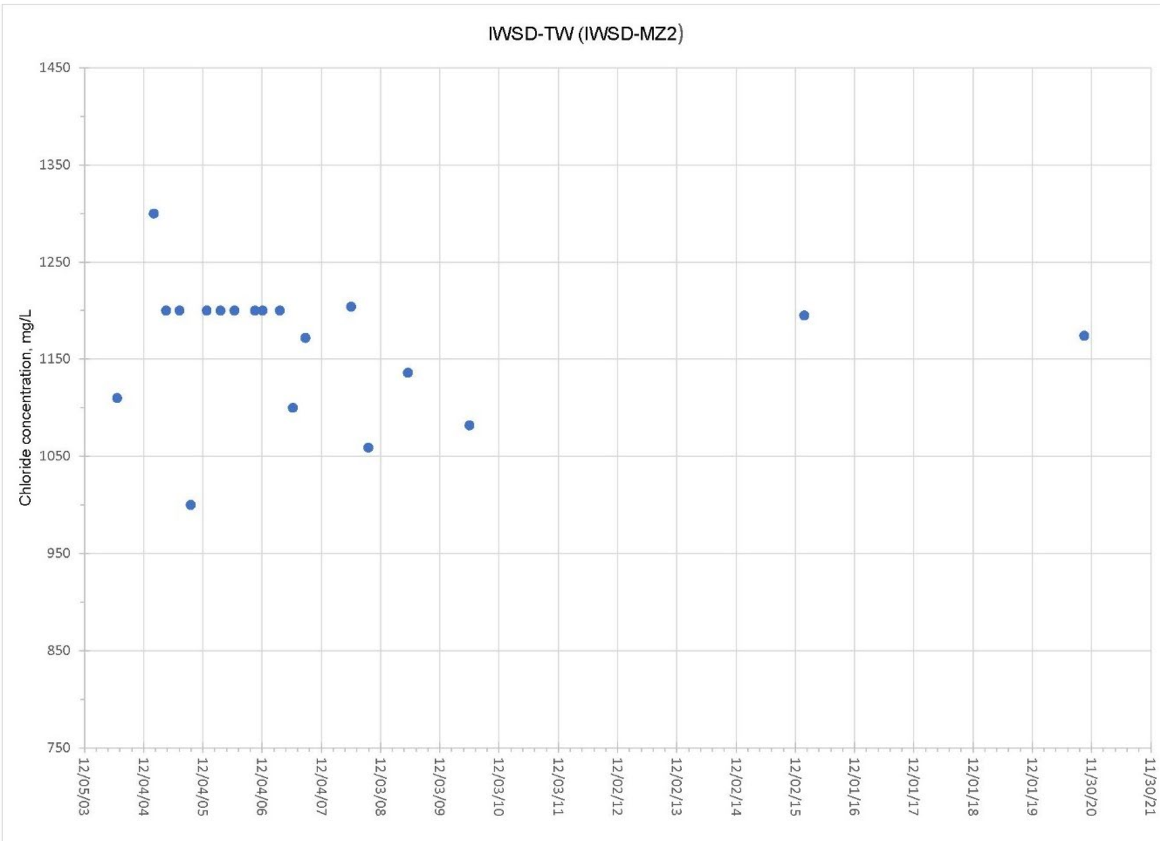


Figure 6-26. Chloride concentrations in Upper Floridan aquifer monitor well IWSD-TW (IWSD-MZ2), Immokalee.

As shown in **Figure 6-27,** well LAB-MZ1 (LAB-PW2), located in LaBelle, has chloride concentrations fluctuating approximately 350 mg/L over the period of record. The maximum chloride concentration (1,000 mg/L) was reported in January 2007. Recent chloride concentrations are more in line with the long-term average at this well. The two most recent samples show a decline in chloride concentrations from 708 mg/L in January 2016 to 673 mg/L in February 2021.

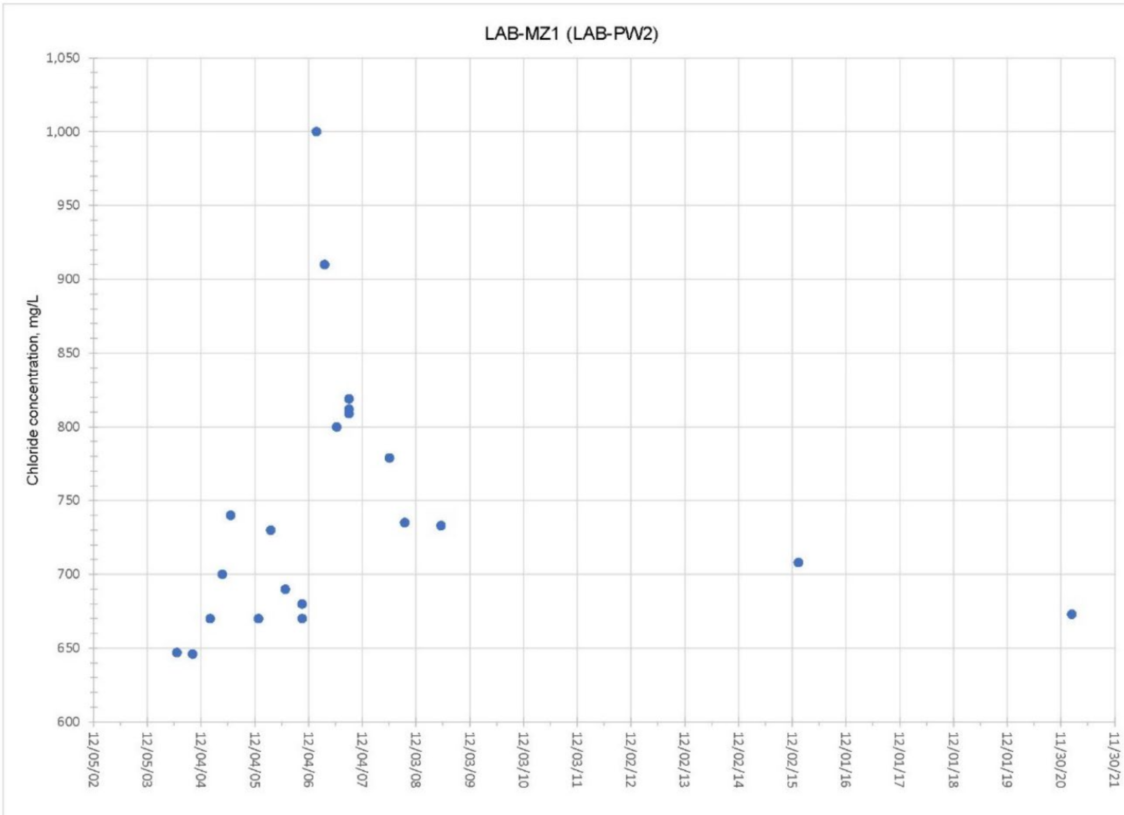


Figure 6-27. Chloride concentrations in Upper Floridan aquifer monitor well LAB-MZ1 (LAB-PW2), LaBelle.

As shown in **Figure 6-28**, well L2-PW2, located in western Hendry County, has chloride concentrations fluctuating approximately 290 mg/L over the period of record. The maximum chloride concentration (851 mg/L) was reported for the most recent sample collected on March 16, 2021, an increase of 200 mg/L over the second most recent sample collected on February 9, 2016. There appears to be an increasing chloride concentration trend since 2010; however, only three samples have been collected and analyzed.

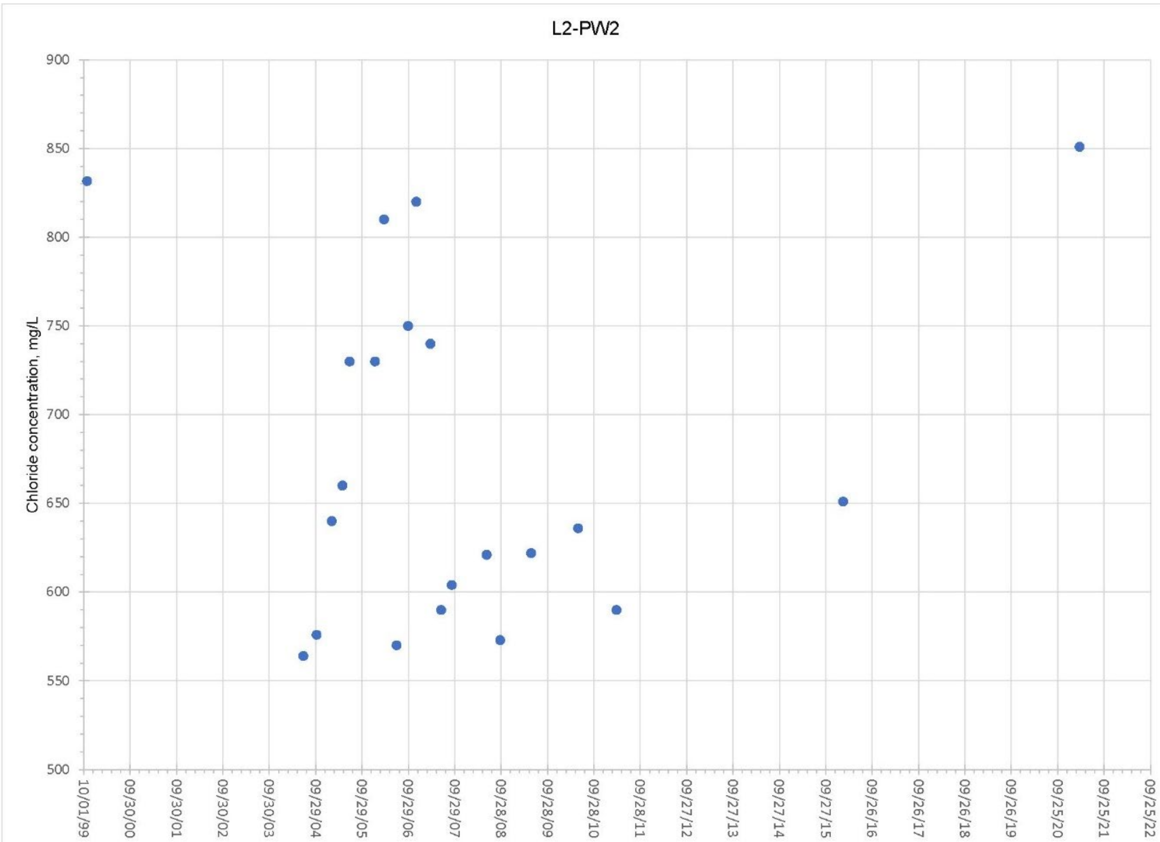


Figure 6-28. Chloride concentrations in Upper Floridan aquifer monitor well L2-PW2, western Hendry County.

FAS Chloride Data from a Recent SFWMD Sampling Event

On a biannual basis, the SFWMD conducts water quality sampling of FAS monitoring wells within the LWC Planning Area. Maps are prepared that are color-coded to indicate the regional range of ambient chloride concentrations within the UFA. **Figure 6-29** presents the concentration of chlorides within the UFA from monitoring wells during the 2020-2021 sampling event.

Figure 6-29. Upper Floridan aquifer chloride concentrations during the 2020-2021 sampling event.

Public Water Supply Utilities Using the Upper Floridan Aquifer

In the LWC Planning Area, the UFA is brackish and requires desalination via reverse osmosis (RO) treatment prior to potable use. The UFA supplies water primarily for PS utilities, and some AG users have permits to withdraw from the UFA for freeze protection or backup supply.

Although UFA chloride concentrations are expected to be high (>250 mg/L), it is still important to monitor water quality trends to ensure that 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.

Nearly all PS utilities utilizing the UFA in the LWC Planning Area have had one or more production wells experience a degradation in water quality, causing the utility to discontinue pumping at one or more wells. This section discusses changes in chloride concentrations over time in six LWC PS wellfields (**Table 6-1**).

Table 6-1. Major Public Supply Upper Floridan aquifer wellfields discussed in this section.

Utility	Permit Number	Number of Existing Permitted FAS Wells	Permitted FAS Allocation (mgd)
Clewiston	26-00769-W	4	2.58
Collier County Utilities (North)	11-00249-W	29	Combined 55.53 mgd
Collier County Utilities (South)	11-00249-W	44	
LaBelle	26-00105-W	2	0.92
Fort Myers	36-00035-W	19	15.25
Lee County Utilities (North)	36-00152-W	18	16.68
Cape Coral (South)	36-00046-W	22	Combined 39.25 mgd
Cape Coral (North)	36-00046-W	34	

mgd = million gallons per day.

Fort Myers Wellfield

The Fort Myers RO treatment plant began operation in 2002, with an initial capacity of 6 million gallons per day (mgd) of net (finished) water using seven UFA production wells. By 2007, the system had been expanded to 13 mgd using 16 production wells. Plans are in place to build out the current RO plant with a capacity of 20 mgd of net (finished) water using a total of 41 UFA production wells. **Figure 6-30** shows chloride concentrations over time for 16 UFA production wells in the Fort Myers RO wellfield. Several wells have chloride concentrations around 1,000 to 1,500 mg/L. However, many wells show notable increases in chloride concentrations 4 to 5 years after installation. These wells generally started with a chloride concentration below 1,500 mg/L but exhibited two-to three-fold increases by 2017. One of the wells (P-10) started with a chloride concentration of approximately 1,750 mg/L, but by 2014, the concentration had increased to approximately 9,000 mg/L.

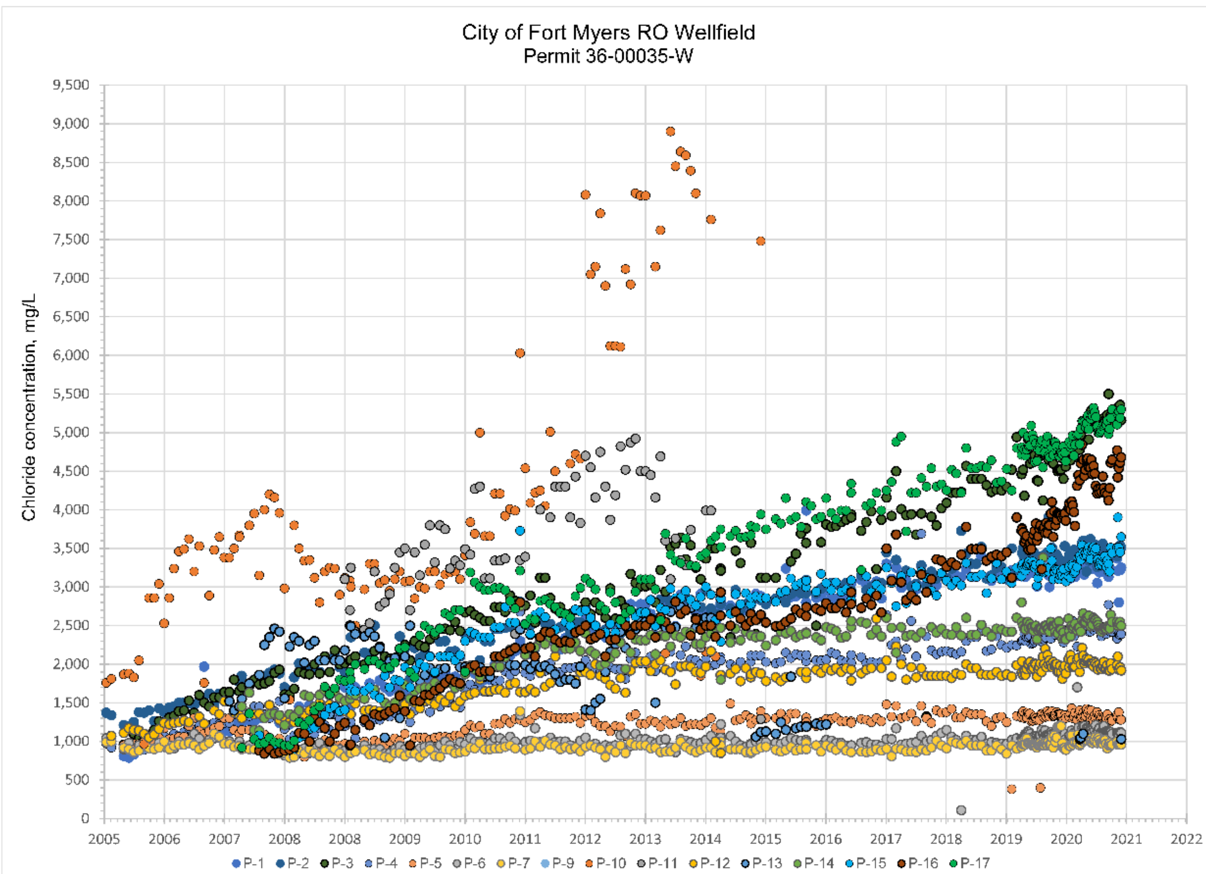


Figure 6-30. Chloride concentration trends at production wells in the Fort Myers wellfield.

Lee County Utilities North Wellfield

Chloride data have been collected at this wellfield since 1985. **Figure 6-31** presents the change in chloride concentrations since December 2004 for 38 production wells in the Lee County Utilities North wellfield. Most of the wells that are still in operation have chloride concentrations greater than about 600 mg/L and a period of record extending back to 2006. Chloride concentrations at well PW-6 increased to 4,800 mg/L within 1 year, and the well was taken offline. Chloride concentrations at most of the wells that came online in 2010 and 2013 remain under 1,500 mg/L and appear to be stable.

Wells PW-9, PW-13A, and PW-16A have reported the highest concentrations of chloride, generally within the 1,800 to 3,000 mg/L range. Starting in 2009, chloride concentrations at well PW-9 increased and remained in the 2,800 to 3,500 mg/L range, until 2018 when chloride concentrations began to decrease to approximately 2,200 mg/L in 2021. During 2021, chloride concentrations once again have increased at PW-9 to approximately 2,800 mg/L. PW-13 chloride concentrations have been declining over approximately the last 3 years and are now around 2,800 mg/L. Chloride concentrations at PW-16A show a slight increasing trend, with the November 2021 chloride sample having a concentration of 2,090 mg/L.

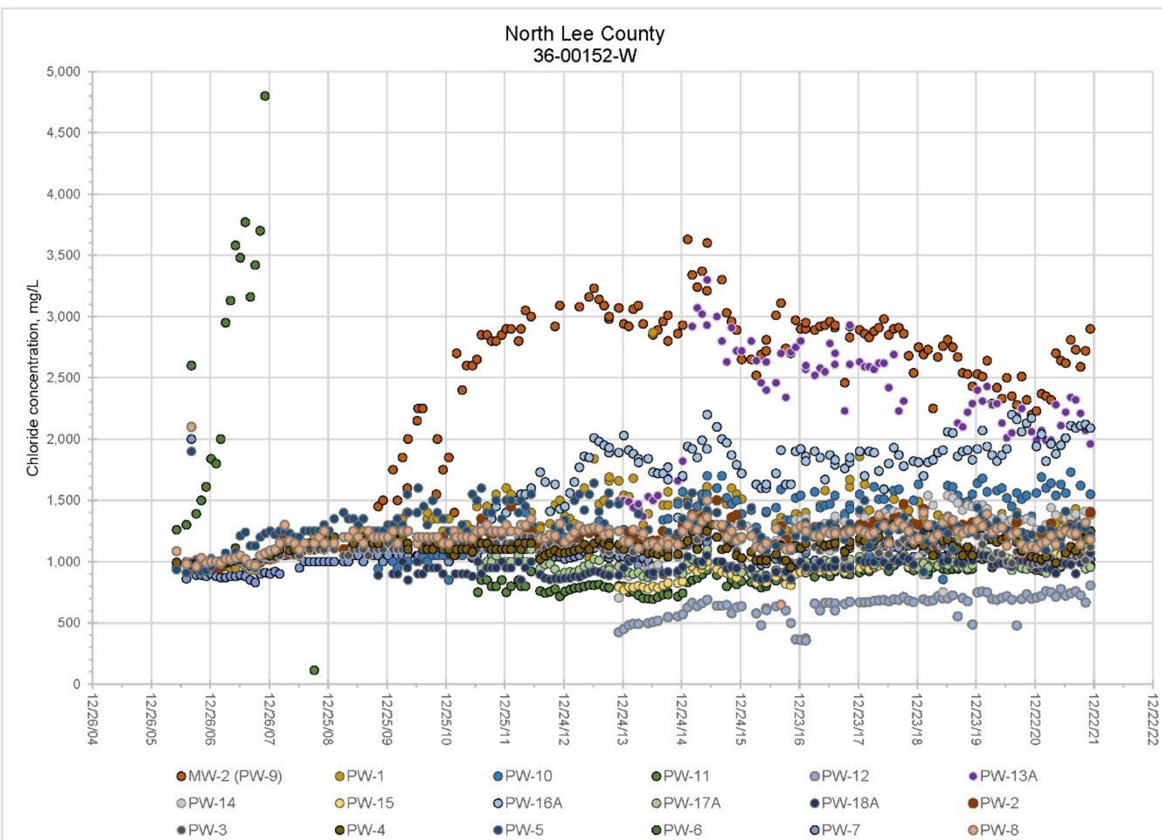


Figure 6-31. Changes in chloride concentrations in operational and nonoperational wells in the Lee County Utilities North wellfield.

Collier County Utilities North Wellfield

All 69 operational and nonoperational UFA production wells in the Collier County Utilities North wellfield are shown in **Figure 6-32**. Most of the production wells have stable chloride concentration trends over time. However, the wells that have higher chloride concentrations show slightly more variation in chloride concentrations. Well RO-2N contained elevated chloride concentrations from 2013 to 2016 (approximately 9,000 mg/L) and was apparently shut down after 2016.

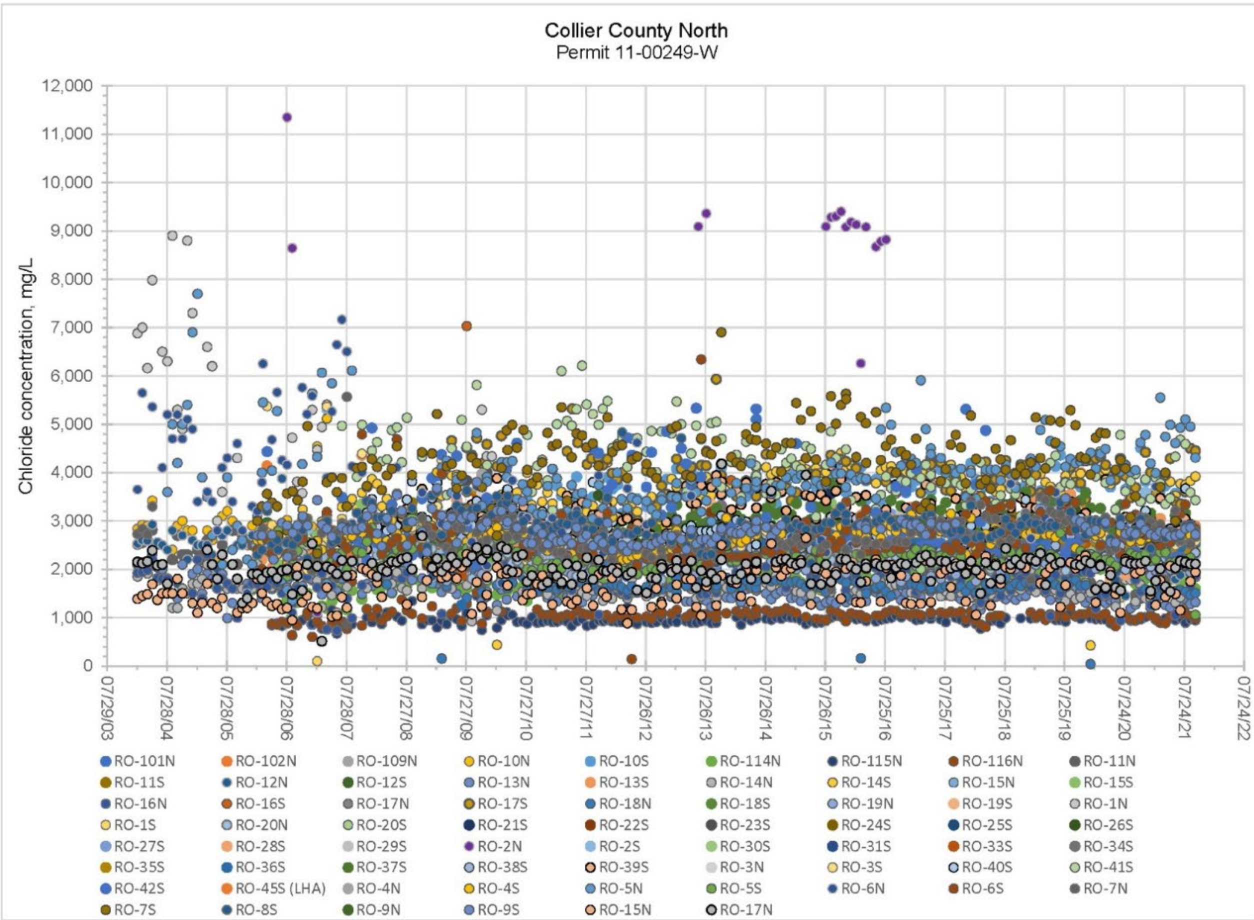


Figure 6-32. Changes in chloride concentrations in production wells at the Collier County Utilities North wellfield.

Cape Coral South Wellfield

Cape Coral was one of the first PS utilities in the LWC to convert to RO treatment for potable water supply and has two UFA wellfields (named Cape Coral North and Cape Coral South). As shown in **Figure 6-33**, most Cape Coral South UFA production wells had initial chloride concentrations between 250 and 1,000 mg/L. All the production wells show increasing chloride concentrations over time. Well RO-14 had an initial chloride concentration of 720 mg/L in July 1985, but the chloride concentrations increased over time to a maximum of 5,280 mg/L in April 2014. The chloride concentrations at RO-14 dropped to about 1,500 mg/L in 2015 but have increased to 2,480 mg/L during the last three sampling events in June, July, and August of 2021. In general, most of the wells with chloride concentrations greater than about 1,000 mg/L have shown steeper increasing chloride concentration trends over time than wells with concentrations less than 1,000 mg/L.

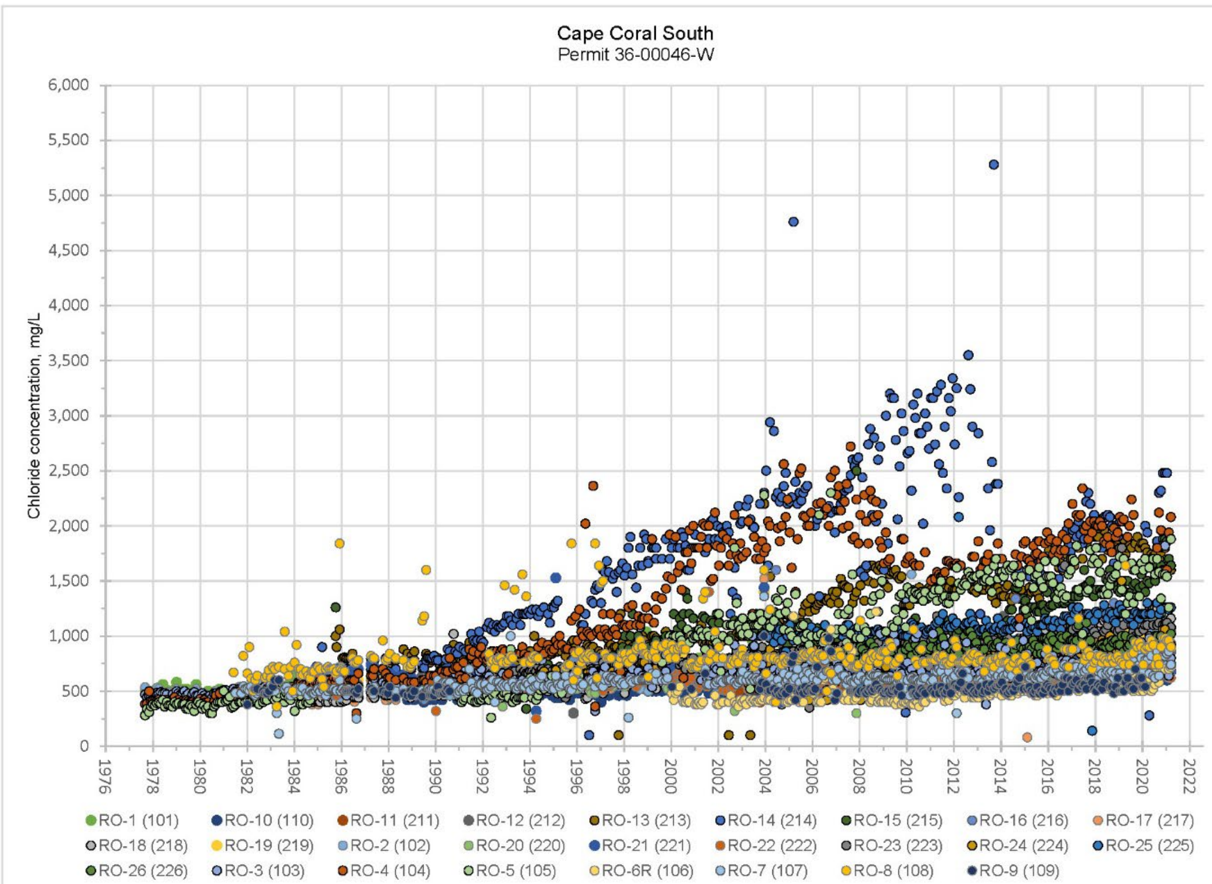


Figure 6-33. Changes in chloride concentrations in production wells at the Cape Coral South wellfield.

Cape Coral North Wellfield

The production wells in the Cape Coral North UFA wellfield are orientated along an east-west transect in northwestern Cape Coral. Although there is a general upward trend in most of the chloride concentrations, most wells remain in the 500 to 1,800 mg/L range (**Figure 6-34**). Three production wells (18N, 17N, and 7N) have shown elevated chloride concentrations and steeply increasing concentration trends compared to most of the wells at this wellfield. Well 18N has reported the highest chloride concentrations of any of the wells with a maximum of 7,640 mg/L but has shown a marked decline in chloride concentrations since February 2020, with the three most recent concentrations in this well reported to be 1,520 mg/L. Concentrations in well 7N have continued to increase, and the October 2021 sample contained 4,000 mg/L chloride. Similarly, well 17N has continued to show increasing concentrations, with the most recent sample in October 2021 having a chloride concentration of 3,621 mg/L.

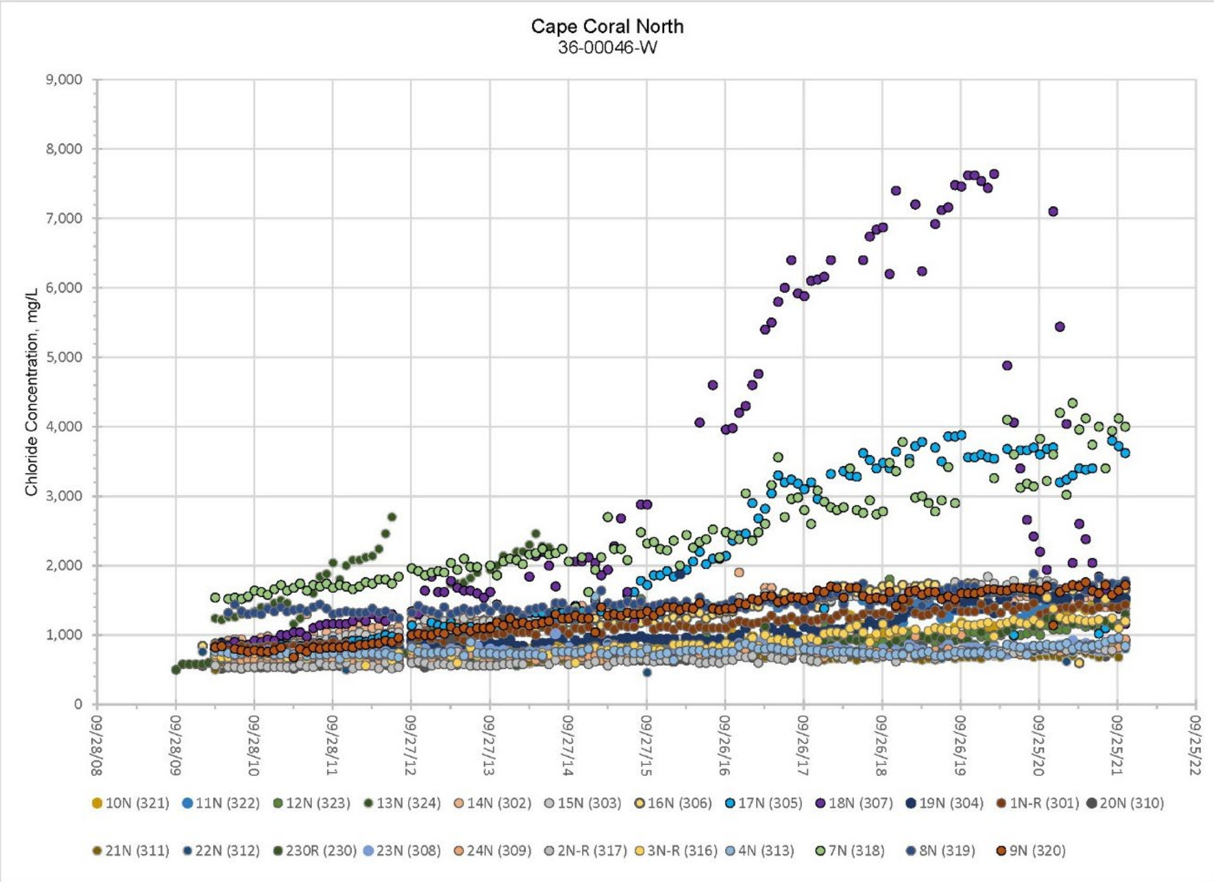


Figure 6-34. Changes in chloride concentrations in production wells in the Cape Coral North wellfield.

Clewiston Wellfield

Chloride concentration trends for all four UFA production wells in the Clewiston UFA wellfield are shown in **Figure 6-35**. Most of the UFA production wells appear to have stable chloride concentration trends except for Well 4, where chloride concentrations increased slightly starting in 2016 but appear to have remained stable since January 2020.

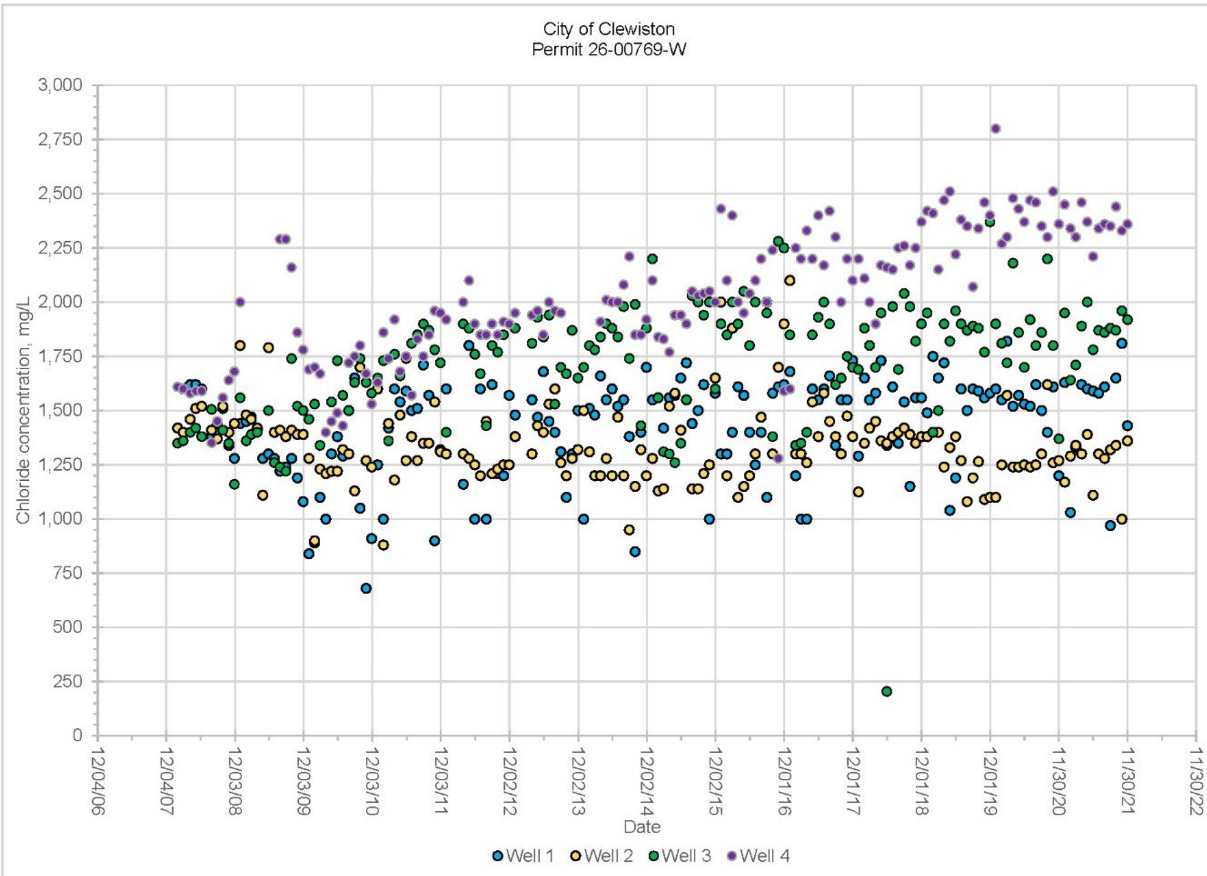
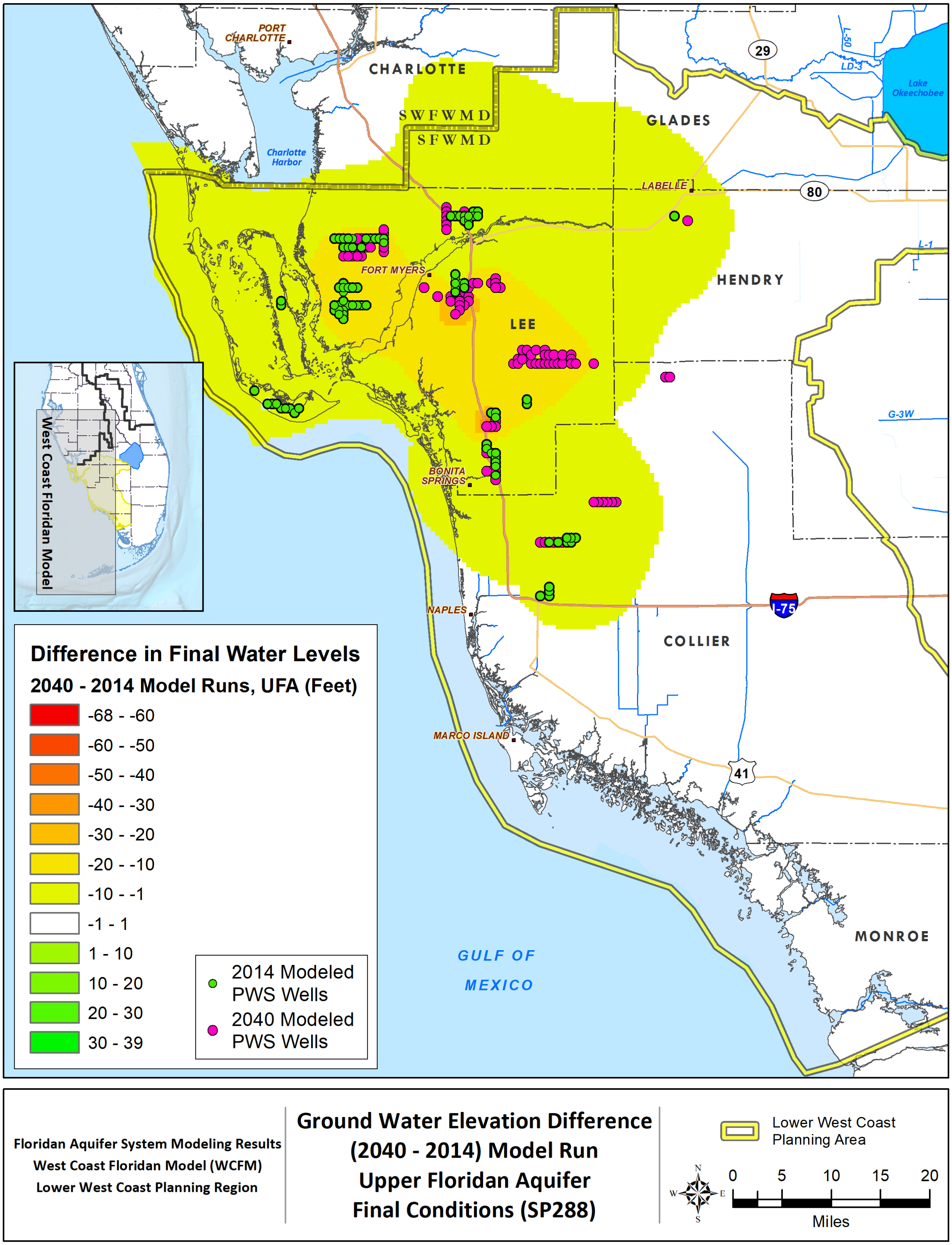


Figure 6-35. Changes in chloride concentrations in production wells in the Clewiston wellfield.

Floridan Aquifer System Groundwater Modeling

The SFWMD's West Coast Floridan Model (WCFM) was used to evaluate potential changes within the FAS as a result of projected groundwater withdrawals in the LWC Planning Area. The WCFM is a three-dimensional groundwater flow and transport model used to simulate water levels and total dissolved solids concentrations within the FAS for the southwestern coast of Florida. The model was developed using the USGS SEAWAT model code. The WCFM simulates the three primary zones in the FAS: the UFA, the APPZ, and the first permeable zone of the Lower Floridan aquifer. In the LWC Planning Area, the APPZ and the first permeable zone of the Lower Floridan aquifer contain groundwater with undesirably high salinity and in Collier County, the APPZ is not productive enough for water supply. There currently are no users withdrawing water from these aquifers within the planning area.

The WCFM results were analyzed for water level and water quality (total dissolved solids) changes by comparing the 2014 withdrawal quantities to the projected 2040 withdrawal quantities. Although there are some localized areas around wellfields with noticeable drawdowns and water quality degradation, the 2040 model results indicate no significant adverse impact to groundwater levels or water quality. **Figure 6-36** presents the difference in water levels within the UFA between 2020 and 2040 as predicted by the model. Overall, the model results conclude use of the FAS is sustainable through 2040. Additional graphics and a concise discussion of the WCFM results, conclusions, and recommendations are provided in **Appendix D.** The complete model design, calibration, and simulation results are contained within Billah et al. (2021).



User Name: ahoffart Map Produced on Date: 7/29/2020 10:56:47 PM \\ad.sfwmd.gov\dfsroot\GS\GSBiz\WS\WCFM\ModelApp2020\mxd\WLdiff_20402014_UFA_Wells.mxd

Figure 6-36. Upper Floridan aquifer water level differences between 2014 and 2040.

Floridan Aquifer System Conclusions

Although this 2022 LWC Plan Update has demands projected to 2045, the previous 2017 LWC Plan Update demand quantities for 2040 are about 4% greater. Therefore, the modeled results are considered to be representative of the future demands. Recent data and modeling results indicate the FAS can meet current and projected demands through 2045 with proper wellfield management. FAS water levels appear stable at current withdrawal rates. Where possible, more frequent sampling and analysis of FAS monitoring wells would aid in better defining the trends. However, model results indicate local decreases in water levels may occur based on assumed wellfield configurations and 2045 pumping rates. Chloride concentration trends show FAS wellfields have experienced some water quality degradation after several years of operation, which is likely to continue. Water level reductions and 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

As PS utilities expand use of the FAS, implementation of these wellfield management activities is important to minimize the effects of water level reductions and water quality degradation. If interference to existing legal users results from another user's withdrawals, the interference shall be mitigated as described in the *Applicant's Handbook for Water Use Permit Applications within the South Florida Water Management District* (SFWMD 2022).

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 and tribal 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 within the LWC Planning Area is provided in **Appendix D**.

SUMMARY OF WATER RESOURCE ANALYSES

The evaluations and analyses associated with this 2022 LWC Plan Update support the findings and conclusions of the 2017 LWC Plan Update. The following are findings regarding the availability of water resources to meet projected 2045 water demands:

- New or increased allocations of surface water from Lake Okeechobee and LOSA, including the C-43 Canal, are limited in accordance with RAA criteria.
- Surface water will remain the primary source for agricultural irrigation, with fresh groundwater from the SAS and IAS as supplemental sources.
- The SAS and IAS historically have served as the primary sources of fresh water for urban demands. However, expansion of SAS and IAS withdrawals is limited due to low aquifer productivity, rate of recharge, potential impacts to wetlands and the increased potential for saltwater intrusion, and proximity to contamination sources. 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.

- The results of the LWCSIM simulations indicated no widespread water level or water quality impacts are projected to occur in the SAS and IAS. However, localized areas of intensive withdrawals from the Mid-Hawthorn aquifer in Cape Coral and the Sandstone aquifer in Lehigh Acres are depressing groundwater elevations towards established MFLs.
- Monitoring well networks have been established for the SAS, IAS, and FAS and provide valuable data for evaluation of saltwater intrusion, aquifer assessment, and groundwater modeling.
- Most large PS utilities in the LWC 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 WCFM 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 northwestern Lee County.
- Saltwater intrusion monitoring and mapping indicate little movement of the saltwater interface in the SAS and IAS from 2009 to 2019. Local-scale investigation of the interface position could be warranted in some areas.

REFERENCES

Bandara, U.C., R. Earle, D. Butler, Y. Assegid, and D.M. Parrish. 2020. *Model Documentation Report for the Lower West Coast Surficial and Intermediate Aquifer Systems Model (LWCSIM)*. South Florida Water Management District, West Palm Beach, FL.

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

McMillon, C. and S. Anderson. 2015. *Sandstone Aquifer at Lehigh Acres Maximum Developable Limits*. Technical Publication WS-38. South Florida Water Management District. West Palm Beach, FL.

SFWMD. 2022. *Applicant's Handbook for Water Use Permit Applications within the South Florida Water Management District*. South Florida Water Management District, West Palm Beach, FL.

Shaw, J.E. and M. Zamorano. 2020. *Saltwater Interface Monitoring and Mapping Program*. Technical Publication WS-58. South Florida Water Management District, West Palm Beach, FL.

United States Environmental Protection Agency. 2021. *National Primary Drinking Water Regulations*. Available at: https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations.

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 Lower West Coast (LWC) 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 *2021 South Florida Environmental Report – Volume II* (https://www.sfwmd.gov/sfer).

TOPICS

- Regional Groundwater Modeling
- Districtwide Water Resource Development Projects
- Comprehensive Everglades Restoration Plan
- Northern Everglades and Estuaries Protection Program
- Big Cypress Basin Programs

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 follows:

> *…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 designing appropriate facilities, 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 LWC 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 planning; land acquisition; design, including modeling; construction; and long-term operations and maintenance. CERP efforts are described in this chapter and in the annual updates of the *South Florida Environmental Report* (https://www.sfwmd.gov/sfer).

Since 2005, the SFWMD has been working with a coalition of government agencies, nongovernmental 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 and improve water quality entering Lake Okeechobee and the coastal estuaries, with ancillary benefits including increased opportunities for groundwater recharge, hydrological enhancement, and habitat improvement. In some cases, dispersed water management projects with storage features are constructed and operated to offset irrigation demands and other water-related needs of the system. Additional information can be found at https://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 planning areas. The models support development of regional water supply plans, minimum flows and minimum water levels (MFLs), water reservations, restricted allocation areas (RAAs), 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.

West Coast Floridan Model

Groundwater withdrawals, particularly from the Floridan aquifer system (FAS), are anticipated to increase with the growing demand for water and limitations on fresh groundwater and surface water sources throughout South Florida. The West Coast Floridan Model (WCFM) is a density-dependent groundwater flow and transport model of the FAS. The model area covers the entire west coast of the District, extending from the Southwest Florida Water Management District boundary in Charlotte County to the Florida Keys. The model was completed, calibrated, and in 2020, used to evaluate potential changes to regional conditions of the FAS in the LWC Planning Area through 2040. **Appendix D** provides further information about the WCFM update and the simulation results.

Lower West Coast Surficial and Intermediate Aquifer Systems Model

The Lower West Coast Surficial and Intermediate Aquifer Systems Model (LWCSIM) was originally completed in 2006. The District updated this model to incorporate new hydrostratigraphic, water level, water use, and saltwater interface data that cover both the surficial and intermediate aquifer systems (SAS and IAS). A hydrostratigraphic reinterpretation report was completed in 2016, and the calibrated model underwent peer review. In 2020, the model was used to evaluate regional water resources from 2014 to 2040. **Appendix D** provides further information about the LWCSIM construction and simulation results.

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 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 LWC 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 outreach; 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 and replacements 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 (RO) 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* (https://www.sfwmd.gov/sfer). 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	224	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 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

Evaluation of groundwater resources involves the installation of wells for short- and 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 and test wells and has improved the accuracy of the SFWMD's groundwater modeling and decision-making regarding 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 since the 2017 LWC Plan Update, as summarized below:

- **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.
- **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 WCFM and LWCSIM models were recalibrated with additional hydrogeologic and hydrostratigraphic data collected since the previous calibration and updated with 2014 to 2040 demands to provide a planning-level evaluation of regional conditions in the SAS, IAS, and 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 groundwater level monitoring** – In an ongoing effort by the USGS, with funding support from the SFWMD, groundwater level monitoring data are collected 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 level monitoring** – In an ongoing effort by the SFWMD, groundwater levels are monitored throughout the District. As of 2020, Districtwide monitoring includes 443 active SFWMD groundwater stations for the SAS, IAS (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 is conducted at select sites, including data collection, analysis, and validation, to supplement the existing groundwater level network.

COMPREHENSIVE EVERGLADES RESTORATION PLAN

The Comprehensive Everglades Restoration Plan (CERP) provides a framework to restore, protect, and preserve the greater Everglades system. The United States Congress approved the restoration plan in the Water Resources Development Act of 2000. CERP efforts are reported in annual updates of the *South Florida Environmental Report* (https://www.sfwmd.gov/sfer). CERP projects in the LWC Planning Area include, but are not limited to, the following:

- Caloosahatchee River (C-43) West Basin Storage Reservoir
- Picayune Strand Restoration Project
- Southwest Florida Comprehensive Watershed Plan (formerly known as Southwest Florida Feasibility Study)
- Lake Okeechobee Watershed Restoration Project

Caloosahatchee River (C-43) West Basin Storage Reservoir

The Caloosahatchee River (C-43) West Basin Storage Reservoir (C-43 Reservoir) is a critical CERP project that will moderate flows to the Caloosahatchee River Estuary and help achieve a more balanced salinity regime. Early in the 20th century, the Caloosahatchee River was channelized (i.e., deepened and straightened), water control structures (e.g., S-78, S-79) were built, and canals were dug in the river basin to drain agricultural lands and urban areas. As a result of the modifications, during periods of prolonged low rainfall, freshwater flow to the estuary is greatly reduced, increasing salinity above tolerance levels for various ecosystem components. During periods of heavy rainfall, large volumes of nutrient- and sediment-rich fresh water are transported into the estuary, affecting habitat quality for seagrasses, oysters, and other aquatic organisms. The C-43 Reservoir location is shown in **Figure 7-1** and is designed to capture and store up to 170,000 acre-feet of water from the Caloosahatchee River Basin or from Lake Okeechobee when releases are necessary due to high lake levels. During dry periods, the stored water can be released to supplement low river flows and maintain optimal salinity levels in the estuary. The area of ecosystem benefits encompasses almost 80,000 acres of riverine and coastal waters.

Construction of the C-43 Reservoir began in late 2015 and is anticipated to be completed in 2024. In 2017, all existing agricultural facilities on the site were removed and the embankment foundation was completed. The Irrigation Pump Station (S-476) was completed in 2019. This pump station replaces the need for local drainage district pump stations. The Inflow Pump Station (S-470), reservoir embankment, and associated structures are currently under construction. The full project involves construction of two pumping stations and the reservoir, which has two cells (**Figure 7-2**). In addition, the reservoir has a perimeter canal that provides seepage management and ensures water can be provided to adjacent landowners. Plans are in place to increase the capacity of the Townsend Canal to accommodate filling the C-43 Reservoir.

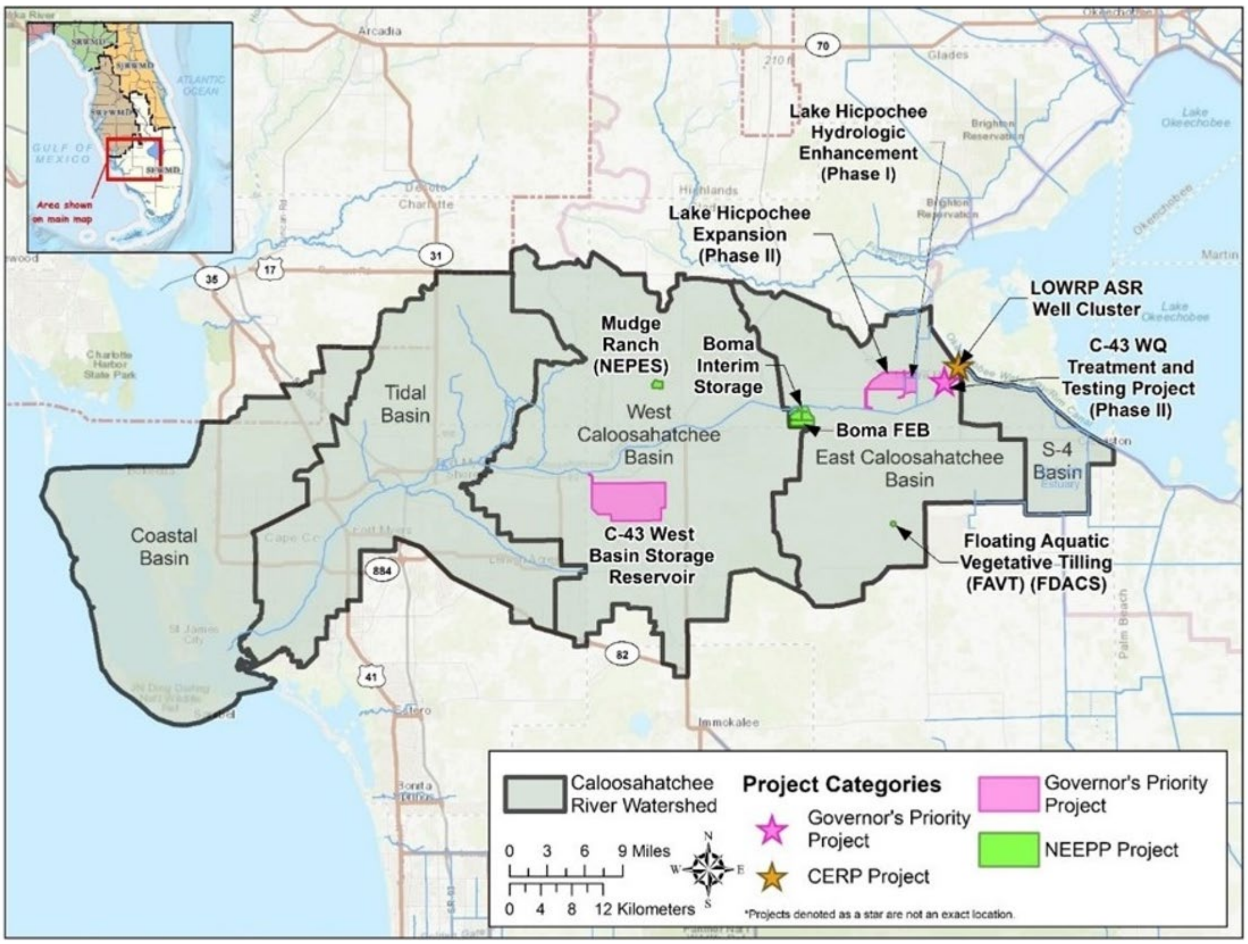


Figure 7-1. Caloosahatchee River Watershed projects.

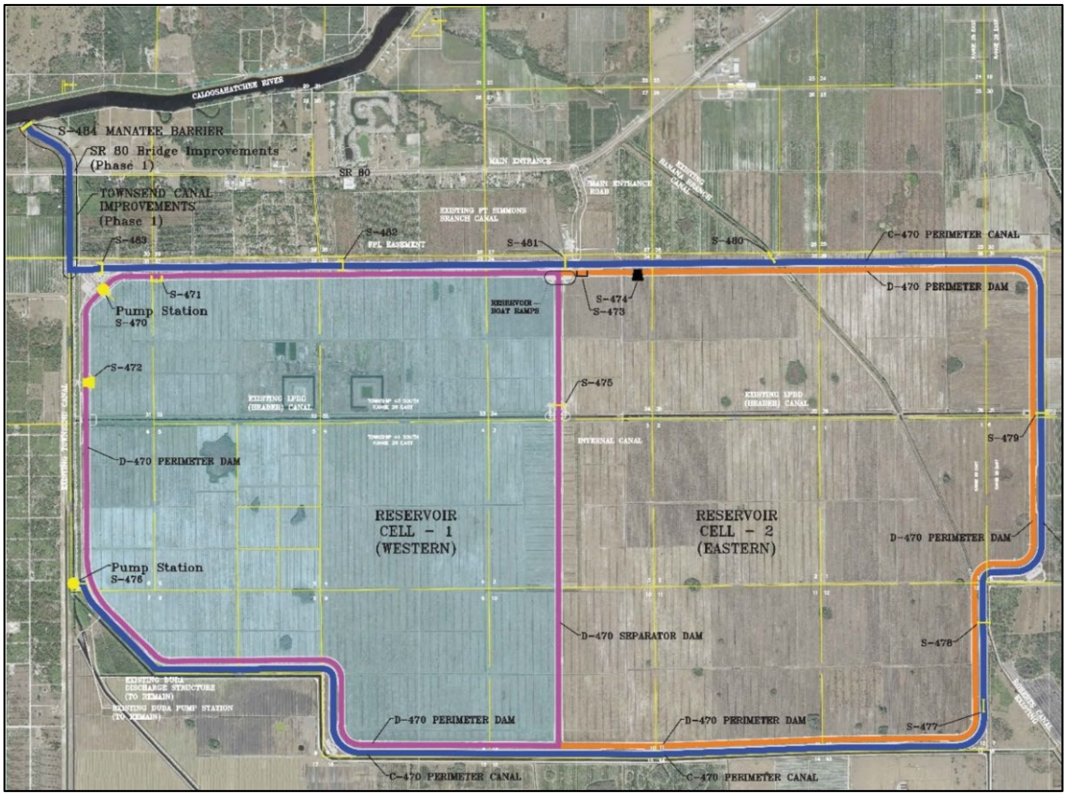


Figure 7-2. The Caloosahatchee River (C-43) West Basin Storage Reservoir site plan.

Picayune Strand Restoration Project

The Picayune Strand Restoration Project is designed to restore more than 55,000 acres of public lands by reducing over-drainage and returning natural and beneficial sheetflow to the project site and adjacent areas, including the Fakahatchee Strand Preserve State Park, Florida Panther National Wildlife Refuge, Ten Thousand Islands National Wildlife Refuge, Collier-Seminole State Park, and related estuaries. Since the filling of the Prairie Canal and removal of the roads east of the Merritt Canal in 2007, three pump stations have been constructed, the Merritt and Miller Canals and the upper 2 miles of the Faka Union Canal. Additionally, the east-west stairstep canals have been plugged. As a result, the Prairie and Merritt canal phases of the project are fully operational, resulting in the hydrologic restoration of about 11,000 acres in the northeastern corner of Picayune Strand and 9,000 acres in the northwestern area of Fakahatchee Strand Preserve State Park. Approximately 75% of roads and 93% of old logging trams have been degraded in the Picayune Strand Restoration Project. The Manatee

Merritt Pump Station

Mitigation Feature, a 2-acre warm water manatee refugium area, was completed in April 2016. Construction on the Southwestern Protection Feature levee began in 2021 and will provide flood protection for existing agricultural and residential properties with an anticipated completion date of 2023. The project cannot be operated for restoration purposes until the Southwest Protection Feature is installed and the Faka Union and Miller canals are plugged, which is anticipated by 2024.

Southwest Florida Comprehensive Watershed Plan

As part of CERP, the United States Congress authorized the Southwest Florida Feasibility Study (now known as the Southwest Florida Comprehensive Watershed Plan) in the Water Resources Development Act of 2000. The purpose of the study was to 1) perform a comprehensive assessment of all watersheds in southwest Florida, and 2) develop a regional restoration plan that addressed all water resource issues within the watersheds. Issues addressed by the study included loss of natural ecosystems, fragmentation of natural areas, degradation of wildlife habitat, alteration of natural freshwater flows to wetlands and estuaries, and water quality degradation in surface waters. The Southwest Florida Comprehensive Watershed Plan (United States Army Corps of Engineers [USACE] and SFWMD 2015) was completed in 2015.

Lake Okeechobee Watershed Restoration Project

In 2016, the USACE and SFWMD began planning efforts for the Lake Okeechobee Watershed Restoration Project (LOWRP), which aims to

- Increase water storage capacity in the watershed, resulting in improved Lake Okeechobee water levels;
- Improve the quantity and timing of discharges to the Caloosahatchee and St. Lucie estuaries;
- Restore wetlands; and
- Improve existing and future water supply.

The LOWRP preliminary project area covers a large portion of the Lake Okeechobee watershed north of the lake. Project features under consideration to meet the project goals include up to 55 ASR wells and re-establishment of former wetland areas. The planning process is anticipated to proceed through 2023.

NORTHERN EVERGLADES AND ESTUARIES PROTECTION PROGRAM

In 2007, the Florida Legislature authorized the Northern Everglades and Estuaries Protection Program (NEEPP; Section 373.4595, F.S.), which expanded the existing Lake Okeechobee Protection Act. In 2016, the Florida Legislature amended NEEPP to further clarify the roles and responsibilities, coordination, implementation, and reporting efforts among the three coordinating agencies: the Florida Department of Environmental Protection, the Florida Department of Agriculture and Consumer Services, and the SFWMD. NEEPP was also amended to indicate that basin management action plans (BMAPs) shall be the component of the watershed protection plans (WPPs) that addresses pollutant loading or total maximum daily loads established in accordance with Section 403.067, F.S. The legislation also requires that the WPPs for the Lake Okeechobee, Caloosahatchee River, and St. Lucie River watersheds are routinely updated as part of NEEPP. The WPPs build on existing approaches and consolidate restoration efforts throughout the Northern Everglades system. The two plans relevant to the LWC Planning Area are described below. More details about specific projects and activities under the WPPs are included in annual updates of the *South Florida Environmental Report* (https://www.sfwmd.gov/sfer). Further information about NEEPP can be found on the SFWMD website (http://www.sfwmd.gov/wpps).

Lake Okeechobee Watershed Protection Plan

NEEPP mandated that the SFMWD, Florida Department of Environmental Protection (FDEP), and Florida Department of Agriculture and Consumer Services (FDACS) develop a Lake Okeechobee Watershed Protection Plan (LOWPP). The plan initially was developed in 2004 (SFWMD et al. 2004) and was updated in 2007, 2008, 2011, 2015, and 2020 (Betts et al. 2020; SFWMD et al. 2007, 2008, 2011; Sharfstein et al. 2015). Future updates to the LOWPPs will be done in accordance with the 2016-amended NEEPP to ensure they are consistent with the state's adopted BMAP for Lake Okeechobee.

The plan includes source controls (e.g., best management practices) and several subregional and regional technologies, such as stormwater treatment areas and alternative treatment technologies, to improve the quality of water within the watershed and delivered to Lake Okeechobee. Several measures are included in the plan to improve water levels within the lake as well as the quantity and timing of discharges from Lake Okeechobee to the northern estuaries to achieve more desirable salinity ranges. These measures include reservoirs, Dispersed Water Management Program projects, ASR, and deep well injection.

Caloosahatchee River Watershed Protection Plan

The Caloosahatchee River Watershed Protection Plan (CRWPP), developed by the SFWMD, FDEP, and FDACS, was submitted to the Florida Legislature on January 1, 2009 (SFWMD et al. 2009). It identified major influences that negatively affect the Caloosahatchee River Estuary's ecological health (primarily water quality, quantity, timing, and distribution) and proposed strategies to minimize those stressors. The plan was updated in 2012 (Balci and Bertolotti 2012) and 2015 (Buzzelli et al. 2015). Future updates to the CRWPPs will be done in accordance with the 2016-amended NEEPP to ensure they are consistent with the state's adopted BMAP for the Caloosahatchee River and Estuary.

The CRWPP contains the following three main components:

- **Pollutant Control Program** – This program is a multifaceted approach to reducing pollutant loads by improving the management of pollutant sources within the watershed. This component comprises source control programs implemented by the coordinating agencies, including best management practices, on-site treatment technologies, stormwater and wastewater infrastructure upgrades and master planning, and regulatory programs focused on water quality and quantity.

- **Construction Project** – This component identifies water quality and storage projects to improve hydrology, water quality, and aquatic habitats within the watershed. It includes regional, subregional, and local water quality and quantity projects (e.g., reservoirs, stormwater treatment areas, chemical treatment, local stormwater projects).
- **Research and Water Quality Monitoring Program** – This program builds on the SFWMD's existing research program and is intended to carry out, comply with, or assess the plans, programs, and other responsibilities created by the CRWPP. The program also will assess the water volumes and timing from the Lake Okeechobee and Caloosahatchee River watersheds and their relative contributions to the estuary. The primary purpose of this component is to track progress toward achieving water quality and storage targets.

Lake Hicpochee Storage and Hydrologic Enhancement Project

Lake Hicpochee was one of three lakes historically considered the headwaters of the Caloosahatchee River (**Figure 7-1**). The channelization of the C-43 Canal in the 1800s resulted in detrimental impacts to the lake. Phase 1 of the Lake Hicpochee Storage and Hydrologic Enhancement Project (completed in 2019) captures surface water from the C-19 Canal, then stores the water before distributing it via a spreader canal to the northwestern area of Lake Hicpochee. Phase 2 of the project (**Figure 7-3**) will include the construction of a flow equalization basin (FEB), a new pump station to draw water from the C-43 Canal, and associated flow features connecting to the existing project. Phase 2 of the project will increase the storage capacity of Phase 1 features and capture runoff from both the C-19 and C-43 basins. Phase 2 is currently under design, and construction is expected to be completed by September 2025.

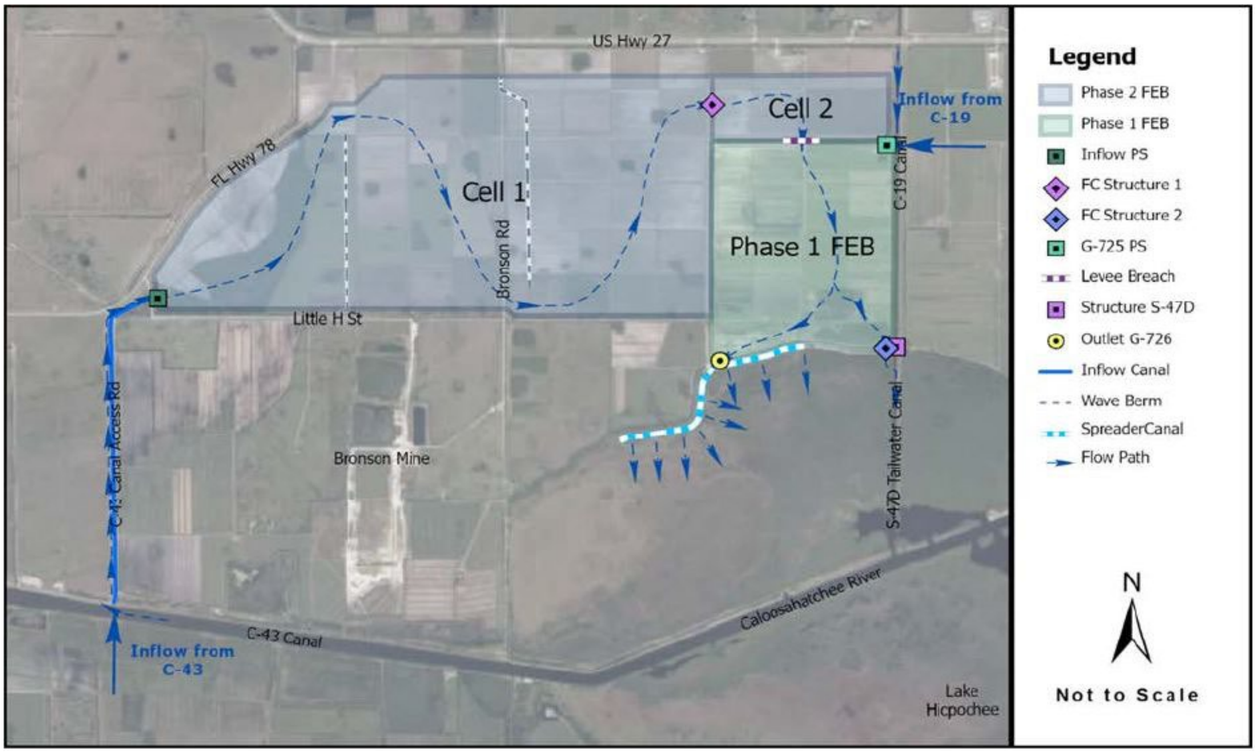


Figure 7-3. Lake Hicpochee Storage and Hydrologic Enhancement Project.

C-43 Water Quality Treatment Feature

The C-43 Water Quality Treatment Feature often referred to as the "Boma" project (**Figure 7-1**) is approximately 1,765 acres of active and fallow citrus land adjacent to the C-43 Canal that was purchased by the SFWMD and Lee County in 2008 for development of a shallow water storage and treatment system (**Figure 7-4**). The Boma property currently includes two interim storage impoundments (total 370 acres) and the C-43 Water Quality Treatment and Testing Phase I mesocosm research facility. Two permanent projects are currently in the design phase for the property and include the C-43 Water Quality Treatment and Testing Phase II test cells and the Boma FEB. Construction of the Phase II test cells project is anticipated to begin in late 2022, and the Boma FEB project is anticipated to begin in 2023.

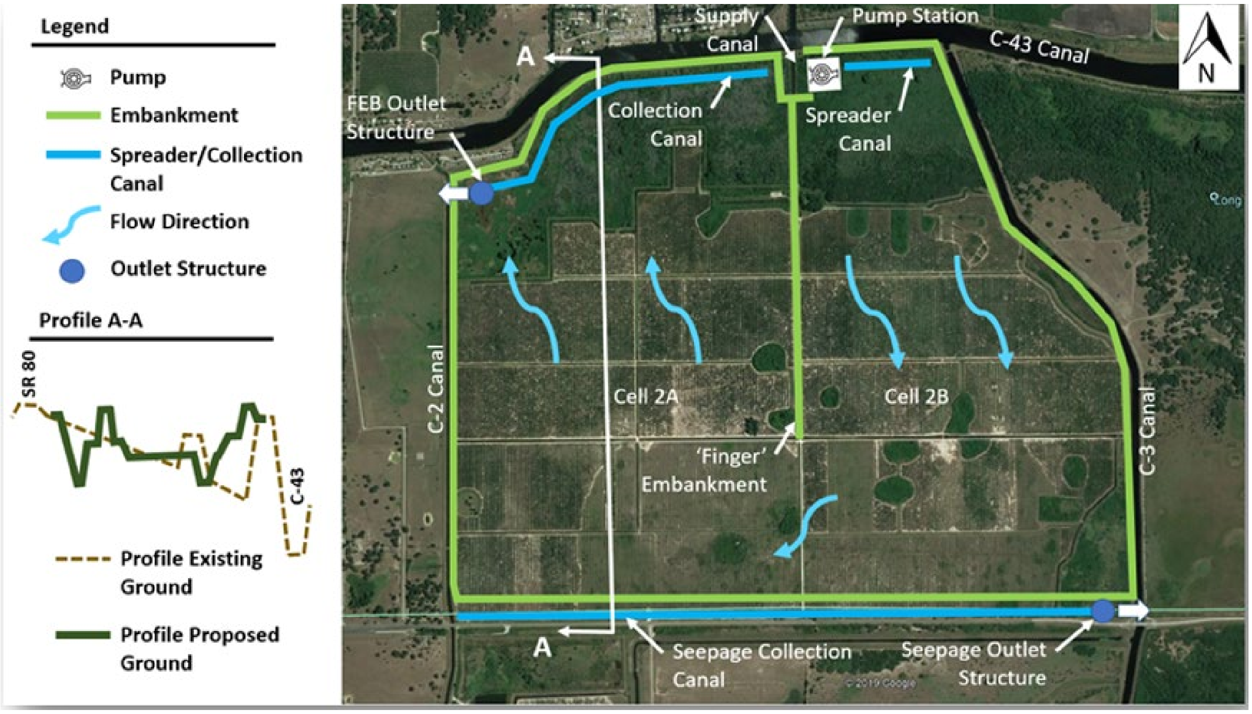


Figure 7-4. C-43 Water Quality Treatment Feature.

BIG CYPRESS BASIN PROGRAMS

The Big Cypress Basin Board is responsible for the operation, maintenance, planning, and capital improvements of approximately 140 miles of canals and 38 water control structures within Collier County and part of Monroe County. The southwest Florida representative on the District Governing Board serves as the chair of the Big Cypress Basin Board.

Big Cypress Swamp

The Big Cypress Basin Board provided cooperative funding focusing on water quality and AWS projects within the basin from 2017-2022 in an amount of $5M. Below are some of the highlights:

Naples Bay Restoration and Water Quality Improvements at the Cove – Stormwater and ecosystem restoration through the removal of nutrient-rich sediment, constructing a pollution control device, and installing a living shoreline to improve water quality.

City of Naples and Collier County West Goodlette-Frank Road Area Joint Stormwater and Septic Tank Replacement Project – Conversion of residential septic tanks to a central sanitary sewer collection system and stormwater improvements. The project will increase the volume of reclaimed water available for water supply use as well as improve water quality in Naples Bay.

Collier County Lely Branch Water Control Structure Project – Construction of a new weir on the Lely Branch Canal, which will limit the need for releases of floodwater during the wet season. This will result in increasing shallow groundwater levels and reducing over-drainage of wetlands and native habitats.

Collier County Freedom Park Water Quality Improvements – Construction of this project included widening the bypass canal along the north side of Freedom Park to allow for enhanced flood protection and increased nutrient reduction of upstream flows before discharging to the Gordon River and into Naples Bay.

City of Naples Reclaimed Water System Expansion Phase 5 – Installation of 11,600 linear feet of reclaimed water mains to increase the amount of reclaimed water within the City and offset the demand of traditional water sources by approximately 0.26 million gallons per day.

REFERENCES

Balci, P. and L. Bertolotti. 2012. Appendix 10-2: Caloosahatchee River Watershed Protection Plan Update. In: *2012 South Florida Environmental Report – Volume I*. South Florida Water Management District, West Palm Beach, FL.

Betts, A., P. Jones, S. Ollis, S. Olson, X. Pernett, S. Sculley, Z. Welch, and J. Zhang. 2020. Appendix 8A-1: Lake Okeechobee Watershed Protection Plan 2020 Update. In: *2020 South Florida Environmental Report – Volume I*, South Florida Water Management District, West Palm Beach, FL.

Buzzelli, C., K. Carter, L. Bertolotti, and P. Doering. 2015. Chapter 10: St. Lucie and Caloosahatchee River Watershed Protection Plan Annual and Three-Year Updates. In: *2015 South Florida Environmental Report – Volume I*. South Florida Water Management District, West Palm Beach, FL.

Geddes, E., S. Coonts, and B. Collins. 2018. *Geochemistry of the Upper Floridan Aquifer and Avon Park Permeable Zone Within the South Florida Water Management District*. Technical Publication WS-47. South Florida Water Management District, West Palm Beach, FL.

Kraft, N. and D. Medellin. 2021. Chapter 5A: 2021 Five-Year Water Resource Development Work Program. In: *2021 South Florida Environmental Report – Volume II*. South Florida Water Management District, West Palm Beach, FL.

SFWMD, FDEP, and FDACS. 2004. *Lake Okeechobee Watershed Protection Plan*. South Florida Water Management District, West Palm Beach, FL; Florida Department of Environmental Protection, Tallahassee, FL; and Florida Department of Agriculture and Consumer Services, Tallahassee, FL.

SFWMD, FDEP, and FDACS. 2007. *Lake Okeechobee Watershed Protection Plan Evaluation Report*. South Florida Water Management District, West Palm Beach, FL; Florida Department of Environmental Protection, Tallahassee, FL; and Florida Department of Agriculture and Consumer Services, Tallahassee, FL.

SFWMD, FDEP, and FDACS. 2008. *Lake Okeechobee Watershed Construction Project Phase II Technical Plan*. South Florida Water Management District, West Palm Beach, FL; Florida Department of Environmental Protection, Tallahassee, FL; and Florida Department of Agriculture and Consumer Services, Tallahassee, FL.

SFWMD, FDEP, and FDACS. 2009. *Caloosahatchee River Watershed Protection Plan*. South Florida Water Management District, West Palm Beach, FL; Florida Department of Environmental Protection, Tallahassee, FL; and Florida Department of Agriculture and Consumer Services, Tallahassee, FL.

SFWMD, FDEP, and FDACS. 2011. *Lake Okeechobee Watershed Protection Plan Update*. South Florida Water Management District, West Palm Beach, FL; Florida Department of Environmental Protection, Tallahassee, FL; and Florida Department of Agriculture and Consumer Services, Tallahassee, FL.

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

Sharfstein, B., J. Zhang, and L. Bertolotti. 2015. Chapter 8: Lake Okeechobee Watershed Protection Program Annual Update. In: *2015 South Florida Environmental Report – Volume I*. South Florida Water Management District, West Palm Beach, FL.

Shaw, J.E. and M. Zamorano. 2020. *Saltwater Interface Monitoring and Mapping Program*. Technical Publication WS-58. South Florida Water Management District, West Palm Beach, FL.

USACE and SFWMD. 2015. *Southwest Florida Comprehensive Watershed Plan*. United States Army Corps of Engineers, Jacksonville, FL and South Florida Water Management District, West Palm Beach, FL.

8

Water Supply Development Projects

This chapter summarizes the proposed water supply development projects anticipated to meet water needs in the Lower West Coast (LWC) Planning Area of the South Florida Water Management District (SFWMD or District) for the 2020 to 2045 planning period. Water supply development projects include 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 and are proposed by water users to meet existing and future demands. Water users such as Public Supply (PS) utilities, local and tribal governments, and self-suppliers including Commercial/Industrial/Institutional (CII) and Agriculture (AG) users are primarily responsible for water supply development projects. For this *2022 Lower West Coast Water Supply Plan Update* (2022 LWC Plan Update), alternative water supply (AWS) development projects have been proposed by PS utilities that rely on non-traditional water sources.

TOPICS

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

Water use permits typically are required for most 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). Regarding water supply development projects, local economic conditions and population growth may affect when water is needed, which projects are required, and how water use permits need to be obtained or 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. Projects listed in this 2022 LWC 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 2022 LWC 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 2020, PS demand in the LWC Planning Area was met by fresh groundwater (45%) and brackish groundwater (55%). The PS average net demand (finished water) is projected to grow from 120.90 mgd in 2020 to 162.87 mgd by 2045, a 35% 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 for irrigation and aquifer recharge purposes that reduce or replace use of current or projected potable 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. 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 permittable. 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.

In the LWC Planning Area, 9 PS utilities have proposed 18 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 25.71 mgd of additional potable water treatment capacity. Combined with existing capacity (237.76 mgd), this will exceed the projected 2045 PS total net (finished) demand of 162.87 mgd.

One PS utility, Florida Governmental Utility Authority (FGUA) – Lehigh Acres, would need to construct 0.22 mgd of water supply to meet its projected 2045 demands. The existing potable water treatment capacity for FGUA – Lehigh Acres is 3.10 mgd, and the projected net demand for 2045 is 3.32 mgd (**Appendix B**). The utility has not proposed any projects but maintains an interlocal agreement with the City of Fort Myers for purchase of up to 2.00 mgd of treated bulk water.

PS utilities also have proposed nonpotable water supply projects that could create 39.70 mgd of additional reclaimed 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 individual reuse inventory reports for the year 2020 (unless otherwise noted for individual facilities) filed by each wastewater utility to the Florida Department of Environmental Protection (FDEP 2021) indicated approximately 75% of wastewater generated in Charlotte County, 78% in Collier County, 0% in Glades County, 0% in Hendry County, and 74% in Lee County was reused for irrigation, and 9%, 1%, 100%, 100%, and 1% of wastewater in those counties, respectively, was reused for aquifer recharge. These percentages include supplemental flows to reclaimed water, which is discussed in some detail in **Chapter 5**. In 2020, 23.97 mgd of supplemental flows were added to reclaimed water to meet reuse demands, while 23.42 mgd of potentially reusable wastewater effluent was disposed in the LWC Planning Area. Wastewater flows are projected to increase by 87.02 mgd from 2020 to 2045. When considering wastewater and disposal flows (excluding supplemental flows), there would be 197.86 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 2020 and 2045.

Water Source	Number of Projects[a,b]	Capacity (mgd)	Cost ($ million)
Potable Projects			
Surficial Aquifer System	1	3.00	$24.20
Floridan Aquifer System	8	**22.71**	$180.81
Potable Total	**9**	**25.71**	**$205.01**
Nonpotable Projects			
Reclaimed Water	17	39.70	$588.40
Aquifer Storage and Recovery	1	1.00[c]	$4.00
Nonpotable Total	**18**	**40.70**	**$592.40**
Total	**27**	**66.41**	**$797.41**

mgd = million gallons per day.
[a] Projects designed to expand distribution of treated water or repair or replace existing facilities 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.

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 LWC Planning Area are projected to increase from 24.53 mgd in 2020 to 34.01 mgd in 2045. DSS needs currently are met and are expected to continue being met with fresh groundwater from the surficial aquifer system (SAS) and the intermediate aquifer system (IAS). As stated in previous chapters, stress is occurring in IAS groundwater levels in limited areas of Cape Coral and Lehigh Acres, wholly or partially due to DSS withdrawals. The City of Cape Coral plans to extend potable water service using alternative water supplies to areas where fresh groundwater IAS withdrawals for DSS are contributing to declining water levels in aquifers approaching the maximum developable limit. The District will continue to engage Lee County to encourage development of long-range plans for a sustainable water supply in DSS areas, such as extending potable water service to other areas where DSS withdrawals are contributing to declining water levels.

Agriculture

AG water use includes self-supplied water used for crop irrigation, greenhouses, nurseries, livestock watering, pasture irrigation, and aquaculture. AG is the largest water use category in the LWC Planning Area and is projected to remain so over the planning horizon. Irrigated crop acreage is expected to increase from 291,765 acres in 2020 to 307,062 acres in 2045. Gross AG water demand is projected to increase 5%, from 592.02 mgd in 2020 to 621.40 mgd in 2045, under average rainfall conditions. **Chapter 2** and **Appendix A** provide more information about AG water use and projected demands.

The majority of AG water demand in the LWC Planning Area is supplied by fresh groundwater from the SAS and IAS and surface water primarily from the C-43 Canal and its connected canals and diversion and impoundment systems. Water availability from most surface water sources is limited by regulatory protections (**Chapter 4**)

Water supply opportunities for AG may be available in the future by capture and use of on-site 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. No specific water supply development projects for this category were provided or identified for this 2022 LWC Plan Update.

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.

Commercial/Industrial/Institutional

The CII water use category includes self-supplied water associated with the production of goods or provision of services by commercial, industrial, and institutional establishments. Water demands for CII in the LWC Planning Area are met primarily using traditional supplies such as fresh surface water and groundwater, and to a limited extent, reclaimed water. The projected average gross demand for this category is estimated to be 48.23 mgd by 2045, which is a slight increase from 2020 demands (37.73 mgd).

Although traditional water supplies generally are considered adequate to meet the relatively small demands projected for CII, 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 the water use permitting process. No specific water supply development projects for this category were provided or identified for this 2022 LWC 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 stormwater management system ponds. Several golf courses use brackish groundwater blended with fresh surface water in on-site lakes. Reclaimed water is used to meet approximately 37% of the irrigation demand for L/R. In the LWC Planning Area, L/R average gross demand is projected to increase from 219.17 mgd in 2020 to 268.04 mgd in 2045.

Golf Course

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, groundwater or surface water from on-site stormwater management ponds. In the LWC Planning Area, reclaimed water is used to irrigate large, landscaped areas such as golf courses, parks, and residential and commercial parcels. Proposed projects submitted by utilities for wastewater treatment facilities are expected to add 39.70 mgd of reclaimed water treatment capacity by 2045. Additional reclaimed water supply may provide an opportunity to convert existing irrigation from traditional freshwater to reclaimed water. No specific water supply development projects for this category were provided or identified for this 2022 LWC Plan Update; however, reclaimed water main extension projects have been proposed and will provide additional reclaimed water for L/R irrigation purposes.

Power Generation

Currently, the Power Generation (PG) water use category includes two PG facilities in the LWC Planning Area: Florida Power & Light (FPL) Fort Myers and the Lee County Solid Waste Energy Recovery Facility.

The FPL Fort Myers facility uses brackish surface water for a one-time pass-through cooling tower system which is returned to the Caloosahatchee River Estuary. Groundwater is used for make-up water for steam generators, inlet spray coolers, and other industrial uses. For the planning period 2020 to 2045, the FPL Fort Myers facility is estimated to have a constant PG demand of 0.53 mgd. This demand is based on the Fort Myers Power Plant's average daily use in 2020 from groundwater sources.

The Lee County Solid Waste Energy Recovery Facility relies entirely on reclaimed water provided by the City of Fort Myers and is anticipated to continue relying on reclaimed water through the planning horizon. In 2020, 1.01 mgd of reclaimed water was supplied to this facility, and demands are anticipated to increase to 1.50 mgd by 2045.

PG water demands are expected to increase slightly, from 2020 to 2045. Because the availability of fresh water is limited in the LWC Planning Area, AWS sources may be the most feasible options to meet future PG use if a new use is proposed. No specific water supply development projects for this category were provided or identified for this 2022 LWC Plan Update.

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, the appropriate regional water supply plan update. Some projects not included in this 2022 LWC 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) 2017 through FY2021, the SFWMD provided more than $25.7 million in AWS funding for 32 projects located throughout the District. Seven of these projects are in the LWC Planning Area, generating 9.78 mgd of AWS capacity and 40.26 mgd of additional reclaimed water distribution capacity (**Table 8-2**).

Table 8-2. AWS projects in the LWC Planning Area funded through the FDEP AWS Program and the Water Protection and Sustainability Program (FY2017 to FY2021).

Project Name	County	Fiscal Year	Total Capacity (mgd)
Ave Maria Utility Company, LLC - Phase III Reclaimed Water System Expansion – Lined Storage Pond and Reclaimed Water Main Extension along Anthem Parkway	Collier	2017-2018	0.60
Naples, City of – Reclaimed Water System Expansion, Phase 5	Collier	2017-2018	0.26
Lee County Utilities – Reclaimed Water ASR (Fort Myers Beach/ Fiesta Village)	Lee	2017-2018	0.18
Cape Coral, City of – Water North 2 Utility Extension Program – Irrigation Canal Pump Station East #10	Lee	2017-2018	7.00
Cape Coral, City of – Water North 2 Utility Extension Program – Irrigation Transmission	Lee	2017-2018	24.00
Cape Coral, City of – Reclaimed Water Expansion: Cape Coral and Fort Myers Interconnect under the Caloosahatchee River	Lee	2020	2.00
Lee County Utilities – Fiesta Village Reclaimed Water Main Extension	Lee	2021	16.00
		Total	**50.04**

AWS = alternative water supply; FDEP = Florida Department of Environmental Protection; FY = Fiscal Year; mgd = million gallons per day; LWC = Lower West 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 FY2017 to FY2021, the SFWMD approved more than $2.8 million in funding towards 60 water conservation projects Districtwide through the CFP, with an estimated water savings of 1.45 billion gallons per year, or 3.96 mgd. In the LWC Planning Area, three projects received over $40,000 in funding with an estimated water savings of 28 million gallons per year, or 0.08 mgd (**Table 8-3**). **Chapter 3** contains additional information on water conservation efforts in the LWC Planning Area.

Table 8-3. Water conservation projects in LWC Planning Area supported by the FDEP AWS Program and Water Protection and Sustainability Program (FY2017 to FY2021).

Project Name	Entity Name	Project Type	Fiscal Year	Proposed Water Savings (mgy)
Collier County				
Bayrock Grove Irrigation Monitoring	AgReserves Inc. DBA – Deseret Farms of Ruskin	Irrigation	2017-2018	20.00
Hendry County				
BWEN Irrigation Water Conservation Project	Bishopwood East of Forest Glen Neighborhood Association Inc. (BWEN)	Irrigation	2017-2018	7.50
Lee County				
High-Efficiency Toilet Rebate Program	Bonita Springs Utilities, Inc.	Indoor Plumbing	2020	0.93
Estimated Yearly Total Water Savings				**28.43**

AWS = alternative water supply; FDEP = Florida Department of Environmental Protection; FY = Fiscal Year; mgy = million gallons per year; LWC = Lower West Coast.

SUMMARY OF WATER SUPPLY DEVELOPMENT PROJECTS

Total average gross water demands within the LWC Planning Area, from all sources, are projected to increase 146.26 mgd (14%) by 2045. During the planning horizon, the PS category has a projected 35% increase in average finished water demand. While utilities proposed a total of nine potable water multiphased projects, only one utility appears to need an increase in treatment capacity before 2045, based on demand projections and treatment system requirements. The evaluation for this 2022 LWC Plan Update indicates groundwater and surface water supplies are adequate to meet the total projected demands through the planning horizon of 2045.

Twenty-four PS utilities are located within the LWC Planning Area. Lee County Utilities is the region's largest utility and is projected to serve approximately 371,422 residents by 2045. FGUA – Lehigh Acres will need to construct 0.22 mgd of additional treatment capacity to meet 2045 projected demands if the interlocal agreement to purchase water from the City of Fort Myers is not renewed. All other PS growth within the LWC Planning Area can be served with existing facilities, although nine utilities have proposed projects. The proposed water supply development projects could generate 25.71 mgd of new potable water treatment capacity to meet the 2045 net PS demand of 162.87 mgd. The new capacity consists of 22.71 mgd produced by projects using groundwater from the Floridan aquifer system (FAS) and 3.00 mgd from the SAS. 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 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 increase in water supply capacities (in mgd) for Public Supply utilities in the LWC Planning Area.

County	Public Supply Utility	Surface Water/ Stormwater		SAS		IAS		FAS		ASR[a]		Reclaimed Water[b]	
		Existing	Proposed[c]	Existing	Proposed[c]	Existing	Proposed[c]	Existing	Proposed[c]	Existing	Proposed[c]	Existing	Proposed[c]
Charlotte	Charlotte Correctional			0.30									
	Town and Country			0.49		0.50			7.01			0.75	3.25
Collier	Ave Maria			0.49		0.50			2.76			0.90	1.25
	Collier County Utilities			20.80	3.00	15.60		15.60	2.00			42.35	5.25
	Everglades City			0.47								0.16	0.20
	Immokalee (IWSD)			5.60					2.50			4.00	3.00
	Marco Island	6.67				6.00				6.67		4.92	
	Naples			30.00								10.00	
	Port of the Islands			0.44								0.20	
	STOF - Immokalee[d]			0.43									
Glades	Moore Haven			0.96									
	Silver Lake - Muse Village					0.33							
Hendry	Clewiston							3.00				1.50	0.75
	LaBelle							1.50				0.75	
	Port LaBelle					0.90						0.50	
Lee	Bonita Springs			10.50				8.56	3.44			11.00	2.00
	Cape Coral							30.00			1.00	32.65	9.00
	Citrus Park – Bonita Terra			0.54								0.20	
	FGUA – Lake Fairways					0.20						0.30	
	FGUA – Lehigh Acres					3.10						2.76	
	Fort Myers							13.00				23.00	15.00
	Lee County Utilities	5.00		8.51		9.41		29.08	5.00	5.00		20.38	
	Pine Island (GPIWA)							3.29					
	Sanibel Island (IWA)							5.99				2.38	
	Total	**11.67**		**79.53**	**3.00**	**36.54**		**110.02**	**22.71**	**11.67**	**1.00**	**158.7**	**39.70**

ASR = aquifer storage and recovery; FAS = Floridan aquifer system; FGUA = Florida Governmental Utility Authority; GPIWA = Greater Pine Island Water Association; IAS = intermediate aquifer system; IWA = Island Water Association; IWSD = Immokalee Water Sewer District; mgd = million gallons per day; SAS = surficial aquifer system; LWC = Lower West Coast; STOF – Immokalee = Seminole Tribe of Florida Immokalee Reservation.

a Estimated recoverable storage capacity, not water supply capacity.

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

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

d The Seminole Tribe of Florida is a sovereign Indian Tribe and an independent Tribal Government separate from Collier County. However, for discussion purposes, information relating to the Seminole Tribe of Florida Immokalee Reservation is included in the calculations for Collier County.

Table 8-5. Proposed potable and nonpotable Public Supply development projects in the LWC Planning Area (2020 to 2045).

County	Implementing Agency	Project Name	Project Description	Project Capacity (mgd)	Total Capital ($M)	Estimated Completion Date
Potable – Surface Water						
Collier	Marco Island	Northwest WTP Biological Activated Filter	Construct pre-treatment system	0.00[a]	$5.70	2023
	Marco Island	Northwest WTP Nanofiltration Filtration Improvements	Improvements to WTP	0.00[a]	$10.00	2025
Potable – SAS						
Collier	Collier County Utilities	Northeast Interim WTP (three phases) and NE Lower Tamiami Aquifer Wellfield	Construct interim WTP and wellfield	2.88	$28.80	2032
	Collier County Utilities	New Northeast 3.0 mgd WTP Using Ion Exchange Phase I	Construct 3 mgd ion exchange WTP	3.00	$24.20	2037
Potable – IAS						
Collier	Ave Maria	Sandstone Aquifer Wellfield Expansion (2 wells) Ave Maria	Construct two supply wells	0.00[a]	$3.70	2023
Potable – FAS						
Charlotte	Town and Country	Phase 3 – 2.51 mgd WTP Expansion and Supply Wells (4 wells, 2 IAS, 2 FAS)	Expand WTP to include RO and construct four supply wells	2.51	$27.21	2023
	Town and Country	Phase 4 – 2.50 RO WTP Expansion, Deep Injection Well, and Supply Wells (4 FAS wells)	Expand RO WTP, construct injection well, and construct four supply wells	2.50	$14.14	2027
	Town and Country	Phase 5 – 2.0 mgd RO Expansion and Supply Wells (2 FAS wells)	Expand RO WTP and construct two supply wells	2.00	$14.38	2031
Collier	Ave Maria	2.76 mgd RO WTP Expansion	Expand RO treatment capacity	2.76	$5.00	2031
	Immokalee (IWSD)	New 2.5 mgd RO WTP	Construct new RO WTP	2.50	$12.00	2032
	Collier County Utilities	New 2.0 mgd Northeast WTP - Phase I	Construct new RO WTP	2.00	$24.20	2037

Table 8-5. Continued.

County	Implementing Agency	Project Name	Project Description	Project Capacity (mgd)	Total Capital ($M)	Estimated Completion Date
Lee	Bonita Springs	3.44 mgd Expansion RO WTP - Phase 3 and 12 FAS Wells	Expand RO WTP and construct 12 FAS wells	3.44	$45.00	2024
	Cape Coral	South RO WTP Replacement	Replace RO WTP	0.00[a]	$20.00	2028
	Cape Coral	North RO WTP Back-up Deep Injection Well	Construct back-up deep injection well	0.00[a]	$9.00	2023
	Cape Coral	North RO WTP New and Replacement FAS Wells	Construct new and replacement FAS supply wells	0.00[a]	$7.20	2025
	Fort Myers	FAS Wellfield Expansion (7 wells)	Construct seven FAS supply wells	0.00[a]	$14.06	2023
	Lee County Utilities	North Lee County WTP and Wellfield Expansion	Expand WTP and FAS wellfield	5.00	$38.88	2025
	Lee County Utilities	Green Meadows RO Wellfield Expansion (4 wells)	Construct four FAS wells	0.00[a]	$4.00	2025
Nonpotable – Reclaimed Water						
Charlotte	Town and Country	Phase 3- 0.75 mgd WWTF Expansion	Expand WWTF	0.75	$40.00	2026
	Town and Country	Phase 4- 1.16 mgd WWTF Expansion	Expand WWTF	1.16	$30.00	2029
	Town and Country	Phase 5- 1.34 mgd WWTF Expansion	Expand WWTF	1.34	$17.00	2033
Collier	Ave Maria	Phase 2- 1.25 mgd WWTF Expansion	Expand WWTF	1.25	$6.50	2030
	Collier County Utilities	Northeast New 1.50 mgd WWTF	Replace 0.75 with 1.50 mgd WWTF	0.75[b]	$65.00	2030
	Collier County Utilities	Foxfire Reclaimed Water Supplemental Wells	Construct supplemental reclaimed water wells in the Lower Tamiami aquifer	1.00	$1.00	2023
	Collier County Utilities	South County WWTF Supplemental Wells	Construct supplemental reclaimed water wells in the Lower Tamiami aquifer	1.00	$3.00	2030
	Collier County Utilities	Golden Gate 2.5 mgd WWTF Expansion	Expand WWTF	2.50	$86.00	2030
	Everglades City	New Rapid Infiltration Basins	Construct rapid infiltration basins	0.10	TBD	2026
	Everglades City	0.1 mgd Reclaimed Water Production Facility	Pumps and piping for public access reuse system	0.10	$3.00	2029
	Immokalee	3.0 mgd Reclaimed Water Production Facility and Water Main Extension	Reclaimed water production facility (filters and high-level disinfection) extension to Williams Ranch	3.00	$3.40	2027

Table 8-5. Continued.

County	Implementing Agency	Project Name	Project Description	Project Capacity (mgd)	Total Capital ($M)	Estimated Completion Date
Hendry	Clewiston	0.75 mgd Reclaimed Water Production Facility and Water Main Extension	Reclaimed water production facility (filters and high-level disinfection) and main extension	0.75	$0.50	2035
	LaBelle	Reclaimed Water Main Extension to Proposed Golf Course	Construct reclaimed water main extension	0.50	$3.00	2027
Lee	Bonita Springs	East 2.0 mgd WWTF Expansion	Expand WWTF	2.00	$38.00	2028
	Cape Coral	Reclaimed Water Interconnect with Fort Myers	Construct reclaimed water main interconnect with City of Fort Myers	0.00[a]	$11.80	2023
	Cape Coral	Southwest WWTF 5.0 mgd Expansion, 15 to 20 mgd	Expand WWTF	5.00	$60.00	2025
	Cape Coral	New 4.0 mgd North WWTF Phase I	Construct WWTF	4.00	$120.00	2035
	Fort Myers	South WWTF Upgrade to Reuse and Interconnect with Cape Coral	Upgrade WWTF to reuse and interconnect with Cape Coral	9.00	$55.00	2023
	Fort Myers	Central 6.0 mgd WWTF Expansion	Expand WWTF	6.00	$60.00	2026
Nonpotable – ASR						
Lee	Cape Coral	ASR Wells for Irrigation Supply	Excess surface water stored in proposed ASR wells	1.00	$4.00	2027

ASR = aquifer storage and recovery; FAS = Floridan aquifer system; IAS = intermediate aquifer system; IWSD = Immokalee Water Sewer District; mgd = million gallons per day; PS = Public Supply; RO = reverse osmosis; SAS = surficial aquifer system; LWC= Lower West Coast; WTP = water treatment plant; WWTF = wastewater treatment facility.

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

[b] Replacing the existing 0.75 mgd WWTF, increases total capacity by 0.75 mgd.

REFERENCES

FDEP. 2021. *OCULUS Electronic Document Management System*. Florida Department of Environmental Protection, Tallahassee, FL. Available online at https://depedms.dep.state.fl.us/Oculus/servlet/login.

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 *2022 Lower West Coast Water Supply Plan Update* (2022 LWC Plan Update) provides conclusions and summarizes future direction for water supply in the LWC 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 increase by 167.43 million gallons per day (mgd) by 2045, primarily due to increases in the Public Supply (PS) and Landscape/Recreational (L/R), followed to a lesser extent by the Agriculture (AG) water use categories (**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 LWC 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 2022 LWC 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 LWC Planning Area include continued coordination with AG stakeholders, PS utilities, and other water users; protection of natural resources; 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 1,166.43 mgd (**Table 9-1**). This is a 16.52% increase from the estimated 2020 demands (1,013,47 mgd) and 3% more than the projected 2040 demands in the 2017 LWC Plan Update.

Table 9-1. Summary of estimated 2020 and projected 2045 gross water demands under average rainfall conditions in the LWC Planning Area, by water use category.

Water Use Category	2020 Estimated Use (mgd)	2045 Projected Demand (mgd)	Percent Change	Percent of Projected 2045 Total Demand
PS	138.46	186.04	34.36%	15.7%
DSS	24.55	33.98	38.41%	2.9%
AG	592.02	621.40	4.90%	52.6%
CII	37.73	48.23	27.80%	4.1%
L/R	219.17	289.23	31.96%	24.5%
PG	1.54	2.03	31.80%	0.2%
Total	**1,013.49**	**1,180.92**	**16.52%**	**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

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 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 to 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 and proactively implement water-saving measures and programs, such as incentives to promote replacement of older water fixtures with new high-efficiency ones.
- 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 that have not yet adopted irrigation ordinances include Clewiston, Ft. Myers Beach, Glades County, Hendry County, LaBelle, and Moore Haven.
- Local governments should develop and adopt 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 and tribal 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 and Self-Conducted Water Audits at 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


Caloosahatchee River 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 LWC Planning Area. Such activities include construction of 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 and related natural systems, 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 and USACE will continue to make progress towards completion of the C-43 West Basin Storage Reservoir, C-43 Water Quality Treatment Feature (Boma), Picayune Strand Restoration, Lake Okeechobee Watershed Restoration, Lake Hicpochee Storage and Hydrologic Enhancement, and other ecosystem restoration projects.
- The USACE is anticipated to complete and implement the Lake Okeechobee System Operating Manual by 2023. The operating manual considers water needs for the environment among other benefits.
- The SFWMD will continue to partner with the USACE on planning for future CERP projects in the Lake Okeechobee and Caloosahatchee River watersheds as well as the Big Cypress Basin.
- The SFWMD will continue to monitor natural areas, including the Caloosahatchee Estuary, Corkscrew Swamp Sanctuary, the Big Cypress National Preserve, and the Picayune Strand State Forest, and provide annual updates on the ecological 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 Caloosahatchee River and LWC aquifers and update them, if needed, in conjunction with future plan updates.

WATER SOURCE OPTIONS

The LWC Planning Area AG users rely primarily on surface water from the C-43 Canal as well as Lake Okeechobee and its connected canals and groundwater where surface water is not available. Fresh groundwater from the surficial aquifer system (SAS) and the intermediate aquifer system (IAS) and brackish water from the Floridan aquifer system (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, proximity to contamination sources, rate of recharge, and low aquifer productivity. Therefore, PS utilities are projected to continue increasing use of the IAS and 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.

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 membrane technology costs continue to decline; however, no seawater projects are proposed in this plan update.

In addition, climate change and sea level rise can affect water resources and water demands in the LWC Planning Area. The District, local governments, and water users need to be diligent in proactively understanding potential impacts and developing resiliency strategies, including development of tools to predict potential impacts, in coordinated effort.

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 LWC Planning Area.

Surface Water

Caloosahatchee River (C-43 Canal)

Surface water is the primary source for the AG water use category in the LWC Planning Area. Surface water supply sources within the LWC Planning Area primarily include the C-43 Canal and Lake Okeechobee with its connected secondary system in the Lake Okeechobee Service Area. Lake Okeechobee borders four water supply planning areas and is formally included in the Lower East Coast Water Supply Plan. 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:

- The SFWMD and USACE will complete the construction of the C-43 West Basin Storage Reservoir and associated 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 Operating Manual by 2023.
- 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 LWC Planning Area, with approximately 35% of the 2020 PS demand met with fresh groundwater from the SAS, 15% from the IAS, and 50% with brackish groundwater from the FAS. This 2022 LWC Plan Update supports the use of reclaimed water for urban irrigation, thereby reducing demands on the potable water system and freshwater resources.

Surficial and Intermediate Aquifer Systems

Development of the SAS and IAS has been maximized in many areas due to the potential harm to water resources and related natural systems, saltwater intrusion, and impacts to existing legal users. At current use rates and locations, water levels in the SAS and IAS appear stable — although there are localized areas within Lee County where the Sandstone and Mid-Hawthorn aquifers are under stress. 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 and IAS 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 (USGS), 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 work with appropriate local governments to identify long-term sustainable water supply solutions in Domestic Self-Supply (DSS) areas that are currently or projected to experience aquifer stress.

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 LWC 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 aquifer properties and could support updates to future groundwater modeling efforts of the FAS.

- The monitoring networks used to assess the SAS, IAS, and FAS are a hybrid of regional monitoring by agencies, such as the SFWMD and USGS, 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.

Floridan Aquifer System Monitor Well

- 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.
- 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 overstressing production zones and to minimize harmful changes in water quality.
- The SFWMD will continue to work with FAS stakeholders and the Southwest Florida Water Management District to further refine assumptions and data used in groundwater 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 IAS with more saline water from the FAS.

Reclaimed Water


Reclaimed Water Piping

In the LWC Planning Area, reclaimed water has been an integral part of water supply for over three decades and 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 freshwater 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, road 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 LWC 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 for seasonal or longer-term drought resilience. 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 IAS wells.


Well Drilling Operation

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 Gulf of Mexico as an additional water source option for the LWC 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 2022 LWC 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 AG 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 USGS 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 utilities and counties 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 with the Southwest Florida Water Management District's planning efforts along the SFWMD boundaries.

CLIMATE CHANGE AND SEA LEVEL RISE

Climate change and sea level rise 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 and sea level rise adaptation strategies.
- Water users should periodically review irrigation schedules and consider installing weather-based controllers.
- PS utilities should plan for climate change and sea level rise by reducing withdrawals from the SAS and by using the IAS and 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 coordinate on resiliency efforts and development of 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 2022 LWC 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 C-43 West Basin Storage Reservoir and other ecosystem restoration projects.
- Completion of repairs to the Herbert Hoover Dike by the USACE and implementation of the new Lake Okeechobee System Operating Manual.

Successful implementation of this 2022 LWC Plan Update requires close coordination and collaboration with local and tribal governments, utilities, agricultural interests, and other stakeholders. This partnering should ensure water resources in the LWC 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.

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 with 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.

Seminole Tribe of Florida A federally recognized Indian Tribe organized pursuant to Section 16 of the Indian Reorganization Act of 1934 and recognized by the State of Florida pursuant to Chapter 285, Florida Statutes.

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.

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

Get the latest information from SFWMD

Learn more about water supply planning in South Florida by signing up for the District's emails.
Visit SFWMD.gov and click on ***"Subscribe for Email Updates."***

Connect with us on Facebook, Twitter, Instagram, LinkedIn and YouTube.

3301 Gun Club Road
West Palm Beach, FL 33406
SFWMD.gov