

Central Florida Water Initiative

Planning Document, Volume I



REGIONAL WATER SUPPLY PLAN 2015

A comprehensive plan for Orange,
Osceola, Polk, Seminole, and
southern Lake counties

This document is the Central Florida Water Initiative (CFWI) Regional Water Supply Plan (RWSP), Volume I, Planning Document. Staff from the South Florida Water Management District (SFWMD), St. Johns River Water Management District (SJRWMD), and Southwest Florida Water Management District (SWFWMD) worked together and in conjunction with members of various Central Florida Water Initiative technical teams and other stakeholders to generate the CFWI RWSP. Section 373.709, Florida Statutes (F.S.), details the components of regional water supply plans.

In November 2015, the respective governing boards of the three water management districts approved the 2015 CFWI RWSP, Volumes I and II with their associated appendices. These documents are available at cfwiwater.com.

Preface

CENTRAL FLORIDA WATER INITIATIVE

In Florida, the water management districts develop regional water supply plans to identify sustainable water supply for all water uses while protecting water resources and related natural systems. Through the Central Florida Water Initiative (CFWI), three water management districts — the St. Johns River Water Management District, South Florida Water Management District, and Southwest Florida Water Management District — are working collaboratively with other agencies and stakeholders to implement effective water resource planning, including water resource and supply development and management strategies to protect, conserve and restore our water resources. The CFWI Planning Area includes all of Orange, Osceola, Seminole, and Polk counties and southern Lake County. This effort used a unified process to address central Florida’s current and long-term water supply needs. The guiding principles of the CFWI as contained in the CFWI Guiding Document are

- ◆ Identify the sustainable quantities of traditional groundwater sources available for water supplies that can be used without causing unacceptable harm to the water resources and associated natural systems.
- ◆ Develop strategies to meet water demands that are in excess of the sustainable yield of existing traditional groundwater sources. Strategies include optimizing the use of existing groundwater sources, implementing demand management, and identifying alternative water supplies that can be permitted and will be implemented as demands approach the sustainable yield of existing sources.
- ◆ Establish consistent rules and regulations for the three water management districts that meet their collective goals, and implement the results of the Central Florida Water Initiative.

The goals of the CFWI, also contained in the CFWI Guiding Document, are one model, one uniform definition of harm, one reference condition, one process for permit reviews, one consistent process, where appropriate, to set MFLs and reservations, and one coordinated regional water supply plan, including any needed recovery and prevention strategies.

The work of the CFWI is captured in a series of documents that makeup the Regional Water Supply Plan. The following table summarizes the main types of information found in each document of the CFWI RWSP. Each of these documents is available from www.cfwiwater.com.

CFWI RWSP: Summary of Volume Contents

Volume I Regional Water Supply Plan (CFWI 2015b)	Volume IA Regional Water Supply Plan Appendices to Volume I (CFWI 2015c)	Volume II Regional Water Supply Plan: 2035 Water Resources Protection and Water Supply Strategies Plan (CFWI 2015d)	Volume IIA Regional Water Supply Plan Appendices to Volume II (CFWI 2015e)
<ul style="list-style-type: none"> • Introduction • Population and Water Demands • Resource Protection and Assessment Criteria • Evaluation of Water Resources • Water Conservation • Water Source Options • Water Supply Development • Water Resource Development • Funding for Water Supply and Water Resource Development Projects • Conclusion • Recommendations/Future Direction 	<ul style="list-style-type: none"> • Appendix A: Population and Water Demand Estimates • Appendix B: Proposed MFLs for Evaluating Groundwater Availability • Appendix C: Overview and Use of the ECFT Groundwater Model • Appendix C-I: Evaluation of Water Quality Degradation Potential in the CFWI Planning Area • Appendix D: Agricultural Best Management Practices (BMPs) • Appendix E: Reclaimed Water Use Inventory • Appendix F: Water Supply Project Options 	<ul style="list-style-type: none"> • Introduction • Water Conservation • Solutions Strategies Projects • Solutions Strategies Environmental Evaluation • Regulatory • Financial Assessment • Conclusions and Implementation Strategies 	<ul style="list-style-type: none"> • Appendix A: Conservation Projects, BMPs, and Programs • Appendix B: Cost Estimating Tool • Appendix C: Solutions Strategies Projects • Appendix D: Updated CFWI Water Supply Project Options • Appendix E: Solutions Strategies Modeling • Appendix F: Solutions Strategies Environmental Evaluations • Appendix G: Regulatory

These CFWI RWSP volumes were available for public review and comment from May 8 through August 17, 2015. A series of public meetings and workshops were also conducted during this period. Comments from the public and other stakeholders were received through a variety of forums including online through the web portal, by mail, at public meetings and workshops, or via email. These comments were compiled along with responses in the CFWI RWSP Comments and Responses Document (CFWI RWSP 2015f), including any resulting changes made to the documents.

Acknowledgements

The Central Florida Water Initiative recognizes and thanks the utilities, state agencies, and other stakeholders for their contributions, comments, advice, information, and assistance throughout the development of the Central Florida Water Initiative (CFWI) Regional Water Supply Plan (RWSP).

Furthermore, the St. Johns River Water Management District, the South Florida Water Management District, and the Southwest Florida Water Management District express their appreciation to all staff who contributed to the development and production of this collaborative regional plan.

For further information about this document, please visit cfwiwater.com.



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Executive Summary

In Florida, the water management districts develop regional water supply plans to identify sustainable water supply for all water uses while protecting water resources and related natural systems. This Central Florida Water Initiative (CFWI) Regional Water Supply Plan (RWSP), including the 2035 Water Resources Protection and Water Supply Strategies document (Solutions Strategies Volume II) was jointly developed by the St. Johns River Water Management District (SJRWMD), South Florida Water Management District (SFWMD), and Southwest Florida Water Management District (SWFWMD) (Districts) in coordination with the Florida Department of Environmental Protection (FDEP) and Florida Department of Agriculture and Consumer Services (FDACS) staff, representatives from utilities, agriculture, and industry, and included input from the public. The CFWI Planning Area is located in central Florida and consists of all of Orange, Osceola, Seminole, and Polk counties and southern Lake County, covering approximately 5,300 square miles. The planning area was based predominantly on the public supply utility service areas in the central Florida region where the boundaries of the three water management districts converge (CFWI RWSP, **Volume I, Figure 1**).

This CFWI RWSP is consistent with the water supply planning requirements of Chapter 373, Florida Statutes (F.S.). **Volume I** of the CFWI RWSP builds upon, and updates, previous water supply plans completed by each of the three Districts that include portions of the CFWI Planning Area. The CFWI RWSP **Volume I** planning effort focused on water demand estimations and projections, water resource assessments based in part on groundwater modeling, and on developing feasible water supply and water resource development options that will meet future water supply needs in a manner that sustains the water resources and related natural systems. **Volume II** of the CFWI RWSP (Solutions Strategies) supplements planning results completed in the CFWI RWSP **Volume I** planning effort to address future water supply needs of the region by evaluating water conservation options and regional alternatives to meet the water supply demand. The CFWI RWSP identifies programs and projects to ensure that adequate and sustainable water supplies are available to meet future water supply needs while protecting the environment and water resources. The CFWI RWSP is based on a planning horizon extending through 2035 and identifies water conservation measures, water supply project options, and water resource development project options.

This CFWI RWSP concluded that traditional groundwater resources alone cannot meet future water demands or currently permitted allocations without resulting in unacceptable impacts to water resources and related natural systems. Primary areas that appear to be more susceptible to the effects of groundwater withdrawals include the Wekiva Springs/River System, western Seminole County, western Orange County, southern Lake County, the Lake Wales Ridge, and the Upper Peace River Basin refer to **Volume II, Chapter 4, Figure 8**. The evaluations also indicate that expansion of withdrawals

associated with projected demands through 2035 will increase the existing areas of water resource stress within the CFWI Planning Area.

Total water demands by all water use categories are projected to increase from an average total water use of approximately 800 mgd to almost 1,100 mgd in 2035. In some areas, utilization of traditional groundwater is near, has already reached, and in some areas has exceeded the sustainable limits. Adverse impacts from withdrawals are already occurring in several areas. Based on the evaluation of groundwater availability, it was estimated that the CFWI Planning Area could potentially sustain an additional estimated 50 mgd of traditional groundwater use but coordinated management strategies will be needed (e.g., wellfield optimization, aquifer recharge and augmentation) to address unacceptable impacts. Additional traditional groundwater, beyond the 50 mgd, is bound by environmental constraints, along with regionally appropriate management and operational controls including additional mitigation will need to be carefully considered. Based on the 2035 demands, the resulting deficit is approximately 250 mgd.

Public water supply constitutes the largest water use in the region. The CFWI Planning Area is currently home to approximately 2.7 million people and supports a large tourist industry, significant agricultural industry, and a growing industrial and commercial sector. The area's population is projected to reach approximately 4.1 million by 2035, which is a 49 percent increase from the 2010 estimate. Agriculture represents the second largest water use in the region, with a projected acreage of 165,000 in 2035. Agricultural acreage is projected to decline within the central urban areas. In other portions of the CFWI Planning Area, industry trends indicate movement toward crop intensification. The CFWI Planning Area also encompasses extensive natural systems such as Green Swamp, Reedy Creek Swamp, Boggy Creek Swamp, Shingle Creek Swamp, the Kissimmee Chain of Lakes (the headwaters to the Kissimmee River), 16 springs, and numerous wetland and surface water bodies.

Current water sources in the CFWI Planning Area include groundwater (fresh and brackish), reclaimed water, surface water, and stormwater. Fresh groundwater sources (i.e., surficial, intermediate, and Floridan aquifers) are considered traditional water sources whereas nontraditional or alternative water sources include brackish groundwater, surface water, seawater, reclaimed water, and water stored in aquifer storage and recovery wells and reservoirs. The CFWI Planning Area has relied on traditional groundwater from the Floridan aquifer system as a primary water source for urban, agricultural, and industrial uses. In addition, over 90 percent of the treated wastewater in the region is reused (178 million gallons per day [mgd]) for landscape irrigation, industrial uses, groundwater recharge, and environmental enhancement.

Total average water use in the CFWI Planning Area is projected to increase from approximately 800 mgd in 2010 to about 1,100 mgd in 2035. This projected increase of approximately 300 mgd represents a total increase in water use of approximately 40 percent. Public supply is now and is projected to continue to be the largest use category in the CFWI Planning Area, and accounts for more than 70 percent of this total projected increase.

Previous central Florida planning efforts and SWFWMD water supply planning and assessment investigations [most notably in the Southern Water Use Caution Area (SWUCA)] have documented that the rate of groundwater withdrawal in certain areas of the CFWI Planning Area is either rapidly approaching, or has surpassed the maximum rate that can be sustained without causing harm or adverse impacts to the water resources and related natural systems.

With the need to have a single, unified tool to effectively evaluate water withdrawals and their associated effects on the water resources and natural systems, the United States Geological Survey was retained to develop an updated, calibrated version of the East Central Florida Transient groundwater flow model. Hydrologic modeling was performed and the results were used along with resource constraints and considerations to evaluate various water-use scenarios. The sustainable limits of groundwater withdrawals reported in this CFWI RWSP are used by the Districts for planning purposes only and should not be viewed as regulatory constraints for specific water use permits. Water use permitting decisions are made with additional information that is more site-specific and which may consider opportunities for water resource development, management strategies, and mitigation of impacts.

Minimum flows and levels (MFLs) have been established for 46 water bodies in the CFWI Planning Area. All 46 of these water bodies are located in the SJRWMD and SWFWMD portions of the CFWI Planning Area. The recent status assessment of MFLs as part of this CFWI RWSP identified 10 water bodies within the CFWI Planning Area that are currently below their established MFLs and an additional 15 water bodies that are projected to fall below their established MFLs within the planning horizon if projected demands were to come from traditional sources. In addition, the SWUCA Saltwater Intrusion Minimum Aquifer Level is not currently being met and water levels in regulatory monitoring wells in the Lake Wales Ridge area associated with the SWUCA Recovery Strategy are projected to not be met by 2035. The CFWI RWSP identifies general prevention and recovery strategies to ensure recovery to the established MFLs as soon as practicable or to prevent the flows and levels from falling below the established MFLs. Adverse impacts to wetlands from withdrawals are currently occurring in several areas and examination of modeled water levels in non-MFL wetlands and water bodies indicated that the number and extent of stressed wetlands are projected to increase in future scenarios. The existence of adverse impacts to wetlands has been documented through field work. Some wetland impacts are most probably the result of multiple factors, including groundwater withdrawals. In some cases, where the cause has been determined, mitigation measures have been implemented.

The risk of water quality change for select wellfields in the eastern portion of the CFWI Planning Area was evaluated as part of this CFWI RWSP. A total of six selected locations were identified through their water use permits as having a history of water quality issues in the production wells but these utilities have been able to maintain delivery of potable quality water through management of their wellfield operations. The evaluation demonstrated that some increased potential for risk of water quality changes but are manageable through wellfield operations.

To meet current and future water needs while protecting the environment and water resources, this CFWI RWSP identified water conservation efforts, groundwater withdrawal optimization, prevention and recovery strategies for targeted MFL water bodies, water supply project options, and water resource development project options.

Water conservation by all water use categories will continue to be a priority to meet the region's future water needs. While significant conservation efforts have been implemented in the CFWI Planning Area, additional conservation is critical. Initial evaluations estimated an additional 42 mgd could be saved with increased conservation efforts. During the Solutions Strategies phase, potential water savings through the implementation of public supply and agricultural best management practices was further evaluated; the water savings estimate was revised to meet or exceed 37 mgd in order to reflect the current levels of agricultural conservation (**Volume II, Chapter 2**). These water savings estimates are influenced by several factors including, but not limited to, voluntary consumer actions, level of conservation education and financial incentives, passive savings, and assumed participation rates in conservation best management practices. As part of the "Next Steps" it is anticipated that efforts will focus on evaluating options to accelerate and increase the implementation of conservation measures in the CFWI Planning Area.

Several sources of water and storage options were considered to address future water needs. The draft CFWI RWSP identified 142 potential water supply project options. Eight new water supply project options were identified during the Solutions Planning Phase, increasing the number of potential water supply project options to 150. The updated list includes 37 brackish/nontraditional groundwater, 87 reclaimed water, 17 surface water (increased from 15), 6 stormwater (new), and 3 management strategies project options. Cumulatively, the 150 water supply project options have the capacity to produce up to 505 mgd (approximately 334 mgd finished water) of additional water supply or water resource benefit, exceeding the estimated future need of 250 mgd. In addition, potentially 122 mgd of raw surface water may be available (see **Volume IIA, Appendix D**, for more detail).

Funding for the development of alternative water supplies is primarily the responsibility of water suppliers and users with potential funding assistance from the state of Florida and the Districts (**Volume I, Chapter 9**).

Although ample water supply project options (**Volume I, Chapter 7**) have been identified, it is not necessarily ensured that projected demands would be met in all places without unacceptable impacts, therefore it will be necessary to optimize groundwater withdrawals, and identify and implement a combination of water conservation and alternative water supply project options to adequately address the projected 2035 water needs.

Uncertainty is inherent in water resource analyses. The Districts considered major sources of uncertainty including water demand projections, groundwater and surface water models, climate variability, and water resource constraints. At a regional level, the best strategy for dealing with uncertainty is the implementation of increased water conservation and a suite of water supply sources and ample water supply project options. Water supply plans are

not self-implementing. Projects included in this CFWI RWSP are options from which local governments, utilities, and others may choose. There is no legal requirement for these project options to be implemented. Current permits and laws limit the scope of regulatory actions that can be taken to impose specific solutions on users. Budgetary constraints and uncertainties of both users and agencies also create hurdles to assuring specific solutions will be economically feasible and affordable.

The CFWI RWSP concludes that the future water demands of the CFWI Planning Area can be met through the 2035 planning horizon, while sustaining the water resources and related natural systems, with appropriate management, continued diversification of water supply sources, conservation, and implementation of the water supply and water resource development projects identified in this plan. Future challenges in water resource development and natural resource protection in the CFWI Planning Area require concerted efforts to monitor, implement management measures, characterize current hydrologic conditions, and project future conditions. Successful implementation of this CFWI RWSP requires close coordination and collaboration with other regional and local governments, utilities, and other water users. Public and private partnering can ensure that water resources in the CFWI Planning Area are appropriately managed.

In May 2014, the governing boards of the three water management districts acknowledged delivery of the Final Draft CFWI RWSP (**Volume I**). The governing boards chose to delay final agency action on the draft plan until the completion of the CFWI Solutions Planning Phase and Solutions Strategies document with any resulting changes or refinements.

The CFWI Solutions Planning Phase was established to address future water supply needs of the region by evaluating water conservation options and regional alternatives to meet the water supply demands identified in the CFWI RWSP. The Solutions Planning Phase also focused on developing the “Next Steps” necessary for CFWI region to meet the water supply needs and protect the environmental systems. The final work product is the CFWI 2035 Water Resources Protection and Water Supply Strategies document (Solutions Strategies), which is included as **Volume II** of this CFWI RWSP. The Solutions Strategies document provides relevant project information to further develop specific water supply project options through partnerships with water users. The document includes project cost estimates, potential sources of water, feasibility and permissibility analysis, and identification of governance structure options.

Some of the evaluations described in the Solutions Strategies, **Volume II**, represent different, refined, or expanded evaluations of certain aspects of the CFWI RWSP, **Volume I**. These evaluations were based on specific assumptions developed by the Districts and CFWI stakeholders to generate a potential implementation and funding scenario for a specific set of project options identified for the CFWI Planning Area. As a result, some of the results presented in the Solutions Strategies Appendices, **Volume IIA** (e.g., projections for future potential conservation) are not the same as the results presented in other sections of the CFWI RWSP, **Volume I**. These results are not inconsistent, but rather represent the results of two evaluations performed for different purposes.

NEXT STEPS

The Steering Committee identified eight “Next Steps” that are critical to achieve water resource sustainability in the CFWI Planning Area. The successful implementation of these “Next Steps” will require the continued commitment and collaboration by the Districts and stakeholders to initiate and achieve the key findings and recommendations of the CFWI RWSP (see **Volume II, Chapter 7** for more detail). The following actions will guide future water supply solutions and will help ensure that future water needs are met without resulting in unacceptable impacts to water resources and related natural systems.

Recommended actions for implementing the results of the CFWI Planning effort include the following steps:

- ◆ Implement Water Conservation Programs

Effective water conservation programs rely on the participation of local governments, residents, the agricultural community, and other users. Comprehensive conservation programs should be developed that include voluntary and incentive-based initiatives, research, education and outreach initiatives, and regulatory initiatives to achieve savings including prioritization of allocated funding to meet or exceed the estimated CFWI RWSP conservation savings.

These conservation programs should support participation at local, regional (CFWI Planning Area), and State levels. These programs could identify and secure funding, develop and implement comprehensive public education and outreach programs, identify and evaluate statewide clearinghouse options for public supply and agriculture, and work to enact water-conserving building codes. Other programs could develop consistent year-round irrigation rules, expand use of SMART irrigation controllers and soil moisture sensors, increase water use irrigation evaluations, expand cost-share programs for agricultural conservation, and support licensing of irrigation professionals.

- ◆ Develop Specific Prevention and Recovery Strategies

Prevention and recovery strategies are critical to the protection and recovery of natural systems. Districts should promptly complete MFL prevention and recovery strategies and continue to monitor, study, and evaluate non-MFL water bodies. As evaluations of stressed and threatened wetland systems are completed, management strategies and projects could be identified and implemented to mitigate for stressed and threatened wetland systems. District Governing Boards should consider using CFWI identified water supply project options and management strategies and support continued coordination among all appropriate stakeholders to achieve resource recovery and protection.

- ◆ Support Development and Implementation of Regional Project Solutions

Regional project solutions should maximize sustainable yields, while minimizing impacts. Proposed groundwater actions should include continuing to monitor, study, and evaluate the Upper and Lower Floridan aquifers for maximum sustainable yields. Regional analysis should continue to explore appropriate uses and users for reclaimed water, including the use of reclaimed water for natural system enhancement and recharge and indirect and direct potable reuse.

The opportunities for additional surface water storage, while continuing to ensure the environmental needs of surface water bodies are met, should continue to be explored. Stormwater projects should continue to be investigated for opportunities to provide natural system enhancement and recharge; optimize potential beneficial use of stormwater by evaluating existing drainage; and encourage coordination of watershed planning, water supply, water quality, natural systems restoration, and flood protection initiatives.

- ◆ Support Additional Alternative Water Supply Project Options

The Solutions Planning Phase focused on 16 regional, multi-jurisdictional project options from the 150 water supply project options identified in the CFWI RWSP (**Volume II, Appendix D**). These 150 water supply project options have the potential to generate significant water to meet future needs.

- ◆ Improve Water Resource Assessment Tools and Supporting Data

The East Central Florida Transient Model was used to simulate water withdrawals. Although the model was sufficient for this task, recommended model updates to support future modeling efforts will reduce model run times and improve modeling efficiency and accuracy. Some of the recommended model updates include expanding the model boundaries to incorporate the actual hydrologic boundaries and areas outside the CFWI Planning Area that could influence water levels within the area. Incorporating additional hydrologic and geohydrologic data, and more recent land use information will improve model accuracy. Implementation of the Data Management and Information Team's Five-Year Work Plan is necessary to collect critical hydrologic and environmental data for the region.

- ◆ Develop Options for Consistent Rules and Regulations

With the Solutions Planning Phase substantially complete, the Regulatory Team will continue to work on developing consistent rules and regulations that meet CFWI collaborative process goals and implement the results of the CFWI. Some proposals for consideration include matching the CFWI program's approach and regulatory tools to the problem; establishing performance measures and timetables; defining the role of regulation in achieving sustainability of water resources; implementing adaptive management; defining existing legal uses; appropriately apportioning

regulatory components of prevention and recovery among existing legal uses; and providing options for all projected reasonable-beneficial uses of water.

- ◆ Continued Communication and Outreach

CFWI is a collaborative process that depends on the active engagement and participation of the stakeholders. Communications will continue to be critical to keep all stakeholders informed and engaged as programs and projects develop.

- ◆ Identify Options for Future CFWI Framework to Support Implementation Strategies

Implementation of this plan relies on the continued collaboration among the responsible entities and appropriate agencies. Recommendations include evaluating potential institutional framework options to support and coordinate strategy implementation; annual reporting on the status of the projects and actions; and conducting a 5-year assessment and update of the 2015 CFWI RWSP.

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Acronyms and Abbreviations

AFSIRS	Agricultural Field Scale Irrigation Requirements Simulation
AGMOD	Agricultural Water Use Model
ASR	aquifer storage and recovery
AWEP	Agriculture Water Enhancement Program
AWS	alternative water supply
BEBR	University of Florida's Bureau of Economic and Business Research
BMPs	best management practices
CII	commercial/industrial/institutional
CERP	Comprehensive Everglades Restoration Plan
CFCA	Central Florida Coordination Area
CFI	Cooperative Funding Initiative
cfs	cubic feet per second
CFWI	Central Florida Water Initiative
CUP	consumptive use permit
DO	dissolved oxygen
DSS	domestic self-supply and small utility
DWSP	District Water Supply Plan
ECFT	East Central Florida Transient Groundwater Model
EDR	electrodialysis reversal
EMT	Environmental Measures Team
EOP	end of permit
EPA	United States Environmental Protection Agency
EQIP	Environmental Quality Incentive Program
F.A.C.	Florida Administrative Code

FARMS	Facilitating Agricultural Resource Management Systems
FAS	Floridan aquifer system
FASS	Florida Agricultural Statistics Service
FAWN	Florida Automated Weather Network
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
FEMA	Federal Emergency Management Agency
FFL	Florida-Friendly Landscaping™
FGBC	Florida Green Building Coalition
FGLP	Florida Green Lodging Program
FGUA	Florida Government Utility Authority
F.S.	Florida Statute
ft bls	feet below land surface
FWS	Florida Water Star SM
FY	Fiscal Year
GAT	Groundwater Assessment Team
GIS	Geographic Information System
gpcd	gallons per capita per day
gpd	gallons per day
gpdpp	gallons per person per day
gpm	gallons per minute
HAT	Hydrologic Assessment Team
IFAS	Institute of Food and Agricultural Services
IGCC	International Green Construction Code
KBWSP	Kissimmee Basin Water Supply Plan
KCOL	Kissimmee Chain of Lakes

LRA	landscape/recreational/aesthetic
LEED	Leadership in Energy and Environmental Design
LFA	Lower Floridan aquifer
M/D	mining/dewatering
MAC	minimal aquifer connection
MFL	Minimum Flows and Levels
MFLRT	Minimum Flows and Levels and Reservations Team
MFR	multi-family residential
mg/L	milligrams per liter
mgd	million gallons per day
MIL	mobile irrigation laboratory
MODFLOW	Modular groundwater flow model
ND	Not determined
NGVD	National Geodetic Vertical Datum of 1929
NRCS	Natural Resource Conservation Service
OCU	Orange County Utilities
OUC	Orlando Utility Commission
PRMRWSA	Peace River Manasota Regional Water Supply Authority
RCID	Reedy Creek Improvement District
RIB	Rapid Infiltration Basin
RO	reverse osmosis
RT	Regulatory Team
RWSP	Regional Water Supply Plan
SAS	Surficial aquifer system
SFR	single-family residential
SFWMD	South Florida Water Management District

SHA	significantly hydrologically altered
SJRWMD	St. Johns River Water Management District
SPT	Solutions Planning Team
STAG	State and Tribal Assistance Grants
Subgroup	Population and Water Demand Subgroup
SWFWMD	Southwest Florida Water Management District
SWIMAL	Saltwater Intrusion Minimum Aquifer Level
SWUCA	Southern Water Use Caution Area
TAZ	traffic analysis zone
TBW	Tampa Bay Water
TDS	total dissolved solids
TWA	Tohopekaliga Water Authority
UF	University of Florida
UFA	Upper Floridan aquifer
USACE	U.S. Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
Water CHAMPSM	Water Conservation Hotel and Motel Program
Water PRO	Water conservation program for restaurants
WaterSIP	Water Savings Incentive Program
WCCF	Water Cooperative of Central Florida
WPCG	Water Planning Coordination Group
WPSP	Water Protection and Sustainability Program
WRAP	Water Restoration Action Plan
WRD	Water Resource Development
WSIS	Water Supply Impact Study

WTP	water treatment plant
WWTP	wastewater treatment plant



Lake Joel – Kissimmee Chain of Lakes

1

Introduction

In Florida, the water management districts (Districts) develop regional water supply plans (RWSPs) to provide for current and future water needs while protecting Florida's water and natural resources. This RWSP assesses existing and projected water needs and water sources required to meet those needs through 2035 in the Central Florida Water Initiative (CFWI) Planning Area. This Planning Area is home to an extensive agricultural industry, large urban communities, active tourism industry, and valued ecosystems.

This plan is an update to portions of existing individual District's water supply plans that include the CFWI Planning Area. Current and projected populations, water demands for all use categories, evaluation of water resource impacts associated with water use, water resource and water supply project options, and related water supply planning information is presented in this document.

Regional water supply plans provide the following information:

- ◆ Water demand estimates and projections
- ◆ An evaluation of existing regional water resources
- ◆ Identification of water supply-related issues
- ◆ A discussion of current water source options to meet projected water demands
- ◆ Water resource and water supply development components, including funding strategies
- ◆ Recommendations for meeting projected demands in the region

This CFWI RWSP also includes a discussion of Minimum Flows and Levels (MFLs) established within the CFWI Planning Area, MFL recovery and prevention strategies where

TOPICS

- ◆ Statutory Requirements and Legal Framework
- ◆ Goal and Guiding Principles
- ◆ Description of the CFWI Planning Area
- ◆ Previous Planning Initiatives
- ◆ Water Resources in the CFWI Planning Area
- ◆ Water Supply Planning for the Next 20 Years

appropriate, water reservations adopted by rule, technical data, and supporting information.

Statutory Requirements and Legal Framework

The legal authority and requirements for water supply plans are primarily found in Chapter 373, F.S. Additional direction about water supply plans is provided in Chapters 163, 187, and 403, F.S. In 2005, legislative amendments strengthened the link between land use and water supply planning as well as created the Water Protection and Sustainability Program (WPSP).

The 2005 amendments tighten the connection between RWSPs and the potable water provisions contained within each local government's comprehensive plan. This portion of the law is designed to ensure that adequate potable water facilities are constructed and are concurrently available with new development. Water supply development projects must be identified and listed, thereby fostering better communications among water planners, local government planners, and local utilities.

The alternative water supply portion of this program is intended to reduce competition between users and natural systems for available water by encouraging the development of alternative water supplies. The WPSP provides annual state revenues and matching District funds to support the development of alternative water supplies by local governments, water supply authorities, and other water users.

It has been determined the CFWI Planning Area is appropriate for water supply planning pursuant to Section 373.036, F.S. The water supply planning region identified in this plan shall be considered a Water Resource Caution Area for the purposes of Section 403.064, F.S., and affected parties may challenge the designation pursuant to Section 120.569, F.S.

Goal and Guiding Principles

The goal for the CFWI RWSP is to ensure sufficient water supply sources and future projects to meet existing and future reasonable-beneficial uses during a 1-in-10 year drought condition through 2035 while sustaining water resources and related natural systems. This goal will be accomplished by

LAW/CODE

The governing board of each water management district shall conduct water supply planning for any water supply planning region within the district identified in the appropriate district water supply plan under Section 373.036, F.S., where it determines that existing sources of water are not adequate to supply water for all existing and future reasonable-beneficial uses and to sustain the water resources and related natural systems for the planning period. (Section 373.709(1), F.S.)

- ◆ Identifying the sustainable quantities of traditional groundwater sources available for water supplies that can be used without causing harm to the water resources and associated natural systems
- ◆ Identifying water conservation and alternative water supply development options to meet reasonable-beneficial water demands that are in excess of the sustainable yield of traditional groundwater sources
- ◆ Protecting and enhancing the environment, including the natural resource areas and systems identified by the Districts as well as any federal, state, and locally identified natural resource areas
- ◆ Providing information to support local government comprehensive plans
- ◆ Achieving compatibility and integration with other state and federal regional resource initiatives
- ◆ Establishing consistent regulatory programs to accomplish the above-listed goals

DESCRIPTION OF THE CFWI PLANNING AREA

History

The St. Johns River Water Management District (SJRWMD), South Florida Water Management District (SFWMD), and Southwest Florida Water Management District (SWFWMD) agreed in 2006 to a Central Florida Coordination Area (CFCA) Action Plan to address the short-term and long-term development of water supplies in the central Florida area, which included Orange, Osceola, Seminole, Polk, and southern Lake counties. The CFCA Action Plan consisted of two phases.

In Phase I, a framework was established to address short-term water resource issues. Phase I concluded in 2008, with interim water use regulations limiting groundwater withdrawals to projected 2013 demands and requiring development of alternative water supplies (AWS) to meet future needs. Because the SWFWMD had already adopted rules for its Southern Water Use Caution Area (SWUCA) that were as restrictive, if not more restrictive, than the CFCA rules, and Polk County has portions in both areas, only the portion of Polk County that is outside the SWUCA was subject to the CFCA rules. The interim CFCA rules sunsetted on December 31, 2012.

Phase II of the CFCA Action Plan began in 2009 with the primary objectives to establish new rules prior to the sunset date and to implement a long-term approach to water resource management in central Florida. This phase involved coordinated activities on a variety of issues including regional water supply planning; investigation and development of traditional and alternative water supply projects; assessment of environmental impacts and groundwater sustainability; and development of water use rules and permitting criteria. The CFWI was created, in part, to incorporate the CFCA Phase II process and broaden

membership to include local government, agriculture, and commercial interests and further emphasize public input.

Central Florida Water Initiative

A primary focus of the CFCA Phase II process was the development and calibration of a hydrologic groundwater flow model to determine the sustainability of groundwater supplies. Because of the complexity of the water resources assessment in the area, the need for additional data, and the desire to build a consensus among the Districts, Florida Department of Environmental Protection (FDEP), Florida Department of Agriculture and Consumer Services (FDACS), utility companies, local governments, and agricultural industry representatives from the area, the analysis was not completed prior to the sunset of the interim CFCA rule. As a result of the economic slowdown in central Florida, projected population and associated water demands grew more slowly than initially predicted. Therefore, the demand for additional water supply was delayed so it was no longer as critical to fast-track certain activities.

It was also agreed that a single RWSP for the area would be appropriate. Therefore, the executive directors of the Districts, in consultation with FDEP and stakeholder groups including public water suppliers, suspended the CFCA Phase II process, to allow for completion of a more robust technical analysis for the planning process. A coordinated effort to protect and restore, where necessary, the water resources of Central Florida remains a priority.

To address the limitations of the 2006 CFCA Action Plan schedule and yet fulfill the overarching objectives outlined in that plan, the CFWI was created in 2011. The CFWI is a collaborative effort among the Districts with other agencies and stakeholders to implement effective and consistent water resource planning, development, and management through the CFWI.

The CFWI builds on the previous work of the CFCA. As a result of the CFWI, the previous CFCA implementation schedule and goals were revised to accommodate additional investigative and collaborative efforts. An executive level Steering Committee was formed to direct the coordinated efforts of the CFWI.

Planning Area Description

The CFWI Planning Area is located in central Florida and consists of all of Orange, Osceola, Seminole, and Polk counties and southern Lake County (**Figure 1**), covering approximately 5,300 square miles. The CFWI Planning Area was based on the utility service areas in the central Florida region where the boundaries of the three Districts converge.

The area is characterized by 43 local and county governments with a growing population and substantial urban sector. The City of Orlando has the largest population in the CFWI Planning Area. However, the residential areas with the largest growth rates are north and

south of Orlando along the I-4 corridor and other major transportation routes. This area supports a large tourist industry and a growing industrial and commercial sector. Agricultural acreage is decreasing in the CFWI urban area. However, agricultural industry trends indicate a shift toward crop intensification on fewer acres, which could result in similar water demands rather than reductions.

Population and Water Demands

Overall, the water demand for all use categories in the CFWI Planning Area is expected to increase by approximately 40 percent from 800 mgd in 2010 to 1,100 mgd in 2035 for average rainfall conditions. The total population in CFWI Planning Area is projected to increase by approximately 49 percent from 2.7 million in 2010 to more than 4.1 million in 2035.

Public supply is the largest water use type in the area, serving an estimated population of 2.6 million people in 2010 (96% of total population). Public supply for the area is provided by 85 private and public utilities, each with a capacity of 0.1 mgd or more. These utilities provide potable water supply for residential, landscape, and industrial uses within the CFWI Planning Area. Public supply demand is projected to increase by approximately 50 percent from 435 mgd in 2010 to 654 mgd in 2035. In 2010, approximately 166,000 people received 20 mgd of water supply from domestic self-supply or small public suppliers (less than 0.1 mgd) and is expected to increase by approximately 20 percent by 2035 to 24 mgd.

Agriculture is the second largest water use type in the CFWI Planning Area. In 2010, there were approximately 152,000 irrigated agricultural acres, with an average water demand of 185 mgd. Agricultural demands are projected to increase only in Osceola County, while decreases are projected to occur in all other CFWI counties. Total irrigated agricultural acreage is expected to increase by about 9 percent to approximately 164,500 acres and average water demand is expected to increase by approximately 16 percent to 215 mgd by 2035.

Other categories of water use in the CFWI include commercial/industrial/institutional and mining/dewatering, power generation, and landscape/recreation/aesthetic categories. Additional information for these water use types can be found in **Chapter 2**.

Natural Features

The planning area contains the headwaters for seven river systems (Alafia, Hillsborough, Kissimmee, Ocklawaha, Peace, St. Johns, and Withlacoochee rivers). The planning area contains four distinct groundwater basins. There are approximately 1,200 square miles (782,000 acres) of wetlands and approximately 475 square miles (300,300 acres) of open water bodies (USFWS 2012) such as lakes. Regional wetlands systems include Green Swamp, Reedy Creek Swamp, Davenport Creek Swamp, Big Bend Swamp, Cat Island Swamp, Boggy Creek Swamp, and Shingle Creek Swamp. There are 16 first, second, and third magnitude springs in the region (FDEP 2004).

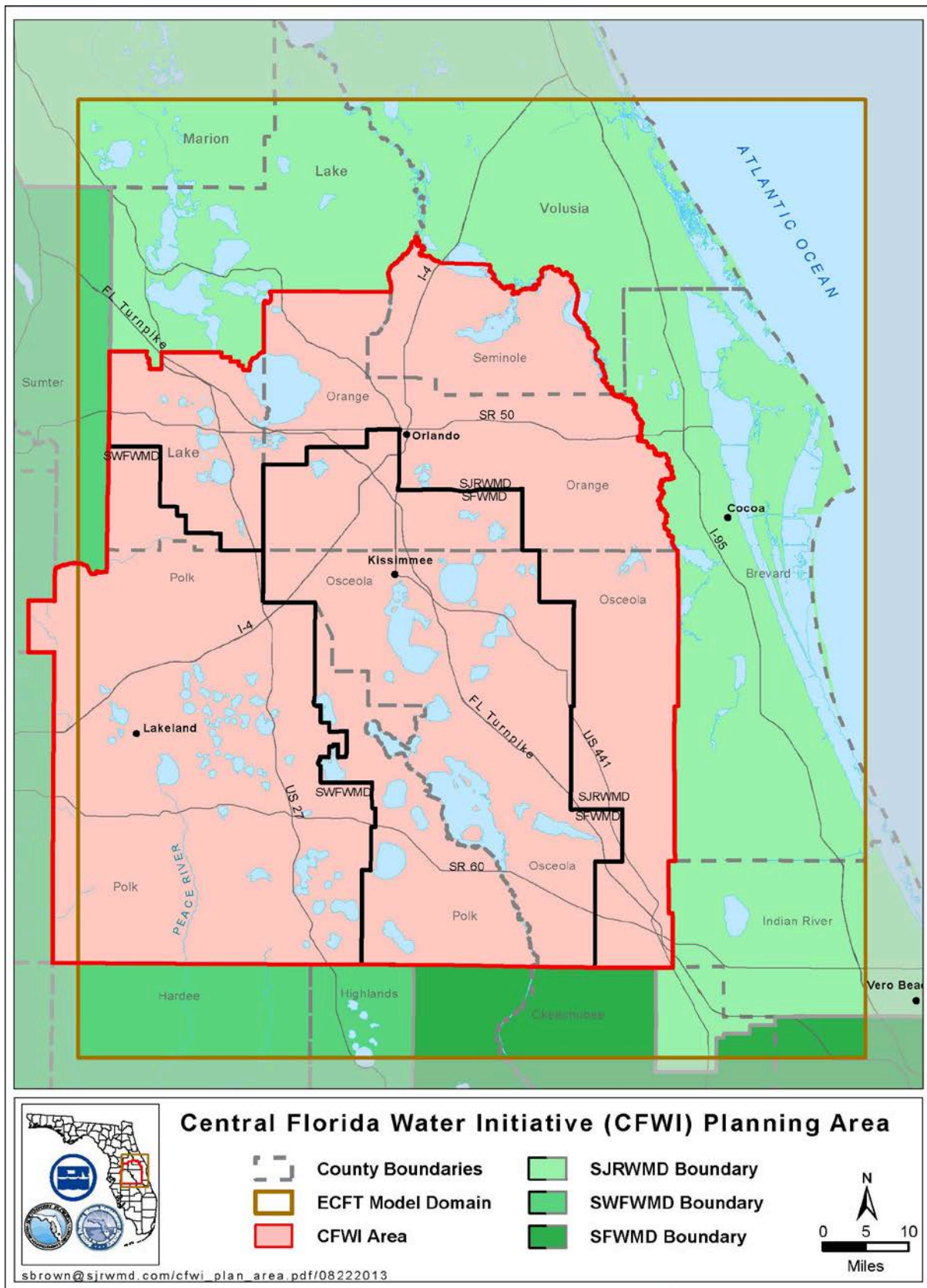


Figure 1. Map of the Central Florida Water Initiative (CFWI) Planning Area.

PREVIOUS PLANNING INITIATIVES

The boundaries of three Districts meet in the CFWI Planning Area. Each District has previously developed water supply plans that included their respective areas of the CFWI Planning Area. Below is a summary of previous water supply planning activities, findings, and recommendations by the individual Districts' water supply plans.

South Florida Water Management District

The portion of the SFWMD that falls in the CFWI Planning Area has been included in the Kissimmee Basin Water Supply Plan (KBWSP). The initial KBWSP was completed in 2000 (SFWMD 2000) and was updated in 2006 (2005-2006 KB Plan Update; SFWMD 2006a, 2006b). The 2005-2006 KB Plan Update supported the 2000 Kissimmee Basin Water Supply Plan's (2000 KB Plan) findings and recommendations, which called for development of alternative water sources to meet most of the region's future water supply needs through 2025. Fresh groundwater from the Floridan aquifer system and groundwater from the surficial aquifer system served the Kissimmee Basin (KB) Planning Area as traditional water sources (SFWMD 2006a). The 2005-2006 KB Plan Update concluded that increased conservation and the development of alternative water supplies were needed to meet water needs, as further development of traditional supplies becomes increasingly limited. The alternative water supply source options identified for the KB Planning Area included brackish groundwater; fresh surface water from the Kissimmee River and Chain of Lakes and associated tributaries; stormwater runoff collection and storage; and reclaimed water.

St. Johns River Water Management District

The SJRWMD historically developed one water supply plan for their entire District, including the Central Florida area. The initial SJRWMD RWSP was completed in 2000 and was updated in 2005 (SJRWMD 2005b); subsequent updates were completed annually from 2006 through 2009 with addenda (SJRWMD 2006a, 2007, 2008, 2009b). SJRWMD's water supply planning and assessment investigations have documented that the rate of withdrawal of groundwater in certain areas of SJRWMD is approaching the maximum sustainable rate that will cause unacceptable adverse impacts to the water resources and related natural systems. Previous plans generally placed this region in a water resource caution area.

To meet the future water use demands in the SJRWMD, the RWSP identified several water supply and water resource development options/projects. These included increased use of reclaimed water, development of brackish groundwater sources, surface water storage through reservoirs, and conservation (SJRWMD 2006a).

Southwest Florida Water Management District

The portion of the SWFWMD located within the CFWI Planning Area has been included in the Heartland Region, which is one of four planning regions of the SWFWMD RWSP. The 2010 Update for the Heartland Planning Region (SWFWMD 2011b) determined that water supply demands for all use categories can be met through 2030 with continued development of alternative water supply sources and conservation. The increase in water demand in the Heartland Planning Region from 2005 to 2030 was projected to be about 130 mgd. As of 2010, it was estimated that at least 16 percent of that demand (22 mgd) has either been met or will be met by projects that are under development. The remaining 108 mgd will be supplied by 41 mgd of unused groundwater quantities that have been permitted to utilities in Polk County, by 43 mgd of offset quantities of reclaimed water that will be available in the region by 2030, and up to 21 mgd through non-agricultural water conservation. An additional source includes reductions in agricultural, commercial/industrial/institutional and mining/dewatering, power generation, and groundwater use resulting from conservation measures and land-use transitions (SWFWMD 2010). Polk County may also be able to meet future demands from nontraditional sources such as surface water and LFA groundwater supplies within Polk County or from importation of water from supplies developed in cooperation with other regional entities outside of Polk County.

Preparation and Coordination with Partners

The CFWI RWSP was developed in an open, public process, in coordination and cooperation with the Districts, FDEP, FDACS, water supply authorities, local government utilities, agricultural and industrial communities, environmental organizations, and other interested parties. Coordination and public participation is critical to ensuring the water supply plan reflects the issues and concerns of stakeholders in the area. A variety of methods and forums were used to notify and solicit input from stakeholders to ensure the plan reflects the issues and concerns of the region.

Six public workshops were conducted during the CFWI RWSP development. Stakeholders representing a cross-section of interests in the region, including agricultural, industrial, environmental, utilities, local government planning departments, state and federal agencies, and the general public, were invited to attend the workshops. During the workshops, participants reviewed and provided comments regarding projected demands and other key plan elements. Water demand projections were coordinated through individual meetings with local government planning departments, utilities, and agricultural industry representatives. Participants also reviewed and provided input on water supply issues, the condition of regional water resources, water source options, and other key aspects of the CFWI RWSP drafts.

Meetings were held with stakeholders from interest groups. Presentations were made before the regional planning councils, advisory committees, professional organizations, and numerous city councils and county commissions. Affected parties were engaged in the

development of the CFWI RWSP by coordinating methods for projecting water demands and assisting with the identification of potential water supply project options. A CFWI RWSP web page was developed to disseminate information, provide draft documents, advertise all public meetings, and solicit comments from interested parties, including the general public. Input received from stakeholders and the public has been incorporated into this plan and will shape and guide water supply development in the CFWI Planning Area for years to come.

Linkage to Regional and Local Planning

The CFWI RWSP process is closely coordinated and linked to the water supply planning of local governments and utilities. Within 6 months following approval of the water supply plan, water management districts are required to notify each public supply utility of the projects identified in this CFWI RWSP for that utility to consider and incorporate into its corresponding local government required water supply facilities work plan in meeting future water demands.

In addition to these utility requirements, local governments are required to adopt water supply facilities work plans, covering at least a 10-year planning period, and related amendments to their comprehensive plans within 18 months following approval of the CFWI RWSP. The work plans contain information to update the comprehensive plan's capital improvements element, which outlines specifics about the need for, and the location of, public facilities, principles for construction, cost estimates, and a schedule of capital improvements. More detailed information on these requirements is contained in **Chapter 7**.

WATER RESOURCES IN THE CFWI PLANNING AREA

Water resources in the CFWI Planning Area include primarily groundwater (fresh and brackish), surface water, and reclaimed water.

Groundwater

Groundwater is supplied from the surficial, intermediate, and Floridan aquifer systems. The surficial aquifer system (SAS) is a shallow, unconfined aquifer that generally yields low quantities of water, and consists of mostly unconsolidated materials. The intermediate aquifer system (IAS) is confined and occurs within layers of sand and clay that, in most areas, separate the overlying surficial aquifer from the underlying Floridan aquifer system. The intermediate aquifer also acts predominantly as a confining layer for the underlying Floridan aquifer system. Due to the makeup of the sediments in this aquifer system it does not produce large quantities of water. The Floridan aquifer system (FAS) is a semi-confined aquifer and is capable of producing large amounts of water. The FAS is composed of sequential layers of limestone and dolomite and is traditionally subdivided into the upper and lower aquifers, which are separated by less productive horizons called the middle

confining unit. The FAS has historically been the primary source of water supply throughout the region.

Declines in groundwater levels, spring flows, river flows, lake levels, and wetlands, as well as increases in groundwater chloride concentrations, have occurred in the CFWI Planning Area. Therefore, alternatives to traditional groundwater need to be developed and implemented to meet the region's growing demands. Nontraditional or AWS sources are presented and described in **Chapter 6**. These sources include reclaimed water, brackish groundwater, surface water, seawater, and stormwater. Aquifer storage and recovery (ASR) systems have great potential to maximize the storage and utilization of surface water and reclaimed water by using the Floridan aquifer to store excess water for retrieval later as needed. Conservation measures by all users will continue to have an important role in managing increasing water demands and enabling water supply systems to support more users.

The Lower Floridan aquifer (LFA) has the potential to be a source of additional water in the CFWI Planning Area, and a number of studies are in progress to evaluate this potential source. However, limited water quality data exists within the LFA and our understanding of the potential local and regional impacts that could result from LFA pumping in areas of the region have not historically utilized this source. Studies should address these concerns prior to the LFA becoming a major source of additional water in areas lacking sufficient data.

Surface Water

The CFWI Planning Area has hundreds of lakes, including the interconnected Alligator and Kissimmee Chains of Lakes, and several major rivers including the St. Johns, Ocklawaha, Peace, Kissimmee, and Withlacoochee. Despite the abundance of surface water features in the region, a relatively small amount is currently withdrawn for public supply or other uses. Lakes, rivers, and creeks in the CFWI Planning Area support significant ecological resources, which must be protected from harmful impacts of any proposed withdrawals or capture of flows from these systems. Capturing flows from these surface water bodies for water supply, particularly to support conjunctive use projects, may be effective but can be expected to have varying levels of reliability, depending on climatic conditions.

Reclaimed Water

Utilities within the CFWI Planning Area are leaders in developing reclaimed water systems, reusing over 90 percent of all domestic wastewater flows within the region (**Volume IA, Appendix E, Table E-1**). Currently, 178 mgd of the 193 mgd of treated wastewater generated is reused for beneficial purposes, including groundwater recharge, agricultural irrigation, environmental restoration, public access irrigation, and cooling water at power generation facilities. Reclaimed water has played a critical role in meeting the current water needs in this region and will continue to support those water needs through 2035.

WATER SUPPLY PLANNING FOR THE NEXT 20 YEARS

Chapter 2 presents the population and water demand projections by water use category through 2035. The total population and total water demands in the CFWI Planning Area are projected to increase by approximately 49 and 40 percent, respectively. The projected water supply to meet the projected demand will come from a combination of traditional and alternative water supply sources.

The CFWI RWSP will be updated every five years as directed by Rule 62-40.531, F.A.C. Each update will address any changes in the economy, growth trends, water usage, water resource and natural systems, and water supply development progress. These updates will reflect changes in the demand estimates and projections while coordinating with the Districts' Consumptive Use Permitting Programs and incorporating changes to local governments' water supply facilities work plans.

NAVIGATE

The CFWI Regional Water Supply Plan (RWSP) consists of this Planning Document (Volume I) and Appendices (Volume IA). These documents are available from CFWIwater.com.



Wekiva River

2

Population and Water Demands

This chapter summarizes the comprehensive analysis of the demand for water for all use categories in the Central Florida Water Initiative (CFWI) Planning Area for the 2010 to 2035 planning period. This chapter describes the methods and assumptions used by the three Districts in projecting water demand for each county within their jurisdiction. SJRWMD and SWFWMD methods, assumptions, and water demand projections were developed in the most recent water supply plans and were vetted during a public input process. As part of the efforts to prepare a single regional water supply plan (RWSP) and to achieve consistency for the CFWI Planning Area, a Population and Water Demand Subgroup (Demand Subgroup) was formed to review and update population and water demand projections for the CFWI Planning Area. The Demand Subgroup consisted of SFWMD, SJRWMD, SWFWMD, Florida Department of Environmental Protection (FDEP), and Florida Department of Agriculture and Consumer Services (FDACS) staff, as well as utility and agricultural industry representatives from the CFWI Planning Area. The water demand projections are provided in five-year increments and include a discussion of important trends in demands. The water

demand projections are to be updated at least once every five years commensurate with this CFWI RWSP pursuant to Rule 62-40.531, F.A.C. The guidance for development of population and demand projections for the CFWI RWSP is provided in Subsection 373.709(2), F.S. and Rule 62-40.531, F.A.C., which describe the minimum requirements for developing demand projections for regional water supply plans. In addition, general reporting conventions and calculations for drought condition (1-in-10 year) for the CFWI

TOPICS

Water Demand Categories

- Public Supply
- Domestic Self-supply
- Agriculture
- Commercial/Industrial/Institutional and Mining/Dewatering (CII and MD)
- Power Generation
- Landscape/Recreational/Aesthetic (LRA)

LAW/CODE

The plan shall be based on at least a 20-year planning period, shall be developed and revised in cooperation with other agencies, regional water supply authorities, units of government, and interested parties, and shall be updated at least once every 5 years (Subsection 373.036(2)(a), F.S.).

RWSP were guided by the documents developed by the Water Planning Coordination Group (WPCG) comprised of staff from FDEP and each of the state's five water management districts (WDPS 1998a, 1998b).

DEMAND ESTIMATES AND PROJECTIONS

Water demands for the public supply, domestic self-supply and small utility, agricultural, commercial/industrial/institutional and mining/dewatering, power generation, and landscape/recreational/aesthetic categories have been projected for each county in the CFWI Planning Area for the years 2010 through 2035. The 2010 water demand values used in this CFWI RWSP are planning projections. The projections were provided by each District based on their water supply planning efforts at the time the CFWI water supply planning began. Because the 2010 numbers are projections, they will not reflect the reported water use values for 2010. The methodologies used by each District to project demands vary for each water use category and are summarized in this chapter. The various methodologies used to project demands are described in more detail in **Volume IA, Appendix A**.

The water demand projections represent those reasonable-beneficial uses of water that are anticipated through the year 2035. Average condition (5-in-10 year) and drought condition (1-in-10 year) demands have been estimated in five-year intervals from 2010 to 2035 for each category. The water demand projections for Lake County reflect only the anticipated demands within the portion of the county in the CFWI Planning Area. Projections for the City of Cocoa are included in the CFWI RWSP, as the utility's water supplies are located within the CFWI Planning Area.

Estimated demand projections for each water use category are intended for planning purposes and do not include potential reductions that could be achieved by additional demand management measures. The use of water conservation and water supply sources to meet water demands are described in **Chapters 5 and 6**.

NAVIGATE

Chapter 5 describes potential conservation-related water use reduction methods.

Chapter 6 describes options for diversifying water supply sources.

Public Supply

The public supply category consists of utilities that have permitted average water use thresholds equal to or greater than 0.1 million gallons per day (mgd).



Potable Water Pump Station Large Diameter Water Main

Methodology for Projecting Population

The population projections developed by the University of Florida's Bureau of Economic and Business Research (BEBR) are generally accepted as the standard throughout Florida. In developing RWSPs, the Districts must consider BEBR medium population projections. [Section 373.709(2)(a)(1)(a), F.S.]. These projections are made at the county level only and require specific methods to distribute the county level projections among utility service providers.

SJRWMD and SWFWMD use a proprietary model that projects future permanent population growth at the census block level, distributes that growth based on growth drivers and inhibitors to parcels within each block, and normalizes those projections to BEBR Medium county projections. These methods are described in published reports (Doty 2009a, 2009b, 2011). For SJRWMD, the City of Cocoa, Seminole County, and the portions of Lake, Orange

(including all of Orange County Utilities (OCU) and Orlando Utilities Commission (OUC)), and Osceola counties located in SJRWMD were included in the model. For SWFWMD, the portions of Lake and Polk counties located in SWFWMD were included in the model. The SJRWMD and SWFWMD methodologies are described in **Volume IA, Appendix A**.

The SFWMD coordinates with public supply utilities to prepare a currently served and future service area maps, distribute current population to the traffic analysis zone (TAZ) boundary level, distribute BEBR Medium county projections using a percent share method, and coordinate with utilities to understand their planned future growth, adjust growth rates, and establish projections. The SFWMD projection area included the portions of Orange (excluding OCU and OUC), Osceola, and Polk counties located in SFWMD. The SFWMD methodology is described in **Volume IA, Appendix A**.

The original 2010 population projections of each District were updated to reflect 2011 published BEBR Medium permanent resident population projections, current service area boundaries, and 2006 to 2010 five-year average gross per capita rates (Smith and Rayer 2011).

Population Projections

Table 1 shows the projected public supply population for the planning period from 2010 to 2035. The permanent population in the CFWI Planning Area is expected to increase by 1,315,124 or 51 percent. Population projections for each utility can be found in **Volume IA, Appendix A, Table A-1**.

Table 1. Public supply population projections for the CFWI Planning Area.

County / City	Permanent Resident Population Projections						2010-2035 Change	2010-2035 Percent Change
	2010	2015	2020	2025	2030	2035		
City of Cocoa	173,445	183,644	194,956	205,230	215,019	224,781	51,336	30%
Lake	130,229	149,914	171,722	193,880	216,532	237,314	107,085	82%
Orange	1,127,098	1,235,208	1,362,603	1,485,046	1,600,443	1,707,286	580,188	51%
Osceola	202,198	253,108	303,718	354,661	405,938	453,751	251,553	124%
Polk	547,344	592,082	644,124	695,952	744,727	789,760	242,416	44%
Seminole	410,787	432,451	457,116	473,558	485,070	493,333	82,546	20%
Total	2,591,101	2,846,407	3,134,239	3,408,327	3,667,729	3,906,225	1,315,124	51%

Methodology for Water Demand Projections

Public supply use for each utility was derived by multiplying its average 2006 to 2010 unadjusted gross per capita rate by its projected population for that five-year increment shown in **Table 1**. Population served and water use data used to calculate the average gross per capita for each utility were derived from the Estimated Water Use Reports (Jackson and White 2012; Nourani and Antoine 2008, 2009; Nourani and Bader 2009; Scott and White

2011), Annual Water Use Data Reports (Hornsby 2007, 2008; SJRWMD 2009, 2010, 2011), and FDEP Monthly Operating Reports. These per capita data had been previously collected and analyzed by the Districts or from data provided as part of the Districts' most recent water supply planning process.

Water Demand Projections

Table 2 shows the projected public supply demand (unadjusted for additional conservation) for the planning period from 2010 to 2035. Water demand in the CFWI Planning Area is expected to increase by 218.31 mgd or 50 percent for the average year (5-in-10 year) condition. Demand projections for each utility are presented in **Volume IA, Appendix A, Table A-1**.

Table 2. Public supply water demand projections (mgd) for the CFWI Planning Area.

County / City	Water Demand Projections (5-in-10)						2035 1-in-10 Demand	2010-2035 (5-in-10) Change	2010-2035 (5-in-10) Percent Change
	2010	2015	2020	2025	2030	2035			
City of Cocoa	23.76	25.16	26.71	28.12	29.46	30.79	32.64	7.03	30%
Lake	29.08	33.39	38.51	43.79	48.85	53.25	56.45	24.17	83%
Orange	201.84	219.18	241.11	262.41	281.43	297.66	315.53	95.82	47%
Osceola	38.05	46.43	54.93	63.81	73.12	81.83	86.74	43.78	115%
Polk	80.65	87.20	94.75	102.24	109.28	115.71	122.65	35.06	43%
Seminole	62.65	65.92	69.56	72.06	73.80	75.10	79.60	12.45	20%
Total	436.03	477.28	525.57	572.43	615.94	654.34	693.61	218.31	50%

Note: mgd = million gallons per day

Considerations

The Subgroup used the best available data for determining public supply needs. SJRWMD has not updated model inputs, other than developments of regional impact, since 2006. The BEBR Medium projections capture the projected CFWI Planning Area rate of growth for the permanent population. However, using the permanent population may not, for some utilities, incorporate some of the important demand drivers inherent to public supply service areas, such as seasonal population, short-term rental population, or tourist population. The Subgroup created a scenario for the public supply utilities which involved updating their respective existing population projections proportionally by county based on the BEBR High population projections published in 2011 (Smith and Rayer 2011). The results from this scenario can be found in **Volume IA, Appendix A, Tables A-9 to A-16**. The projected population and projected demand for the region in 2035 has the potential to be 15 percent and 14 percent higher, respectively (**Table A-15**).

The use of gross per capita rates is nationally recognized as standard methodology for water supply planning. However, this practice assumes that past water use is predictive of

future water use and incorporates the current economic conditions and current rates of reclaimed water use and water conservation into the future projections. Factors such as conservation, less landscape irrigation with potable water, and increases in multifamily housing can decrease the gross per capita rates. Conversely, expanded tourism and other commercial development, larger irrigated lots, and increases in single-family housing can increase the gross per capita rates. Factors affecting gross per capita rates and public supply water demands will be captured during future water supply plan updates.

The data used to calculate the Districts' most recent five-year average gross per capita is a combination of FDEP's monthly operating report data and metered data. Although both are valid methodologies, they may produce differing results.

Domestic Self-supply and Small Utility

The domestic self-supply and small utility (DSS) category consists of two subcategories: (1) small utilities that have permitted or annual average water use thresholds below 0.1 mgd, and (2) domestic self-supply (individual private homes or businesses that are not utility customers and receive their water from wells that do not require a consumptive use permit). The population and water demand projections for the DSS category include estimates for both subcategories.

Methodology for Projecting Population

The DSS population projections are calculated as the difference between the total BEBR Medium county projections (Smith and Rayer 2011) and the population projections estimated for utility service areas.

Population Projections

Table 3 shows the projected DSS population for the planning period from 2010 to 2035. The population in the CFWI Planning Area is expected to increase by 47,837 or 29 percent. Although the overall DSS population in the CFWI Planning Area is projected to increase, there are counties in which the DSS population is expected to decrease. This is a result of the expansion of public supply systems and the conversion of DSS residents to a public supply system. Population projections are presented in **Volume IA, Appendix A, Table A-3**.

Table 3. Domestic self-supply population projections for the CFWI Planning Area.

County	Population Projections						2010-2035 Change	2010-2035 Percent Change
	2010	2015	2020	2025	2030	2035		
Lake	13,486	15,950	17,789	20,445	23,190	25,080	11,594	86%
Orange	18,858	16,792	14,997	13,554	12,157	10,414	-8,444	-45%
Osceola	66,487	57,292	54,082	49,339	42,062	35,249	-31,238	-47%
Polk	54,751	62,518	69,776	76,348	83,773	91,940	37,189	68%
Seminole	11,931	12,849	15,084	24,642	37,230	50,667	38,736	325%
Total	165,513	165,401	171,728	184,328	198,412	213,350	47,837	29%

Methodology for Water Demand Projections

The per capita rate for the DSS category was derived by multiplying the average 2006 to 2010 county residential per capita rate by the projected DSS population for each county. The water use data used were the same as described in the public supply category.

Water Demand Projections

Table 4 shows the projected DSS demand for the planning period from 2010 to 2035. Demand in the CFWI Planning Area is expected to increase by 4.06 mgd or 20 percent for the average year (5-in-10) condition. Demand projections are presented in **Volume IA, Appendix A, Table A-3**.

Table 4. Domestic self-supply water demand (mgd) projections for the CFWI Planning Area.

County	Water Demand Projections						2035 1-in-10 Demand	2010-2035 (5-in-10) Change	2010-2035 (5-in-10) Percent Change
	2010	2015	2020	2025	2030	2035			
Lake	1.75	2.09	2.34	2.71	3.09	3.35	3.55	1.60	91%
Orange	2.37	2.15	1.96	1.80	1.64	1.46	1.55	-0.91	-38%
Osceola	8.80	7.56	7.13	6.50	5.55	4.66	4.94	-4.14	-47%
Polk	6.29	7.16	7.84	8.43	9.10	9.83	10.42	3.54	56%
Seminole	1.15	1.26	1.48	2.48	3.75	5.12	5.43	3.97	345%
Total	20.36	20.22	20.75	21.92	23.13	24.42	25.89	4.06	20%

Note: mgd = million gallons per day

Considerations

DSS water use is typically not metered, thus estimates of future demand are based on reasonable assumptions of water use. If these assumptions are incorrect, the resulting demand could be either higher or lower than anticipated. This limitation is expected to have little impact on estimating total water use in the CFWI Planning Area as any estimate of increased residential water demand will be either captured by this category or by the public supply category.

Agriculture

Agriculture is the second largest category of water use in the CFWI Planning Area. This category includes the self-supplied irrigation of crops and other miscellaneous water uses associated with agricultural production. Irrigated acreage and projected water demands were determined for a variety of crop categories, such as citrus, vegetables, melons, berries, field crops, greenhouse/nursery, sod, and pasture.



Field Crop - Broccoli

In addition, only SFWMD and SWFWMD included projected demands associated with other agriculture, such as aquaculture, dairy/cattle, poultry, and swine, which are reported as miscellaneous type uses.

Methodology for Acreage Projections

Each District calculated agricultural acreage projections for crop types using their standard methodology. The methodologies are comprehensively described in published reports (SFWMD 2010; Doty 2011; SWFWMD 2011c) and briefly summarized below.

Acreage projections for the portions of Orange, Osceola, and Polk counties in SFWMD were formulated based on a cumulative review of the information through geographic information system (GIS)/permitting analysis, analysis of historical Florida Agricultural Statistics Service (FASS) data, market trends, agricultural agency and stakeholder input, and other sources. SFWMD combined land use/land cover information from 2005 aerial photography with a GIS analysis to create a baseline of existing acreage.

Acreage projections for Seminole County and the portions of Lake and Orange counties located in SJRWMD were based on the existing 2005 agricultural spatial layer and the acres projected to intersect with population growth developed by the proprietary model discussed in the public supply section. For the portion of Osceola County in SJRWMD, the 2010 agricultural acreage was determined based on data received from county extension agents (University of Florida [UF]/ Institute of Food and Agricultural Science [IFAS]) (UF/IFAS). For each subsequent 5-year increment in the planning horizon, the percent change from 2002 to 2007 in acreage for farms with irrigated acres in Osceola County based on FASS data was applied.

Acreage projections for the portions of Lake and Polk counties in SWFWMD were formulated using a base year of 2005 and based on analyses of GIS, permitting data, analysis of historical FASS data, and other sources. SWFWMD's GIS resources were used to compare the agricultural water use permitting information and land use/land cover property appraiser parcel data for each county and to record the future land use for each parcel and permitted area. Aerial photography provided another layer of information for land use/land cover analysis and commodity category determination.

Acreage Projections

Table 5 shows the projected agricultural acreage in the CFWI Planning Area for the planning period. Agricultural acreage is expected to increase by 12,894 acres or 9 percent from 2010-2035. The majority of this increase is related to the production of energy crops in Osceola County. Agricultural acreage and demand is projected to decrease in other counties because of projected population growth, the conversion of agricultural lands to residential, commercial or industrial use, and the influence of agricultural market trends in the region. Acreage projections by county, District, and crop type can be found in **Volume IA, Appendix A, Tables A-17 through A-19**.

Table 5. Agricultural acreage projections for the CFWI Planning Area.

County	Total Acreage Projected						2010-2035 Change	2010-2035 Percent Change
	2010	2015	2020	2025	2030	2035		
Lake	17,275	16,776	16,276	15,776	15,278	14,782	-2,493	-14%
Orange	12,748	10,501	9,218	8,043	7,306	5,895	-6,853	-54%
Osceola	28,393	52,030	52,543	53,176	54,161	54,773	26,380	93%
Polk	88,614	88,142	88,026	87,910	87,794	87,677	-937	-1%
Seminole	4,591	3,950	3,310	2,669	2,029	1,388	-3,203	-70%
Total	151,621	171,399	169,373	167,574	166,568	164,515	12,894	9%

Methodology for Water Demand Projections

The Districts calculated average demand projections for irrigated commodities using different methodologies. SFWMD and SWFWMD determined demands (for the respective areas as noted above) by multiplying projected irrigated acreage by the irrigation requirements of each crop type (based on Agricultural Field Scale Irrigation Requirements Simulation (AFSIRS) and Agricultural Water Use Model (AGMOD), respectively). For the portions of Lake, Orange, and Seminole counties in SJRWMD, demands were determined by multiplying the percentage change in agricultural acreage (2005 to 2035) by the 2005 agricultural self-supply water use as reported in the Annual Water Use Data Report (SJRWMD 2005a). Demand projections for the portion of Osceola County in SJRWMD were determined by multiplying projected irrigated acreage by the irrigation requirements of each crop type (based on Modified Blaney-Criddle). The estimates for miscellaneous type

uses, such as aquaculture, equestrian, dairy/cattle, poultry, and swine are based on regulatory data or a per head water use rate.

Water Demand Projections

Table 6 shows the projected agricultural demand for the planning period from 2010 to 2035. Overall, CFWI Planning Area agricultural average demands are expected to increase by 29.60 mgd or 16 percent by 2035. Agricultural demands are projected to increase in Osceola County, while decreases are projected to occur in all other counties. Agricultural demand projections by crop type and for miscellaneous uses can be found in **Volume IA, Appendix A, Tables A-17 to A-19**.

Table 6. Agricultural water demand (mgd) projections for the CFWI Planning Area.

County	Water Demand Projections						2035 1-in-10 Demand	2010-2035 (5-in-10) Change	2010-2035 (5-in-10) Percent Change
	2010	2015	2020	2025	2030	2035			
Lake	11.17	10.83	10.38	10.04	9.70	9.35	13.62	-1.82	-16%
Orange	17.21	15.44	13.66	11.86	10.09	8.30	13.32	-8.91	-52%
Osceola	53.75	91.03	93.00	95.27	97.87	100.83	160.15	47.08	88%
Polk	95.75	95.14	94.89	94.64	94.38	94.13	130.69	-1.62	-2%
Seminole	7.36	6.34	5.31	4.28	3.26	2.23	3.40	-5.13	-70%
Total	185.24	218.78	217.24	216.09	215.30	214.84	321.18	29.60	16%

Note: mgd = million gallons per day

Considerations

Agricultural acreages and water demands are difficult to predict because they depend upon the choices individual agricultural producers make from year to year. Those choices are affected by numerous factors, including weather, markets, disease, proprietary information, and demand for agricultural land for other uses. SJRWMD and SWFWMD projections were based on existing respective water supply plans that relied on BEBR population projections that project continued population growth and development, and corresponding declines in agricultural acreage and water use (Smith 2008, 2009). Agricultural projections can be volatile and it is uncertain how population changes/future land use conversions may affect them.

The Districts each use different methods and land use coverages for projecting acreage and water demands. In 2013, Chapter 373.709, F.S. was amended to provide that for future water supply plans, the FDACS provide data indicative of future Agriculture Self-Supply water demands. Any adjustments of or deviation from the data provided by FDACS must be described and presented along with the original data.

As stated earlier in the chapter, the 2010 data are based on projections. This resulted in inconsistencies between data in the plan and data that are now available. For example, 2010 water use data show increases in agricultural water use from 2005 to 2010 for some counties in the CFWI Planning Area. However, this CFWI RWSP projects decreases for those counties in 2010 and throughout the planning period. In addition, the 2010 water use data indicate that the acreage for some crops (e.g., blueberries) expanded rapidly from 2005 to 2010; however, this expansion is not reflected in the plan.

It is difficult to project acreage and water use demands for crops that are relatively new or expanding rapidly because there are limited data available upon which to base projections. Biofuel feedstocks and blueberries could potentially have increased acreage during the planning period, resulting in increased agricultural water demands. The single biofuel feedstock project included in this CFWI RWSP suggests that biofuel feedstock production can significantly increase agricultural water demands in the future. Although central Florida accounts for 35 percent of the state's blueberry acreage and has been identified as an area with potential for expansion in the future (UF/IFAS 2012), this plan does not project any increased acreage for blueberry production.

Agricultural demand projections used in the CFWI planning process generally assume that agricultural water use will change in direct proportion to changes in acreage. However, increased agricultural water use also can occur when the number of acres remains constant or even declines if more intensive crop production methods are used. Double or triple cropping and converting to more water intensive crops are examples of production changes that could result in increased water use per irrigated acre. The CFWI projections did not consider uses proposed in pending water use permit applications because of the uncertainty inherent in the permit application process. In addition, the SFWMD projections include no irrigated pasture acreage and any future demands associated with conversion of these acres are not included in the CFWI planning process.

Commercial/Industrial/Institutional and Mining/Dewatering

This category represents the self-supplied water use associated with the production of goods or provisions of services by commercial, industrial, and institutional (CII) establishments. This category also includes the use of water associated with mining and long-term dewatering operations (MD). Commercial uses include general businesses, office complexes, commercial cooling and heating, bottled water, food and beverage processing restaurants, gas stations, hotels, car washes, laundromats, and water used in zoos, theme parks, waterslides, and other attractions. Industrial uses include manufacturing and chemical processing plants and other industrial facilities; spraying water for dust control; maintenance, cleaning, and washing of structures and mobile equipment; and the washing of streets, driveways, sidewalks, and similar areas. Institutional uses include hospitals, group home / assisted living facilities, churches, prisons, schools, universities, military bases, and other types of institutions. Mining uses include water associated with the extraction, transport, and processing of subsurface materials and minerals. Dewatering includes the removal of water to control surface or groundwater levels during construction

or excavation activities. Short-term dewatering activities and landscape irrigation of the property around the CII facilities in SFWMD are not included in this category.

Methodology for Water Demand Projections

For SJRWMD and SWFWMD, water demand for the CII and MD category incorporated historical water use trends, percent of historical permitted water use, and trends in population growth. For SFWMD, CII and MD water demand is derived from the District's water use permitting database and, where available, reported water use. The methodologies are described in published reports (SFWMD 2012; Doty 2011; SWFWMD 2011c). This type of water demand was not found to vary significantly during drought conditions (1-in-10 year); therefore, the average and 1-in-10 demands are the same.

Water Demand Projections

Water demand by the CII and M/D category is expected to increase by 21.80 mgd or 29 percent by 2035 (see **Table 7**). While the overall trend for the CFWI Planning Area is an increase in CII and M/D, there are expected decreases in Polk and Seminole counties as a result of conversion or hook-up to a public supply utility, market trends, and trends in decreasing self-supply. The CII/ and MD water demand projections by county and District can be found in **Volume IA, Appendix A, Table A-5**.

Table 7. Commercial/Industrial/Institutional and Mining/Dewatering water demand (mgd) projections in the CFWI Planning Area.

County	Water Demand Projections						2035 1-in-10 Demand	2010-2035 (5-in-10) Change	2010-2035 (5-in-10) Percent Change
	2010	2015	2020	2025	2030	2035			
Lake	7.75	9.96	12.17	14.38	16.60	18.82	18.82	11.07	143%
Orange	10.31	12.13	14.16	16.44	19.02	21.59	21.59	11.28	109%
Osceola	0.64	0.76	0.92	1.11	1.33	1.55	1.55	0.91	142%
Polk	54.99	48.30	49.20	50.64	52.12	53.70	53.70	-1.29	-2%
Seminole	0.36	0.32	0.29	0.25	0.22	0.19	0.19	-0.17	-47%
Total	74.05	71.47	76.74	82.82	89.29	95.85	95.85	21.80	29%

Note: mgd = million gallons per day

Considerations

Projections can be challenging because growth plans are often considered proprietary until the projects become public and there is considerable turnover in the number of permits in the CII and MD category.

Power Generation

This category represents the self-supplied water use associated with power plant and power generation facilities. Power generation includes the use of water for steam generation, cooling, and replenishment of cooling reservoirs.

Methodology for Water Demand Projections

The Districts incorporated historical water use trends, percent of historical permitted water use, trends in population growth, and power generation facilities' 10-year site plans to estimate future power generation demands. The methodologies are described in published reports (SFWMD 2012a; Doty 2011; SFWMD 2011c). Because power generation water demand was not found to vary significantly during drought conditions (1-in-10 year), the average and 1-in-10 demand projections are the same.

Water Demand Projections

Table 8 shows the projected power generation demand projections for the planning period from 2010 to 2035. Power generation demands are expected to increase by 5.21 mgd or 30 percent. Power generation demand projections by county and District can be found in **Volume IA, Appendix A, Table A-6**.

Table 8. Power generation water demand (mgd) projections for the CFWI Planning Area.

County	Water Demand Projections						2035 1-in-10 Demand	2010-2035 (5-in-10) Change	2010-2035 (5-in-10) Percent Change
	2010	2015	2020	2025	2030	2035			
Lake	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0%
Orange	0.89	1.02	1.16	1.29	1.42	1.55	1.55	0.66	74%
Osceola	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.00	0%
Polk	15.35	15.95	16.81	17.75	18.80	19.90	19.90	4.55	30%
Seminole	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0%
Total	17.20	17.93	18.93	20.00	21.18	22.41	22.41	5.21	30%

Note: mgd = million gallons per day

Considerations

The Districts rely on voluntary data and cooperation from stakeholders, as not all facilities are required to report water use to the Districts and/or are exempt from obtaining water use permits from the Districts. In addition, most facility site plans only include projections for 10 years, while this CFWI RWSP projects water demand through 2035.

Landscape/Recreational/Aesthetic

The landscape, recreational and aesthetic (LRA) category represents the self-supplied water use associated with the irrigation, maintenance, and operation of golf courses, cemeteries, parks, medians, attractions, and other large self-supplied green areas. Landscape use includes the outside watering of plants, shrubs, lawns, ground cover, trees, and other flora in such diverse locations as the common areas of residential developments and industrial buildings, parks, recreational areas, cemeteries, public right-of-ways, and medians. Recreational use includes the irrigation of recreational areas such as golf courses, soccer, baseball and football fields, and playgrounds. Water-based recreation use is also included in this category, which includes public or private swimming and wading pools, and other water-oriented recreation such as water slides. Aesthetic includes fountains, waterfalls, and landscape lakes and ponds where such uses are ornamental and decorative. SFWMD does not issue consumptive use permits to aesthetic uses. Therefore, only aesthetic uses in SJRWMD and SWFWMD are included in the projection estimates.



Walt Disney World Magnolia Golf Course

The LRA category also includes projections for miscellaneous irrigation or additional irrigation demand. Miscellaneous irrigation use represents wells that are less than six inches in diameter, and those uses that have a permit by rule, and are used for irrigation at residences that receive potable water for indoor use from a utility. Miscellaneous irrigation

use is only projected for those areas within the SWFWMD boundaries of the CFWI Planning Area.

Methodology for Acreage Projections

Although the acreage projection methods differ slightly between the Districts all methods incorporated historical acreages, permitted data, historical golf course trends, and also examined population growth trends. SWFWMD also incorporates data from the golf course industry to identify the rate of future growth. The methodologies are described in published reports (SWFWMD 2012; Doty 2011; SWFWMD 2011c). The methodology for projecting the number of miscellaneous irrigation wells in the SWFWMD is addressed in a separate report (Smith 2004). SWFWMD estimates that approximately 300 gallons per day are used for each well.

Acreage Projections

Table 9 shows the projected LRA acreage projections for the planning period. LRA acreage is projected to increase by 7,601 acres or 90 percent by 2035. Acreage projections by county and District can be found in **Volume IA, Appendix A, Table A-7**.

Table 9. Landscape/Recreational/Aesthetic acreage projections for the CFWI Planning Area.

County	Total Acreage Projections						2010-2035 Change (acres)	2010-2035 Percent Change
	2010	2015	2020	2025	2030	2035		
Lake	1,491	1,706	1,919	2,132	2,348	2,558	1,067	72%
Orange	4,948	5,136	5,961	6,860	7,841	8,791	3,843	78%
Osceola	1,156	1,299	1,689	2,111	2,573	2,773	1,617	140%
Polk	142	194	246	299	352	405	263	185%
Seminole	667	830	991	1,154	1,315	1,478	811	122%
Total	8,404	9,165	10,806	12,556	14,429	16,005	7,601	90%

Methodology for Water Demand Projections

Although the water demand projection methods differ slightly between Districts, all methods incorporated historical water use trends and percent of historical permitted water use.

Water Demand Projections

Table 10 shows the projected LRA demand projections for the planning period from 2010 to 2035. LRA demand is expected to increase by 31.97 mgd or 80 percent. Water demand projections by county and District can be found in **Volume IA, Appendix A, Table A-7**. The projected number of wells and miscellaneous irrigation demand projections for the SWFWMD can be found in Smith (2004).

Table 10. Landscape/Recreational/Aesthetic water demand (mgd) projections for the CFWI Planning Area.

County	Water Demand Projections ^a						2035 1-in-10 Demand	2010-2035 (5-in-10) Change	2010-2035 (5-in-10) Percent Change
	2010	2015	2020	2025	2030	2035			
Lake	3.81	4.36	4.90	5.44	5.99	6.53	8.41	2.72	71%
Orange	11.85	12.45	14.37	16.44	18.68	22.59	26.46	10.74	91%
Osceola	2.71	3.04	3.95	4.94	6.02	6.49	7.60	3.78	139%
Polk	17.95	20.09	22.05	23.99	25.95	27.95	35.48	10.00	56%
Seminole	3.89	4.84	5.78	6.73	7.67	8.62	11.10	4.73	122%
Total	40.21	44.78	51.05	57.54	64.31	72.18	89.05	31.97	80%

Note: mgd = million gallons per day

^a Demand projections include miscellaneous irrigation

Considerations

SWFWMD is currently the only district that projects water demand for miscellaneous irrigation use (additional irrigation demand). The miscellaneous irrigation water use is typically not metered, thus estimates of future demand are based on reasonable assumptions of water use.

Stakeholder Review

Population, agricultural acreages and water demand projection methodologies, results, and analyses used in their most recent water supply planning process and carried into this CFWI planning process were provided to the Districts' water use regulation staff and stakeholders for review. Changes suggested by stakeholders were incorporated only if they were based on approved methodologies and supported by complete documentation. Stakeholders also provided input to the CFWI RWSP water demand projections. Comments from stakeholders can be found in **Volume IA, Appendix A; Table A-21**.

SUMMARY

The Districts estimated water demand projections are for counties or portions of counties located within the CFWI Planning Area and represent those reasonable-beneficial uses of water that are anticipated to occur through 2035. Total water demand does not account for reductions that could be achieved by additional demand management measures such as water conservation.

While it was understood that the planning demand projection methodology differed among the Districts, changes were made in nearly all Districts population projection methodologies to help achieve some consistency. These changes make it inappropriate to compare the

planning demand projections in this CFWI RWSP with current or in-progress District RWSPs or projections produced by individual Districts for use in consumptive use permitting.

Overall, for the CFWI Planning Area, water demand for all use categories is expected to increase by 310.95 mgd or 40 percent by the year 2035. **Table 11** shows the demand projection summaries for each water use category. The public supply category shows the largest increase in water demand for the CFWI Planning Area with an additional need of 218.31 mgd, representing 70 percent of the total additional demand. The LRA category is projected to have a high percent increase in water use (80 percent).

Table 11. Summary of projected water demand (mgd) in the CFWI Planning Area.

Category	Water Demand Projections						2035 1-in-10 Demand	2010-2035 (5-in-10) Change	2010-2035 (5-in-10) Percent Change
	2010	2015	2020	2025	2030	2035			
Public Supply									
	436.03	477.28	525.57	572.43	615.94	654.34	693.61	218.31	50%
Domestic Self-supply and Small Utilities (DSS)									
	20.36	20.22	20.75	21.92	23.13	24.42	25.89	4.06	20%
Agriculture									
	185.24	218.78	217.24	216.09	215.30	214.84	321.18	29.60	16%
Commercial/Industrial/Institutional and Mining/Dewatering (CII and MD)									
	74.05	71.47	76.74	82.82	89.29	95.85	95.85	21.80	29%
Power Generation									
	17.20	17.93	18.93	20.00	21.18	22.41	22.41	5.21	30%
Landscape/Recreational/Aesthetic (LRA)									
	40.21	44.78	51.05	57.54	64.31	72.18	89.05	31.97	80%
Total	773.09	850.46	910.28	970.80	1,029.15	1,084.04	1,247.99	310.95	40%

Note: mgd = million gallons per day.

3

Resource Protection and Assessment Criteria

Water supply to meet the demands described in **Chapter 2** is largely dependent on the availability of water resources. Understanding the relationship and effect of meeting existing and future water demands on the natural system is critical to water supply planning. This chapter provides an overview and summary of the resource protection tools, definitions, statutory and rule criteria, and their relationship to each other and the related assessment criteria used in this CFWI RWSP.

REGULATORY PROTECTION OF WATER RESOURCES

- ◆ Consumptive use permitting addresses the use of water resources so that the water resource is protected from harm (Section 373.219, F.S.).
- ◆ Minimum Flow and Level (MFL) criteria define the point at which further withdrawals will be significantly harmful to the water resources or the ecology of the area (Sections 373.042 and 373.0421, F.S.).
- ◆ Water reservations set aside water for the protection of fish and wildlife or public health and safety. Reserved water is not available to be allocated to consumptive uses (Subsection 373.223(4), F.S.).
- ◆ Water shortage restrictions are used to limit water use when sufficient water is temporarily unavailable to meet user needs or when conditions require temporary reductions in use to prevent serious harm to water resources (Sections 373.175 and 373.246, F.S.).

Chapter 373, F.S., directs Florida's water resources shall be managed to ensure their sustainability (Section 373.016, F.S.). Each District has developed water resource protection standards or regulatory tools consistent with this legislative direction. These regulatory tools are discussed in this chapter and are summarized in **Volume IA, Appendix B, Table B-1** and include

Consumptive Use Permitting

Pursuant to the provisions of Section 373.223, F.S., an applicant seeking a consumptive use permit must provide reasonable assurances to the respective District that the proposed use of water

- 1) Is a reasonable-beneficial use as defined in Section 373.019, F.S.
- 2) Will not interfere with any existing legal use of water
- 3) Is consistent with the public interest

Each District specifies the procedures and criteria used by District staff to review consumptive use permit applications in adopted rules and incorporated documents commonly referred to as a Basis of Review or Applicant's Handbook. These criteria direct applicants on how to provide reasonable assurances to meet the conditions for issuance, including how to demonstrate demand, complete assessments on the potential for impacts, and request a permit duration.

- ◆ Saltwater intrusion
- ◆ Wetland and other surface waters
- ◆ Pollution
- ◆ Impacts to off-site land uses
- ◆ Use of reclaimed water
- ◆ Interference with existing legal uses
- ◆ Minimum Flows and Levels
- ◆ Water Reservations
- ◆ Restricted Allocation Areas within SFWMD

Permits are conditioned to ensure uses are consistent with the overall objectives of the District and are not harmful to the water resources of the area (Section 373.219, F.S.). Conditions for issuance of a consumptive use permit address multiple issues, including but not limited to

Level of Certainty

The consumptive use permitting program allocates water to accommodate this variability in demand by establishing a level of certainty linked to a drought condition. If a water shortage declaration is issued, a permit holder can expect temporary reductions in allocation through implementation of water shortage criteria (Sections 373.175 and 373.246, F.S.). In wet years, permit holders are expected to use less water than allocated. Permitting to a level of certainty allows for economic certainty in access to water.

The Florida legislature established a 1-in-10 year drought event level of certainty planning goal [Section 373.709(2)(a), F.S.]. Each District has implemented a level of certainty commensurate with the need for resource protection. SFWMD uses the planning goal in its consumptive use permitting program; therefore SFWMD permit applicants must demonstrate the conditions for permit issuance are satisfied during a 1-in-10 year drought condition. Demands are calculated assuming the 1-in-10 year drought condition and impacts resulting from a proposed withdrawal are analyzed during this same drought event. Permit applicants for irrigation uses in SFWMD and SJRWMD must demonstrate the conditions for permit issuance are satisfied during a 2-in-10 year drought condition, except within the SFWMD's Southern Water Use Caution Area (which includes most of Polk County) where a 5-in-10 year drought condition is used for crops that receive effective rainfall.

Impact Evaluation Criteria

Impact evaluation criteria are applied to various resource functions and existing legal user interference criteria to establish the hydrologic change that can occur without causing harm. For the purposes of consumptive use allocation, the harm standard addresses each of the following

- ◆ Saltwater intrusion
- ◆ Wetland and other surface water bodies
- ◆ Aquifer mining
- ◆ Pollution movement
- ◆ Off-site land uses
- ◆ Existing legal users

Minimum Flows and Levels (MFLs)

Section 373.042, F.S., requires the FDEP or the Districts to establish minimum flows for surface watercourses and minimum levels for both groundwater and surface water. MFLs represent the level at which further withdrawals would be significantly harmful to the water resources or ecology of the area. MFLs are adopted by administrative rule for priority water bodies and calculated using the best information available.

Each District is required to submit an annual priority list and schedule for the establishment of MFLs to FDEP for approval. The priority list is based on the importance of waters to the state or region and the existence of or potential for significant harm to the water resources or ecology of the region. Considerations and exclusions associated with MFL establishment and implementation, including changes and structural alterations that affect hydrology, minimum water body size requirements, and whether a water body currently serves its historical hydrologic functions, are provided in Section 373.042 (1), F.S.

If the water body is below or projected to fall below existing MFL criteria, the District shall expeditiously develop and implement a recovery or prevention strategy. At the time the minimum flow or level is initially adopted, if the water body is below or projected to fall below the initial minimum flow or level, the District shall simultaneously develop and approve a recovery or prevention strategy with the MFL. The goal of a recovery strategy is to achieve the adopted MFL as soon as practicable. The recovery strategy must include the provision of sufficient water supplies for all existing and projected reasonable-beneficial uses, and may include the development of additional supplies, construction of new or improved storage facilities, and implementation of conservation or other efficiency measures. The strategy, when appropriate, should include development of additional water supplies, water conservation, and other efficiency measures concurrent with, to the extent practical, and to offset, reductions in permitted withdrawals, consistent with the provisions in Chapter 373, F.S.



St. Johns River – Middle Basin

A prevention strategy is developed concurrently with the adoption of the MFL or subsequent to adoption when the MFL's criteria are currently met, but are projected not to be met within the next 20 years. The goal of a prevention strategy is for the water body to continue to meet the established MFL criteria in the future. Both recovery and prevention strategies must include phasing or a timetable that allows for the provision of sufficient water supplies for all existing and projected reasonable-beneficial uses. These strategies must include provisions to provide sufficient water supplies for all existing and projected

reasonable-beneficial uses and may include the development of additional water supply and water resource projects.

The State Water Resource Implementation Rule 62-40.473, F.A.C., directs the Districts to consider environmental values associated with coastal estuarine, riverine, spring, aquatic, and wetlands ecology and express MFLs as one or more flows and levels defining a minimum hydrologic regime to establish the limit beyond which further withdrawals would cause significant harm. However, a minimum flow or level need not be expressed as multiple flows or levels if other resource protection tools, such as reservations implemented to protect fish and wildlife or public health and safety, that provide equivalent or greater protection of the hydrologic regime of the water body, are developed and adopted in coordination with the minimum flow or level.

Chapters 40C-8, 40D-8, and 40E-8, F.A.C., contain the adopted MFLs as well as definitions and the policy and purpose considerations used in the establishment of MFLs, and Chapter 40D-80 contains the regulatory portion of MFL Recovery and Prevention Strategies for certain MFLs. These MFLs are used in regulatory permitting programs as a resource constraint. These MFLs are also considered in the CFWI RWSP process to determine sustainable water supply.

Adopted and Proposed MFLs in the CFWI Planning Area

MFLs have been adopted for 46 water bodies, including 33 lakes or wetlands, 6 springs, and 7 river/stream systems (**Table 12**) within the SJRWMD and SWFWMD portions of the CFWI Planning Area. MFLs have not been adopted within the SWFWMD portion of the CFWI Planning Area. The location of adopted and proposed MFLs in the East Central Florida Transient (ECFT) groundwater model domain are shown in **Figure 2**. Additional information on adopted and proposed MFLs is provided in **Volume IA, Appendix B**.

Twenty-eight water bodies within the CFWI Planning Area and 24 water bodies outside the CFWI Planning Area but within the ECFT groundwater flow model domain are currently scheduled for development or reevaluation of the MFLs. Reevaluation involves the review of the previously adopted MFL and, if appropriate, revising the MFL. Proposed MFLs have been developed for some of these water bodies, but have not yet been adopted as District rules.

Table 12. Lakes, wetlands, and rivers with adopted MFLs in the CFWI Planning Area.

Lakes	District	Grid	Lakes	District	Grid
Cherry Lake	SJRWMD	A-2	North Lake Wales	SWFWMD	B-4
Crooked Lake	SWFWMD	B-4	Pine Island Lake	SJRWMD	A-2
Crystal Lake	SWFWMD	B-4	Prevatt Lake	SJRWMD	B-2
Dinner Lake	SWFWMD	B-4	South Lake Apshawa	SJRWMD	B-2
Eagle Lake	SWFWMD	B-4	Sylvan Lake	SJRWMD	C-2
Lake Annie	SWFWMD	B-4	Venus Lake	SWFWMD	B-4
Lake Bonnie	SWFWMD	B-4			
Lake Brantley	SJRWMD	C-2			
Lake Burkett	SJRWMD	C-2			
Lake Clinch	SWFWMD	B-5			
Lake Emma	SJRWMD	A-2			
Lake Howell	SJRWMD	C-2			
Lake Irma	SJRWMD	C-2			
Lake Lee	SWFWMD	B-4			
Lake Louisa	SJRWMD	B-2			
Lake Lucy	SJRWMD	A-2			
Lake Martha	SJRWMD	C-2			
Lake Minneola	SJRWMD	B-2			
Lake Mabel	SWFWMD	B-4			
Lake McLeod	SWFWMD	B-4			
Lake Parker	SWFWMD	A-4			
Lake Pearl	SJRWMD	C-2			
Lake Starr	SWFWMD	B-4			
Lake Wailes	SWFWMD	B-4			
Mills Lake	SJRWMD	D-2			
North Lake Apshawa	SJRWMD	B-2			

Wetlands	District	Grid
Boggy Marsh	SJRWMD	B-3

Springs	District	Grid
Miami Spring	SJRWMD	C-2
Palm Spring	SJRWMD	C-2
Rock Spring	SJRWMD	B-2
Sanlando Spring	SJRWMD	C-2
Starbuck Spring	SJRWMD	C-2
Wekiwa Spring	SJRWMD	B-2

Rivers	District	Grid
Lake Monroe	SJRWMD	C-2
Peace River at Bartow	SWFWMD	A-4
Peace River at Ft. Meade	SWFWMD	B-5
St. Johns River at S.R. 50	SJRWMD	D-2
Taylor Creek	SJRWMD	D-3
Upper Hillsborough River	SWFWMD	A-3
Wekiva River at S.R. 46	SJRWMD	C-2

District = water management district; SJRWMD = St. Johns River Water Management District; SWFWMD = Southwest Florida Water Management District; Grid refers to **Figure 2**; reports on adopted MFLs for individual water bodies are available from the SWFWMD web site (http://www.swfwmd.state.fl.us/projects/mfl/mfl_reports.php) and the SJRWMD technical library.

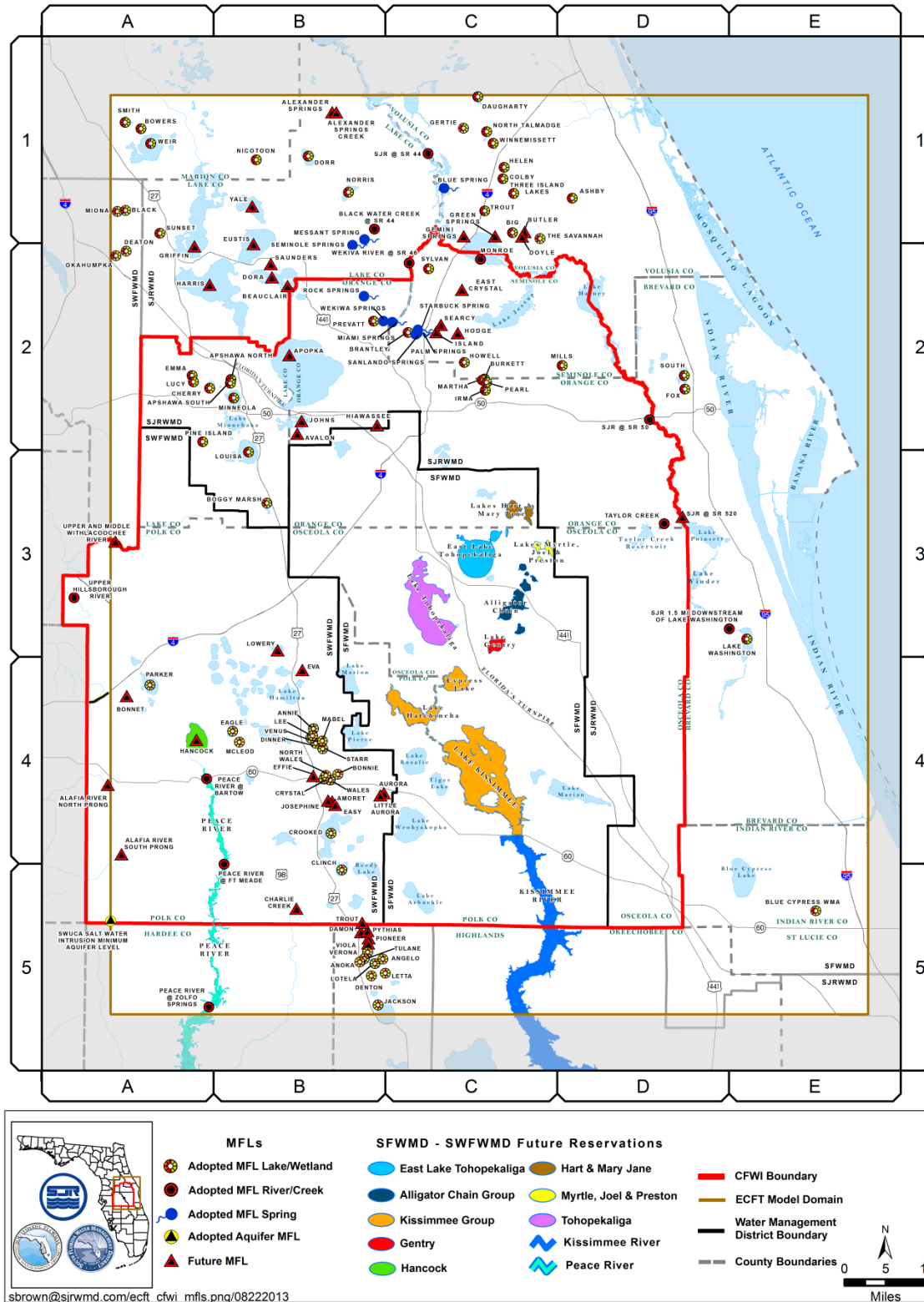


Figure 2. Locations of adopted and proposed MFLs and reservations in the CFWI Planning Area and ECFT groundwater model domain. (Proposed MFLs are subject to change; this figure represents proposed MFLs at the time of evaluation.)

Water Reservations

A water reservation rule sets aside water for the protection of fish and wildlife or public health and safety. When a volume of water is reserved, it is unavailable for allocation to water uses. Water reservations are developed based on existing water availability and/or consideration of future water supplies that water resource projects make available. Water reservations are adopted into rule by the Districts or FDEP. Reservations are subject to review at least every five years and revised if necessary (Section 373.223(4), F.S.; Rule 62-40.474 F.A.C.). All present existing legal uses of water are protected when adopting a reservation, so long as such use is not contrary to the public interest.

All Districts are required to submit an annual priority list and schedule for the establishment of reservations within their boundary to FDEP for approval.

The SWFWMD anticipates reserving from use water necessary to recover and protect MFLs established for the Southern Water Use Caution Area (SWUCA), a 5,100 square mile section of the District where lowered aquifer levels have caused salt water to intrude into the Floridan aquifer near the coast in a region identified as the Most Impacted Area (MIA) and contributed to reduced flows in the upper Peace River and lowered lake levels in portions of Polk and Highlands counties (SWFWMD 2006). Future reservations in the SWUCA will be established on a case-by-case basis to address water that is developed through water resource development projects designed to recover and maintain established MFLs. The SWFWMD anticipates adopting a reservation for Lake Hancock, which is located in the CFWI Planning Area, to support recovery of minimum flows in the Peace River (see **Figure 2**).

The SFWMD has proposed the Kissimmee Basin water reservation, which includes the Upper Chain of Lakes and the Kissimmee River and its floodplain (see **Figure 2**) in its 2014 Priority Water Body List for future adoption. Initial technical work to support establishment of a water reservation for the Kissimmee Basin was conducted in 2008 and a substantial ecologic and hydrologic analysis of the region/system/area was completed and documented in the draft Technical Document (SFWMD 2009b). This Technical Document underwent a voluntary independent scientific peer review in 2009. The technical information is being reassessed to determine the quantity of water needed for the water reservation. Rulemaking was initiated in 2014 to develop a water reservation rule for the Kissimmee Basin in the CFWI Planning Area.

Water Shortage

In accordance with Sections 373.175 and 373.246, F.S., water shortages are declared when necessary to prevent serious harm from occurring to the water resources. The goal is to protect the remaining supply through demand management and ensure a fair distribution of that supply. Chapters 40C-21, 40D-21, 40E-21, and 40E-22, F.A.C., contain the Water Shortage Plans for the three Districts involved in the CFWI Planning Area.

RESOURCE PROTECTION OVERVIEW

Environmental Assessment Considerations

The estimation of available traditional groundwater in the CFWI Planning Area was based on observation of existing environmental conditions and the estimation of potential water resource impacts resulting from groundwater withdrawals on identified environmental constraints. Chapter 373, Florida Statutes (F.S.), directs that Florida's water resources shall be managed to ensure their sustainability (Section 373.016, F.S.). Determining sustainable levels of groundwater withdrawals requires a detailed level of evaluation. For the CFWI Planning Area, measuring sticks were developed by the CFWI Environmental Measures Team (EMT) that would link model output to anticipated environmental response to address the sustainability of the water resources. The measuring sticks, identified in **Volume IA, Appendix B** and in CFWI 2013a, b, were developed for water resources including MFLs, non-MFL water bodies, wetlands and water quality, springs, rivers and groundwater system, and were used as constraints or considerations along with other regulatory considerations by the Districts to review potential environmental concerns in a uniform manner.

Additional information was also considered in support of this evaluation. This included statistical analyses of long-term trends in hydrologic data for the central Florida region (Intera 2010) and GIS-based analyses of the spatial distribution of the potential susceptibility of surface water features to groundwater withdrawal-induced hydrologic changes and land alteration (CFWI 2013a)

MFL Assessment for the CFWI Planning Area

To support the CFWI RWSP process, the most recent compliance status of MFL water bodies in the CFWI Planning Area was evaluated. Assessments for MFLs within and performed by the SJRWMD represent compliance status as of 2005. Compliance for MFLs within the SWFWMD was determined using information collected through 2011 that reflected site-specific hydrologic conditions.

Additionally, the adopted or currently proposed MFL sites were used as measuring sticks for evaluations of regional groundwater availability. Based on the ECFT groundwater model predicted changes in Upper Floridan aquifer (UFA) water levels, spring flows, or groundwater flows, the magnitude of drawdowns of the potentiometric surface of the UFA in the vicinities of the MFL lakes, wetlands, or springs that could occur without causing exceedance of adopted (or proposed) MFLs was estimated. This allowable UFA drawdown is referred to as the MFLs measuring stick "freeboard" or "remaining freeboard." The remaining freeboard represents the approximate amount of additional UFA drawdown under the MFL water body that can occur in association with future increases in water withdrawals.

The measuring sticks identified for consideration were based on adopted and proposed MFLs associated with the CFWI Planning Area. Twenty-five lakes/wetlands and six springs with MFLs were chosen as measuring sticks based upon the availability of predictive tools to evaluate the MFLs. Other considerations associated with this analysis included proposed MFLs for several lakes and established and proposed MFLs for several river segments. Additionally, the ECFT groundwater model simulated groundwater flows across the model boundary that could affect the SWUCA Saltwater Intrusion Minimum Aquifer Level (SWIMAL) (an MFL) and water levels in regulatory monitoring wells associated with the SWFWMD SWUCA Recovery Strategy were assessed. Additional information regarding MFLs measuring sticks and their use is available in **Volume IA, Appendix B**.

MFL Prevention and Recovery Strategies

An important part of the water supply planning process is the assessment of MFL water bodies to determine if existing flows and levels are below the MFL or projected to fall below, the MFL within 20 years. For existing MFLs, the Districts shall expeditiously develop and implement a recovery or prevention strategy. At the time the minimum flow or level is initially adopted, if the water body is below or is projected to fall within 20 years below, the initial minimum flow or level, the District shall simultaneously approve the recovery or prevention strategy required by Section 373.0421(2), F.S.

SWFWMD

The SWFWMD established SWUCA in 1992 due to environmental concerns related to groundwater withdrawals in the southern and central regions of the SWFWMD. The primary resource concerns within the SWUCA include lake levels along the Lake Wales Ridge, flows in the upper Peace River, and saltwater intrusion into the UFA from the Gulf of Mexico. In 2006 SWFWMD adopted lake and river MFLs within the SWUCA and SWIMAL for the Most Impacted Area of the SWUCA to address these resource concerns. The District has also adopted regulatory well water level target to support recovery of MFLs within the SWUCA.

The SWUCA Recovery Strategy (SWFWMD 2006) is the only recovery strategy currently being implemented in the CFWI Planning Area. The strategy is relevant to recovery of several CFWI Planning Area water bodies, including Lakes Bonnie, Crooked, Eagle, McLeod, North Wales, Starr, Wailes and two segments of the Peace River (Peace River at Bartow and Ft. Mead). See **Table 12** and **Figure 2** for water body locations. Recovery for the SWIMAL adopted for the Most Impacted Area (MIA) of the SWUCA is also addressed by the strategy. The purpose of this recovery strategy is to reduce the rate of saltwater intrusion in the UFA from the coastal region, identified as the MIA, restore low surface water flows to the upper Peace River, and increase surface water levels in area lakes by 2025, while providing for sufficient water supplies. The strategy has six basic components: conservation, alternative water supply development, resource recovery projects, land-use transitions, water use permitting, and monitoring and reporting.

SWFWMD has developed a three-point prevention strategy to address water bodies within the SWUCA and elsewhere in the District where flows or levels are anticipated to fall below adopted MFLs. The strategy includes (1) monitoring of water levels and flows for water resources/sites with adopted MFLs to evaluate the need for prevention strategies; (2) assessment of potential water supply/resource problems as part of the RWSP process; and (3) implementation of a consumptive use permitting program that ensures consumptive uses do not cause exceedance of adopted MFLs.

The SWUCA recovery strategy will be reevaluated and updated in coordination with the updates to the SWFWMD RWSP updates. This evaluation will include revisiting demand projections, and potential sources, as well as monitoring the recovery in terms of both resource trends and trends in permitted and used quantities of water.

SJRWMD

The SJRWMD (2006b) previously identified eight CFWI water bodies that would likely not meet adopted MFLs if all projected 2025 water use demands were realized, necessitating the development of prevention strategies. These prevention water bodies include Cherry Lake, Lake Louisa, Lake Minneola, North Lake Apshawa, South Lake Apshawa in Lake County, and Lake Brantley, Sylvan Lake, and Starbuck Spring in Seminole County (see **Table 12** and **Figure 2** for water body locations).

SJRWMD's general prevention strategy to prevent water levels or flows from falling below MFLs adopted for these water bodies includes: (1) not issuing consumptive use permits that would cause water levels and flows to fall below adopted MFLs; (2) identification of alternative water supply project options that, if implemented, would prevent water levels and flows from falling below adopted MFLs and assisting, as appropriate, in the implementation of these projects; and (3) identifying water resource development projects that would prevent water levels and flows from falling below adopted minimum values and implementing these projects.

The development of more specific strategies has been on hold during the CFWI RWSP process until new tools, including the ECFT groundwater model, were available. The development of more specific strategies will resume following completion of the CFWI RWSP. However, it is expected that the implementation of alternative water supply project options and water resource development projects identified in this CFWI RWSP will contribute to preventing water levels in the water bodies listed above from falling below established minimums. Specific projects for the individual water bodies or groups of water bodies are provided in SJRWMD 2006b.

Assessment of Wetlands and Non-MFL Lakes

The evaluation of lakes and wetlands without MFLs within the region was an integral part of the CFWI Planning Area analysis. The Environmental Measures Team (EMT) was tasked with determining the current status of wetlands with respect to hydrologic stress and alteration, and to develop tools to evaluate modeled future wetland conditions within the

CFWI Planning Area. The EMT consisted of scientists from the Districts, the FDEP, and representatives of the public supply utilities. The EMT reviewed previous environmental assessments conducted within the region, conducted additional wetland assessments, and performed other tasks in support of the determination of sustainable groundwater withdrawals in the CFWI. The final work product of the EMT was a set of tools that were used to evaluate likely effects of groundwater withdrawals, as predicted by modeled water levels, on wetland resources. Detailed descriptions of the EMT's methods and results can be found in their technical document (CFWI 2013a).



Lake Mary Jane

Between 2007 and 2012, over 350 wetland sites within and near the CFWI Planning Area were visited and assessed by the EMT. Although most of these sites had no recorded water stage elevation measurements, 44 sites had relatively robust hydrologic data records and were used to conduct a statistical analysis of wetland stress. The determination of stress in the assessed non-MFL lakes and wetlands was based on combinations of the following criteria:

- ◆ A multi-decadal trend of decreasing water levels seen on historical aerial photography.
- ◆ Physical evidence of permanently reduced wetland hydrology or invasion/establishment of species from drier ecological communities.
- ◆ Soil oxidation or loss (due to reduced water levels) observed in wetlands that had organic soils.

The term “stress” should not be confused with ecological “stressors” such as periodic extreme hydrologic conditions driven by climate. The stress indicators described above and used for the assessments were developed to exclude the effects of periodic drought or long-term rainfall trends and focused on impacts that were associated with non-natural (outside of normal climatic variability) chronically reduced water levels that have persisted for many years.

In addition, the term “stress” should not be equated with “harm” or “significant harm” which are regulatory terms that should not be equated with the methods used to assess impacts during this planning assessment. While many of the hydrologic indicators observed during field assessments are the same as those gathered during a regulatory review, no determination of harm was made during the assessment.

Two methods were used to evaluate wetlands under future modeled water level conditions. The first method utilized a statistical evaluation of isolated lake and wetland systems, which are considered to be inherently more vulnerable to impacts from lowered groundwater levels. The statistical method evaluated the probability of change in stress status based upon the observed ecologic and hydrologic conditions of 44 wetland sites, which had both ecological and hydrological data (“Class 1” wetlands) [CFWI 2013a].

The second method examined outputs from modeled future water withdrawal scenarios, which were used to calculate surface water level changes in assessed wetlands to examine potential impacts under these scenarios. These model scenarios and outputs are described in **Chapter 4** and **Volume IA, Appendix C**. The mean water level was calculated for each wetland assessment site from monthly model outputs from modeled scenarios. The difference between the mean surface water level for the Reference Condition (2005) and a future modeled withdrawal condition was used to determine if wetland water levels would be expected to increase, decrease, or remain the same under the future condition. The magnitudes of water level change from a reference condition, at assessed wetland sites, were mapped to indicate areas of greatest change.

Assessment of Non-MFL Springs

Springs without adopted MFLs were also identified as resource considerations for analyses supporting the assessment of groundwater availability in the CFWI Planning Area. Ten springs have sufficient period of record for discharge measurements to allow for the evaluation of the impacts of projected changes in groundwater withdrawals on spring flow. Of these 10 springs, three are within the CFWI Planning Area. The three springs evaluated are the second magnitude Apopka Spring in Lake County, and the third magnitude Clifton Springs and Island Springs in Seminole County. Results for these springs are summarized in **Chapter 4**.

Water Quality/Saltwater Intrusion

Water quality considerations are those associated with potential upconing of underlying poor quality groundwater at selected wellfields in the eastern portion of the CFWI Planning Area. Consideration of saltwater intrusion related to the SWUCA is discussed in the MFLs section.

The eastern portions of the UFA within the CFWI Planning Area are known to have poorer quality groundwater that has not been flushed from the aquifer by fresh water recharge. Wells and wellfields operating near these regions are subject to the possible migration of this residual poorer quality water as a result of withdrawals. This potential movement is considered local in nature. As such, the modeled changes in aquifer drawdowns within the ECFT model were evaluated for selected wellfield production zones, including facilities operated by the City of Winter Springs, City of Cocoa, City of Oviedo, Florida Governmental Utility Authority (Town of Chuluota), and the City of Sanford. These sites were identified based upon their history of water quality in production and monitoring wells and existing requirements for wellfield management plans within the utilities' consumptive use permits. Increased pumpage from an upper aquifer may result in increased flow from aquifers below and has the potential to increase the local risk to maintain potable water quality.

To evaluate this possibility, the ECFT groundwater model simulated cell-by-cell water flows for areas surrounding each wellfield, which were then examined to determine if the projected withdrawals, in combination with the proposed individual utility operations, would suggest possible increases in risks of upward water movement from lower more saline aquifers into these wellfields. The monthly vertical flows between the production horizon and the model layer below each wellfield were summarized for the 12-year simulation period and the difference between the Reference Condition (2005) and 2035 withdrawal condition results were examined. The comparison in flow changes between these scenarios is intended to provide only a qualitative review of the risk potential for a given wellfield (see **Volume IA, Appendix C-I**).

Climate Change and Water Supply in Florida

A reliable and economically feasible water supply is the key to the future of Florida's economy. Climate change has the potential to significantly impact the sustainability of water supplies throughout the state. While climate change is occurring across the globe, impact or effects vary and the degree and rate of change remains uncertain. Long-term data do however indicate changes in parameters such as temperature, rainfall, and sea level.

The uncertainty of climate change challenges water providers as they plan for the future. Traditionally, water resource planning has used historical climatic and other hydrologic data to represent future water supply conditions. Temperature, precipitation, stream flow, groundwater levels, evaporation, and other related factors may be expected to vary as they have in the past. With climate change, future water resource planning must be able to

consider additional uncertainties and greater climatic and hydrologic variability (Water Utility Climate Alliance 2010).

Potential climate change impacts to water supply in the CFWI Planning Area include increased potential for saline groundwater intrusion and more frequent intense rainfall events with longer interim dry periods. Although future quantitative projections of climate change effects will be refined over time, consensus among the scientific community is that the effects of climate change, such as rising sea levels, are occurring. As noted by Berry et al. (2011), these effects represent a broad challenge to traditional water supply planning approaches in Florida:

“As climate change progresses hydrologic systems will be altered due to changes in the water cycle and rising sea levels. These fundamental changes to the water system interject uncertainty about how climate change will impact Florida’s hydrologic systems and present significant difficulties for water managers attempting to develop strategies to meet long-term water supply needs for the state. The uncertainty about how climate change will impact Florida’s water resources and its infrastructure creates a challenge for most sectors of Florida’s economy.”

Magnitude of Climate Change Effects in Florida

Understanding the types and magnitude of climate change effects is necessary in order to identify vulnerable infrastructure and to implement an adaptive water supply plan. These effects should not be considered in isolation, because they magnify the impact on water supply infrastructure and the reliability and quality of current and future water sources.

Effects of Climate Change on Water Supply

In Florida, water demand is highly dependent on temperature and precipitation as they relate to evapotranspiration. Three key factors: evaporation, transpiration, and atmospheric humidity are directly proportional to increasing air temperature. These three factors also influence increases in water demand. Fresh water withdrawals for agricultural, recreational, and residential irrigation are largely seasonal in nature; and historical water use data show increased water demand during periods of drought (Marella 2004; Verdi et al. 2006; Marella 2009). Therefore, if climate change causes precipitation in Florida to decline or the frequency of droughts to increase, peak water demand for agricultural, recreational, and residential irrigation may increase (the inverse with opposite impacts could also occur). This could lead to uncertainty in the ability of water supply infrastructure to meet peak demands across these user groups.

On a regional scale, impacts of rising sea levels or other climate change phenomena may be associated with a gradual, continuous shift of populations from coastal communities to inland communities, thus accelerating demand projections. Similarly, population migrations

associated with specific storm events may be associated with shorter-term variation in water demand projections. Demand projections developed by the Districts for all water use categories are revised every five years for regions where water supplies may not be adequate. These scheduled revisions provide an opportunity to incorporate changes to projected populations if migration becomes apparent. Climate change effects may also limit the ability of coastal communities to build resilient water-supply systems. As such, they may seek to strengthen partnerships with inland utilities or regional water supply authorities to utilize inland water sources on an emergency basis after significant storm events or on a relatively continuous basis as saline groundwater potentially migrates landward due to sea-level rise. The options available for adaptive infrastructure development and use may be revisited in the five-year regional water supply planning process.

Managing Uncertainty

Climate change adds to the uncertainty associated with long-term water supply planning, affecting demand projections, infrastructure vulnerability, and potentially the availability of reliable supply options. Current global climate models evaluate long-term water availability, but “have limited uses in impact analysis when the seasonal characteristics of a region’s future water availability is the main interest” (Lowe et al. 2012). However, informed planning, adaptive infrastructure, and strong partnerships among utilities and other water users working together to provide solid infrastructure design, future water supply development, and long-term planning can provide the flexibility necessary to ensure long-term sustainable water supplies in Florida and offset future uncertainty.

For example, as a part of future water supply development and long-term water supply planning, local governments and utilities can integrate climate change uncertainty into infrastructure planning and design by evaluating climatic and other hydrologic data with longer periods of record that incorporate relatively greater variability, considering predicted changes in precipitation, sea levels, evaporation, and other hydrologic factors; incorporating projected ranges of climate change effects as constraints when evaluating water supply options; and identifying potentially vulnerable infrastructure.

As part of a collaborative effort to address climate and water resource issues, the Florida Water and Climate Alliance (Alliance) is a stakeholder-scientist partnership focused on increasing the relevance of climate science data and tools for water resource planning and supply operations in Florida. The Alliance is building a learning network, implementing research projects, and sharing knowledge and information on water and climate issues. The Alliance partners include utilities, Districts, and climate/water scientists and experts from the University of Florida, Florida Climate Institute, Southeast Climate Consortium, and the UF/IFAS Center for Public Issues Education (<http://floridawca.org>).

4

Evaluation of Water Resources

SUMMARY OF ANALYTICAL AND MODELING TOOLS

Groundwater modeling was used to assist in development of this plan. The model represents the performance of a real system through a series of mathematical equations, which describe the physical processes that occur in that system; they represent a simplified version of the real world that may be used to predict the behavior of the modeled system under various conditions. The model simulated the potential impact of the projected water use demands on the environment and groundwater sources in the CFWI Planning Area. Information from local comprehensive plans, utilities, BEBR, FDACS, IFAS, and the Districts' permitting databases were used to support this analysis. Where specific information was not available, professional judgment was used. The ECFT groundwater model was the primary model used in this analysis.

East Central Florida Transient Groundwater Model

With the strong desire to have a single, unified tool to effectively evaluate water withdrawals and their associated effects on the water resources and natural systems, the United States Geological Survey (USGS) was retained to develop an updated, calibrated version of the existing ECFT groundwater model, which was subsequently enhanced by the Districts, FDEP, utilities and other stakeholders in the CFWI Planning Area. The model area or domain includes the CFWI Planning Area, but excludes the western edge of Polk County (**Figure 3**). The ECFT groundwater model uses the USGS modular three-dimensional finite difference groundwater flow model, commonly known as MODFLOW. The model area is divided into 1,250-foot by 1,250-foot cells using a grid defined by series of rows and columns. The model simulates transient groundwater flow in the surficial aquifer system (SAS) and the Floridan aquifer system (FAS). The ECFT groundwater model generates two principal types of output for each model cell: computed head (water levels) that result from the simulated conditions, and water budgets. The water budgets characterize the inflows and outflows for each cell. Detailed information on the ECFT groundwater model is provided in **Volume IA, Appendix C**.

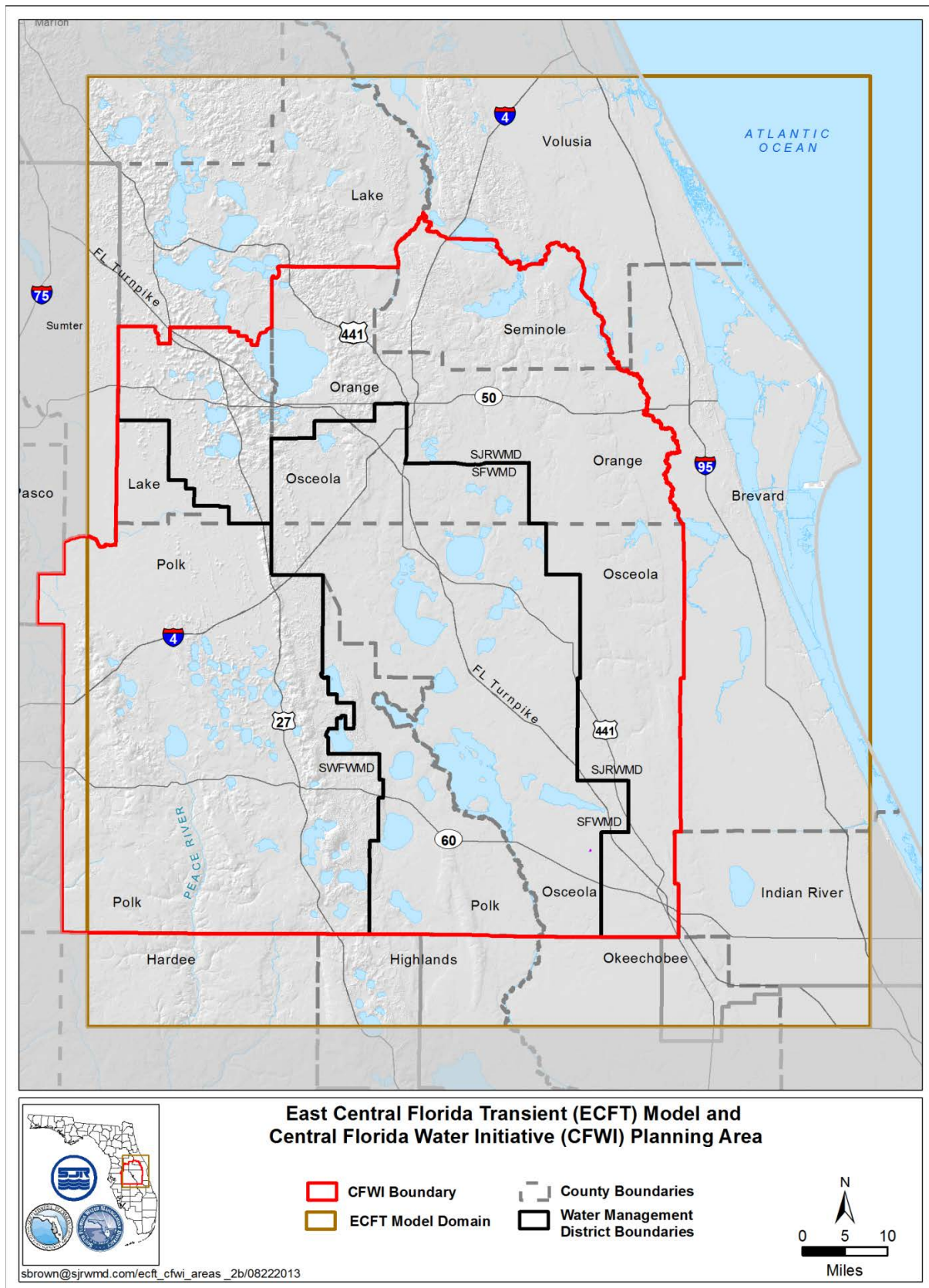


Figure 3. ECFT groundwater model domain boundary and CFWI Planning Area.

Results from ECFT groundwater model simulations were used to estimate groundwater availability within the CFWI Planning Area (see **Figure 3**). The model was used to predict potential impacts on wetlands water levels, lake water levels, spring flows, and groundwater levels in the FAS and SAS caused by projected increases in groundwater use. Hydrologic modeling was performed to evaluate effects of various water-use scenarios.

GROUNDWATER AVAILABILITY

Purpose and Process

The purpose of the effort was to develop planning-level estimates of groundwater availability within the CFWI Planning Area under current and projected future water use conditions. Additionally, results of the groundwater modeling were used to estimate the sustainable quantities of traditional groundwater sources within the CFWI Planning Area that may be used as a water supply without causing unacceptable impacts to regional water resources and associated natural systems. Resource constraints and considerations (described in **Chapter 3**) were used to evaluate various water supply conditions and to estimate sustainable groundwater quantities. The assessment represents a planning-level evaluation designed to identify existing and future water supply development considerations. Assumptions used in the assessment are outlined in this chapter to provide context for the results from the assessment. The groundwater availability estimate will be used by the Solutions Planning Team to plan for the timing, magnitude, and location of alternative water supply and water resource development project development. **Figure 4** illustrates the groundwater availability assessment process, highlighting the collaboration between the various teams that occurred during the CFWI planning process.

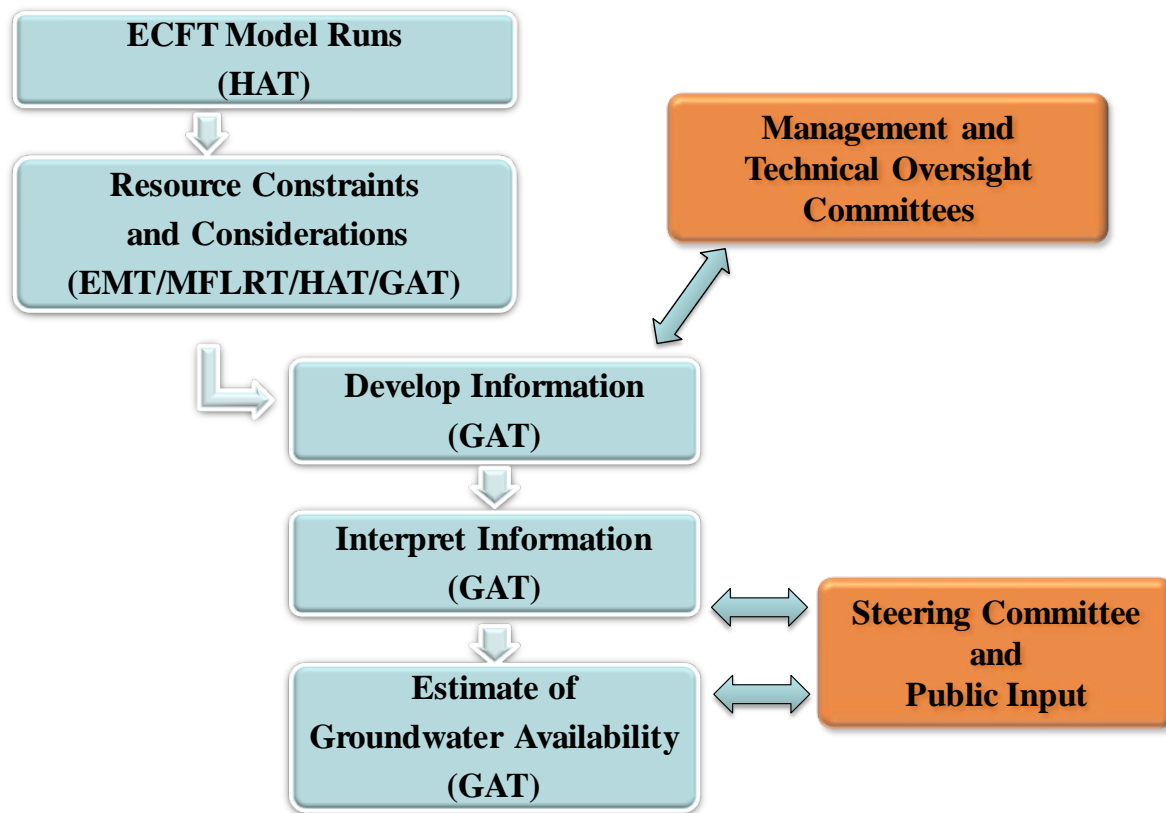


Figure 4. CFWI groundwater availability assessment process flow chart.

Note: Identifying use of the ECFT groundwater model and emphasizing interactions among technical teams (Environmental Measures Team [EMT], Groundwater Availability Team [GAT], Hydrologic Analysis Team [HAT], Minimum Flows and Levels Reservation Team [MFLRT], the Management and Technical Oversight Committees, the Steering Committee, and public stakeholders.

Overview of Water Resource Considerations and Methods Used to Evaluate Potential Impacts

To support the CFWI water supply planning process, the recent status of water bodies in the CFWI Planning Area and ECFT groundwater model domain with adopted Minimum Flows and Levels (MFLs) was characterized. In addition, hydrologically stressed condition was assessed for selected non-MFL lakes and wetlands to further characterize the recent status of surface water resources in the CFWI Planning Area.

To assess the potential impacts of cumulative water use on the environment and groundwater resources using the ECFT groundwater model, water resource constraints or

considerations called “measuring sticks” (as discussed in **Chapter 3**) were used to identify environmental impact limits that could be used to develop planning-level estimates of groundwater availability. The measuring sticks included

- ◆ Adopted and proposed MFL water bodies within the CFWI Planning Area
- ◆ Other regulatory considerations, including the SWFWMD Southern Water Use Caution Area (SWUCA)
- ◆ Non-MFL lakes, wetlands, and springs within the CFWI Planning Area
- ◆ Saltwater intrusion

Based on these measuring sticks, a variety of methods were used to determine the magnitude of hydrologic change predicted by the ECFT groundwater model that could occur without

- ◆ Violating adopted or proposed MFLs.
- ◆ Reducing groundwater levels below target levels established for several wells as part of the SWUCA Recovery Strategy.
- ◆ Further impacting groundwater levels in the Most Impacted Area (MIA) of the SWUCA.
- ◆ Causing an unacceptable increased risk that non-MFL lake or wetland constraints would become hydrologically stressed.
- ◆ Leading to unacceptable changes in non-MFL spring flows or groundwater quality associated with potential upward movement of connate water at selected wellfields in the eastern portion of the CFWI Planning Area.

Minimum Flow and Level Water Bodies

For evaluation of lake, wetland, or spring MFL measuring sticks, the magnitude of estimated drawdown (in feet) of the Upper Floridan aquifer (UFA) potentiometric surface in the vicinity of the MFL sites that could occur without contributing to exceedance of adopted MFLs was identified for a Reference Condition (2005) and other simulated withdrawal scenarios. This drawdown variable, referred to as “freeboard” or “remaining freeboard”, was expressed as the potential or allowable drawdown in the UFA, in feet, for lake or wetland MFLs. In cases where current MFLs are not being achieved, the freeboard would be a negative value.

Effects associated with the drawdown of the potentiometric surface of the UFA on some MFL measuring sticks were characterized using metrics other than freeboard or remaining freeboard. For example, drawdown effects relative to the Reference Condition (2005) for the Peace and Hillsborough rivers were characterized based on model-predicted groundwater exchange between the rivers and underlying aquifer systems and groundwater flow across the ECFT groundwater model domain boundary.

Southern Water Use Caution Area (SWUCA) Saltwater Intrusion Minimum Aquifer Level (SWIMAL)

Water quality in the coastal portion of the UFA in the SWFWMD (west of the southwest corner of the CFWI Planning Area) was identified as a consideration for this planning level assessment of groundwater availability. Saltwater intrusion has been occurring in this area, which is included in the larger SWUCA that was established by the SWFWMD, for the past several decades in response to groundwater withdrawals throughout the groundwater basin. As discussed in **Chapter 3**, a saltwater intrusion minimum aquifer level (SWIMAL) was established and the SWUCA Recovery Strategy was adopted in 2006 to recover groundwater levels in the area and to slow the landward movement of saltwater in the Floridan aquifer. Groundwater withdrawal scenarios for the CFWI Planning Area were therefore evaluated to predict any adverse effect on the SWUCA recovery efforts. The evaluations were made by calculating the simulated change in groundwater flows to the currently impacted area in response to projected groundwater withdrawals within the CFWI Planning Area.

Southern Water Use Caution Area Regulatory Well Targets

Regulatory well targets developed to support MFLs recovery in the SWUCA were evaluated using the same approach that was used for evaluating potential withdrawal effects on adopted and proposed MFLs. The magnitude of drawdown of the potentiometric surface of the UFA in the regulatory wells that could occur without causing groundwater levels to fall below the targets (i.e., the remaining freeboard) was characterized for all simulated withdrawal scenarios.

Non-MFL Lakes and Wetlands

A total of 357 wetlands were assessed by the EMT and determinations of wetland stress and the presence of substantial hydrological alteration were made for each site. Relatively robust hydrologic records were available for 44 of the 357 evaluated sites; this subset of assessed sites was referred to as the “Class 1” wetland data set (**Table 13**). The remaining 313 wetlands were classified according to how much information was available for them, with Class 3 being those wetlands where neither the current stress condition nor the hydrologic history of the wetland were known.

Table 13. Summary of wetland data classes in the CFWI Planning Area.

Wetland Data Class	Data Class Characteristics		
	Wetland Type (Ridge or Plains)	Current Stress Condition	Water Level Hydrograph
Class 1	Known	Known	Known
Class 2	Known	Known	Unknown
Class 3	Known	Unknown	Unknown

During the field assessment of wetland systems, wetlands were noted as significantly hydrologically altered (SHA) if there were obvious physical alterations that would significantly alter the hydrology in the wetland system. It was recognized the hydrologically altered systems may be stressed by factors other than groundwater withdrawals and considerations for these effect were incorporated in the EMT's analysis of water levels in wetlands (CFWI 2013a).

Examples of significantly altered hydrology would include

- ◆ Ditches through the wetland that would alter water levels.
- ◆ Substantial urbanization of the contributing watershed that would significantly alter the amount of runoff being discharged to the wetland.
- ◆ A portion of the wetland was physically removed (excavated or filled).
- ◆ Isolation or re-routing of significant portions of the watershed that previously contributed water to the wetland.

Two methods were used to evaluate wetlands under future modeled water level conditions, each using a different approach to visualize the recent and modeled future condition of wetlands in the CFWI Planning Area. The first approach used a statistical analysis to infer the number of currently stressed and projected future stressed wetlands in the CFWI Planning Area. The second approach examined the recent stress condition of assessed wetlands and evaluated the projected change in water levels at these sites.

The statistical analysis examined only isolated lake and wetland systems. Isolated wetlands, including those associated with lakes without established MFLs, were evaluated because they are expected to be the more hydrologically sensitive wetland type occurring within the CFWI Planning Area. These isolated wetlands were further grouped into those that were located within plains and ridge physiographic province settings. Analysis of hydrologic data from the Class 1 Plains and Ridge wetlands were conducted separately to determine the statistic that best discerns stressed and unstressed wetlands. The distribution of stressed and unstressed wetlands was used to infer the general percentage of stressed Class 3 wetlands within the CFWI Planning Area. A more detailed description of methods and analysis can be found in the EMT technical document (CFWI 2013a).

The second method used to evaluate wetlands examined output from modeled future water withdrawal scenarios at specific assessment sites. Changes in modeled surface water levels

between the reference condition and some future modeled scenario were examined to determine if water levels would be expected to increase, decrease, or remain the same at EMT-assessed wetlands. These model scenarios and outputs are described in **Chapter 4** and **Volume IA, Appendix C**. The mean water level was calculated for each wetland assessment site from monthly model outputs from modeled scenarios. The magnitudes of water level change from a reference condition at assessed wetland sites were mapped to indicate areas of greatest change.

Non-MFL Springs

Potential changes in discharge from three springs within the CFWI Planning Area that do not have adopted MFLs were estimated for the 2035 withdrawal scenario using the approach described above for springs with adopted MFLs. This evaluation was conducted to support identification of environmental impacts that could occur over the 20-year span addressed by this CFWI RWSP.

Aquifer Water Quality/Saltwater Intrusion

For considerations associated with water quality concerns, modeled or estimated changes in groundwater flow relative to the Reference Condition (2005) were evaluated for changes in flow between groundwater layers included in the ECFT groundwater model for selected wellfield production zones. Saltwater intrusion in coastal portions of the SWUCA is described in the SWUCA Saltwater Intrusion Minimum Aquifer Level (SWIMAL) section.

A limited number of wells and wellfields operated in the eastern portion of the CFWI Planning Area have a history of water quality issues related to the vertical migration of underlying connate water into the wellfield production zones. These locations include facilities operated by the City of Winter Springs, City of Cocoa, City of Oviedo, Florida Governmental Utility Authority (Town of Chuluota), and the City of Sanford. Vertical groundwater flows surrounding these wellfields associated with future withdrawal scenarios were examined to determine if the projected CFWI Planning Area withdrawals would cause a risk to increased upward flow of poor quality water into these wellfield locations.

ANALYSIS

To determine the potential effects of projected water demands on the environment and water resources, a series of ECFT groundwater model runs were performed and evaluated. Scenarios used for the model runs were developed to correspond with withdrawal conditions (demands) estimated or projected for 2005, 2015, 2025, and 2035 as well as the potential pumpage of all currently permitted quantities, that is an end of permit (EOP) scenario. Interim year scenarios can be found in **Volume IA, Appendix C**. The 2005 withdrawal condition was identified as the Reference Condition (2005). Potential areas of concern were identified based on the response of various water resource constraints or considerations (i.e., measuring sticks) to groundwater level drawdown between the Reference Condition (2005) and the other demand scenarios.

Water Supply Demands

Modeled groundwater withdrawals for the Reference Condition (2005) represent the pumping required to meet the demands for water (e.g., population, irrigated agricultural acreage, and commercial/industrial activity) as they occurred in 2005 given the rainfall that occurred over the 12-year model period from 1995 to 2006. Actual and estimated pumping information provided the bases for these demands. Demand levels for 2035 and the other future withdrawal scenarios used in the ECFT groundwater model are based on population projections from BEBR, local government comprehensive plans, and utility service areas, and estimated agricultural acreage (see **Chapter 2**). Calculated irrigation demands were developed using the methodologies described in **Chapter 2** and distributed over the model period based on observed monthly distribution patterns. Public supply and domestic self-supply demands were based on historical per capita water use and monthly distribution patterns. A tabulated summary of model inputs, including withdrawals, is located in **Volume IA, Appendix C, Table C-2**.

Each withdrawal scenario was developed to simulate water levels resulting from groundwater withdrawals needed to serve the demands that either existed or were projected to occur in the year identified for the particular scenario. For example, the 2035 withdrawal scenario was based on the quantity of water needed to meet demands associated with the projected agricultural acreage, use by the projected population to be served by utilities or self-served, and commercial/industrial uses for 2035. Groundwater withdrawals were varied from month to month for each simulation based on peaking factors. The peaking factors were based on the monthly rainfall amounts and changes of demands served through the calibration period (1995-2006). This concept assumed that the same water use response to variations of rainfall from that period will persist into the future. Descriptions of the 2015, 2025, and EOP withdrawal scenarios can be found in **Volume IA, Appendices B and C**.

ECFT Groundwater Model Simulations

The ECFT groundwater model was developed and used to estimate changes of water levels as a result of changes in groundwater withdrawals for each simulation based on changes of projected water demands with other factors such as rainfall, runoff, and evapotranspiration being consistent between scenarios. Each scenario represented a different groundwater withdrawal quantity and distribution based on the amount necessary to serve estimated or projected demands. The model scenarios were run for 12 years (144 months) using monthly stress periods, constant land use information representing 2004/2005 conditions, and observed monthly rainfall amounts that occurred between 1995 and 2006. Based on this approach, the principal differences between scenarios were changes in withdrawal volumes and the corresponding irrigation quantities. The differences in model input for the model calibration period and three of the five scenarios that were evaluated are summarized in **Volume IA, Appendix C, Table C-1**

The model scenarios developed to assess groundwater availability represented withdrawal conditions corresponding to estimated or projected demands of 2005, 2015, 2025, 2035, and EOP. Additionally, an EOP scenario was conducted to quantify the potential change in water levels that would occur if all currently permitted groundwater users pumped their total allocated permitted quantities. Groundwater withdrawals for each scenario were varied from month to month throughout the simulation based on the amount of rainfall received and demands served and as a result will differ from those demands presented in **Chapter 2**. The 2015, 2025, and EOP scenarios can be found in **Volume IA, Appendices B and C**.

The 2005 withdrawal scenario was selected as the Reference Condition (which represents relatively recent demands) and was used as the basis to calculate differences in water levels and flows due to changes in groundwater withdrawals resulting from other model simulations. The 2005 scenario also corresponds with the most recent land use condition incorporated in the ECFT groundwater model, and is consistent with the time period when time environmental data were collected at wetland and lake sites in central Florida associated with the CFWI planning effort. The total water demand represented in the Reference Condition was 653 mgd, average daily flow. This Reference Condition (2005) demand differs from the 1995-2006 average of 800 mgd, which is described in **Volume IA, Appendix C**.

The ECFT groundwater model simulations results were used to assess lake and spring MFLs compliance. These considerations were based on MFLs compliance status thresholds and whether the results of a modeled scenario of future withdrawal conditions would suggest compliance or lack of compliance with adopted or proposed MFLs including MFLs proposed for reevaluation. Target groundwater levels established for two groups of wells as part of the SWFWMD SWUCA Recovery Strategy were also identified and used as other resource considerations. Model results were also used to assess the probability of change of the stress condition for non-MFL lake and wetland sites based on changes of groundwater withdrawals. Several springs without adopted MFLs were also evaluated, based on changes in simulated discharge associated with the model scenarios. Water quality considerations

included those associated with potential saltwater intrusion and adverse impacts on MFLs adopted for an aquifer system in the MIA of the SWUCA and potential upconing of poorer quality groundwater at selected wellfields in the eastern portion of the CFWI Planning Area.

Distribution of Groundwater Withdrawals

The distribution of groundwater withdrawals within the ECFT groundwater model domain was estimated for major water use categories with emphasis on withdrawals in the CFWI Planning Area. Agricultural withdrawals are distributed throughout the model area with a greater concentration in the western portion of the model domain. Public supply withdrawals tend to be most concentrated along the I-4 and US 27 corridors, and commercial/industrial/institutional withdrawals tend to be most concentrated in southwestern Polk County. With respect to the projected increase in groundwater withdrawals over time, **Figure 5** compares the distribution of withdrawals for the Reference Condition (2005) to the 2035 withdrawal condition scenarios based on total withdrawals summarized over uniform 10-mile by 10-mile sections of the CFWI Planning Area. For this comparison, changes in projected withdrawals over time are most pronounced in the northern-central portion of the CFWI Planning Area.

Results of Analysis

Results for the assessment of the Reference Condition (2005) are presented in this section along with results for the 2035 withdrawal condition. Results from the 2015, 2025, and EOP scenarios can be found in **Volume IA, Appendix C** and the *EMT Final Report* (CFWI 2013a). Assessment results are presented for

- ◆ Adopted and proposed MFLs within the CFWI Planning Area
- ◆ Other regulatory well considerations, including the SWFWMD SWUCA
- ◆ Non-MFL lakes and wetlands
- ◆ Non-MFL springs flows
- ◆ Saltwater intrusion

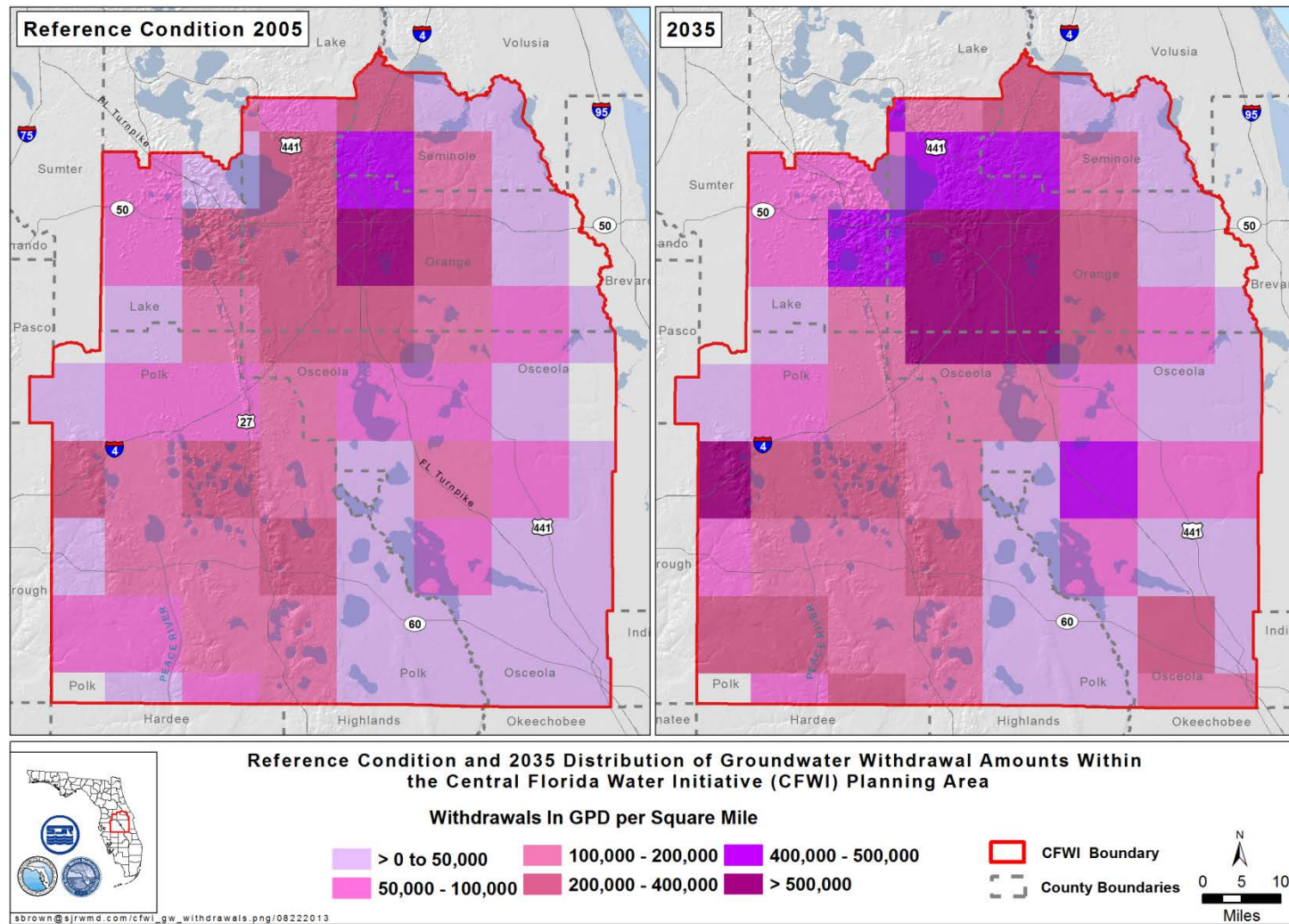


Figure 5. Comparison of the distribution of groundwater withdrawal quantities for the Reference Condition (2005) and the 2035 withdrawal scenarios based on withdrawal totals for 100 square mile sections of the CFWI Planning Area contained within the ECFT groundwater model domain (gpd = gallons per day).

Recent Status and Reference Condition Assessment Results

Adopted and Proposed MFLs within the CFWI Planning Area Including the SWUCA SWIMAL

Minimum flows and levels compliance status assessments indicated that adopted MFLs are currently being met at 36 sites, while MFLs adopted for 10 sites including seven lakes, one spring, and two river segments, are not being met (**Figure 6**; see also **Chapter 3** and **Volume IA, Appendix B, Table B-4**). SWFWMD's SWUCA SWIMAL, which may be influenced by groundwater withdrawals in the CFWI Planning Area, is established for a region of the SWUCA outside of the CFWI Planning Area and ECFT groundwater model domain and, is also not currently being met. A recovery strategy is in place for the lakes and river segments within the CFWI Planning Area where MFLs are not being met. Similarly, a recovery strategy is in place for the SWUCA SWIMAL. A strategy for the single spring MFL that is not being met has yet to be developed.

MFLs have been proposed for nine additional priority water bodies within the CFWI Planning Area. Reference condition status assessments indicate that all of the proposed MFLs, including potential reevaluated MFLs, if adopted, would be met.

Southern Water Use Caution Area Regulatory Well Targets

Based on the Reference Condition (2005) status assessment, regulatory well targets developed to support MFLs recovery in the SWUCA are being met.

Non-MFL Lakes and Wetlands

Reference Condition (2005) withdrawal scenario results for non-MFL lakes and wetlands are shown in **Table 15** and in **Volume IA, Appendix C, Table C-4**.

Non-MFL Springs

Recent status of the three CFWI Planning Area springs without adopted MFLs was characterized using annual median flows. Based on period of record discharge values, median values were 28 cfs for Apopka Spring, 1.4 cfs for Clifton Spring, and 8.3 cfs for Island Spring. **Table 16** includes the period of record and Reference Condition (2005) discharge values.

Aquifer Water Quality/Saltwater Intrusion

Wellfield facilities operated by the City of Winter Springs, City of Cocoa, City of Oviedo, Town of Chuluota, and the City of Sanford have a history of elevated but manageable water quality constituents related to the vertical migration of poorer quality water into the wellfield production zones. This history was considered representative and appropriate for characterization of the recent status of these systems.

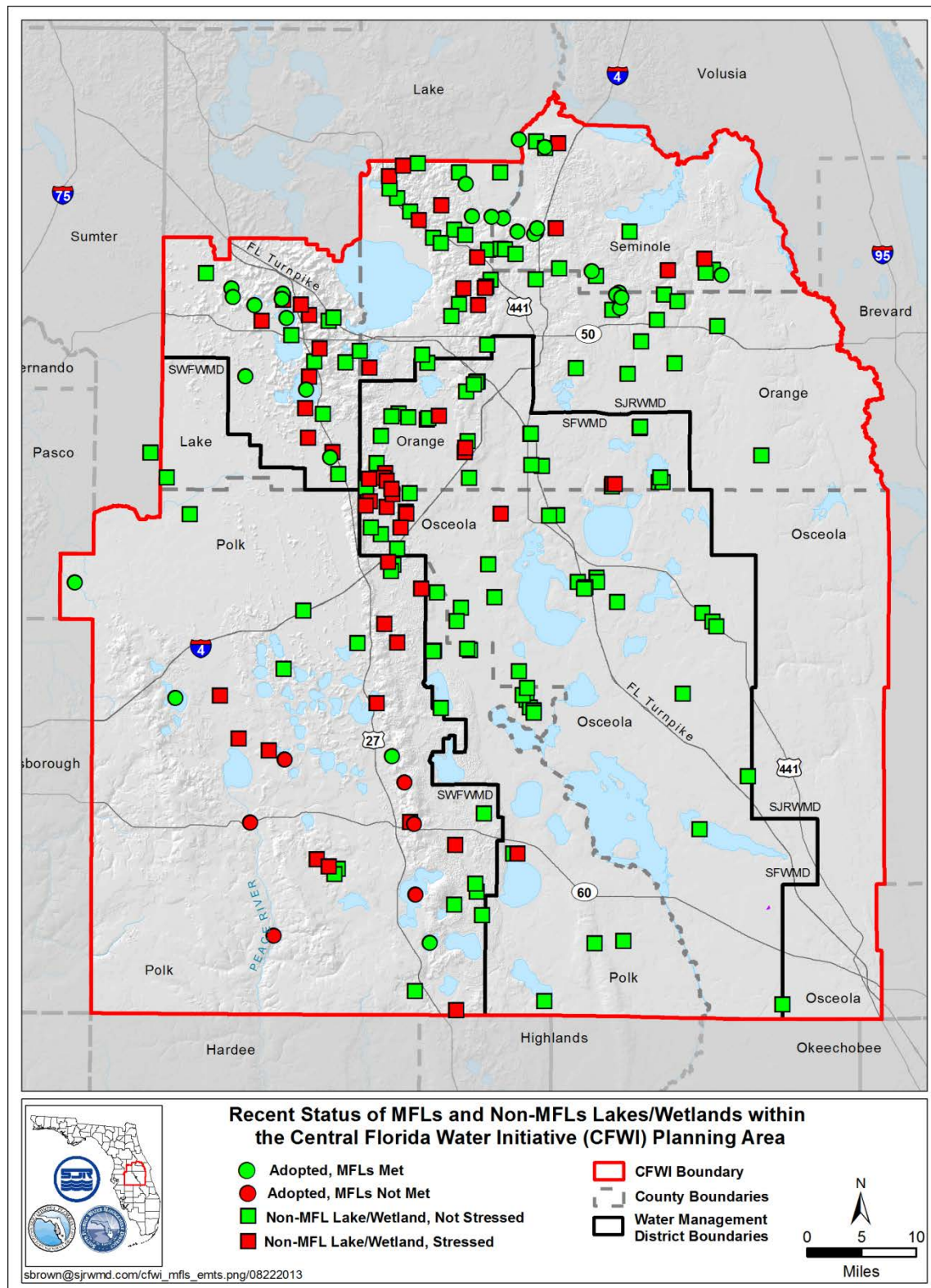


Figure 6. Recent status of MFLs compliance and characterization of stressed condition of non-MFL lake and wetland sites that have not been substantially hydrologically altered in CFWI Planning Area.

2035 Assessment Results

The results of the 2035 withdrawal scenario are presented in terms of changes in water levels and flows associated with MFL sites and other constraints and considerations identified for use as measuring sticks to support the groundwater availability assessment. The assessment of potential impacts to environmental features was largely focused on changes in water levels in the SAS (SAS, Layer 1 of the ECFT groundwater model) and the UFA (Layer 3 of the ECFT groundwater model). Water budget models were used to establish relationships between changes in UFA water levels and changes in SAS water levels. These relationships were used to predict potential impacts to surface water resources.

The patterns of change between the Reference Condition (2005) and the 2035 withdrawal scenario in the SAS and UFA water levels are shown in **Figures 7** and **8**, respectively. Although the water level changes are mostly related to differences in withdrawal quantities, some changes are due to differences in the locations of withdrawal points between the Reference Condition (2005) and the 2035 withdrawal scenario. Differences in SAS water levels for the two simulations were most pronounced in the ridge areas located along US Highway 27 and near Lake Apopka, Winter Haven, and Lakeland. Differences in the UFA water levels for the two simulations are most pronounced in north-central Osceola county and southwestern Orange County.

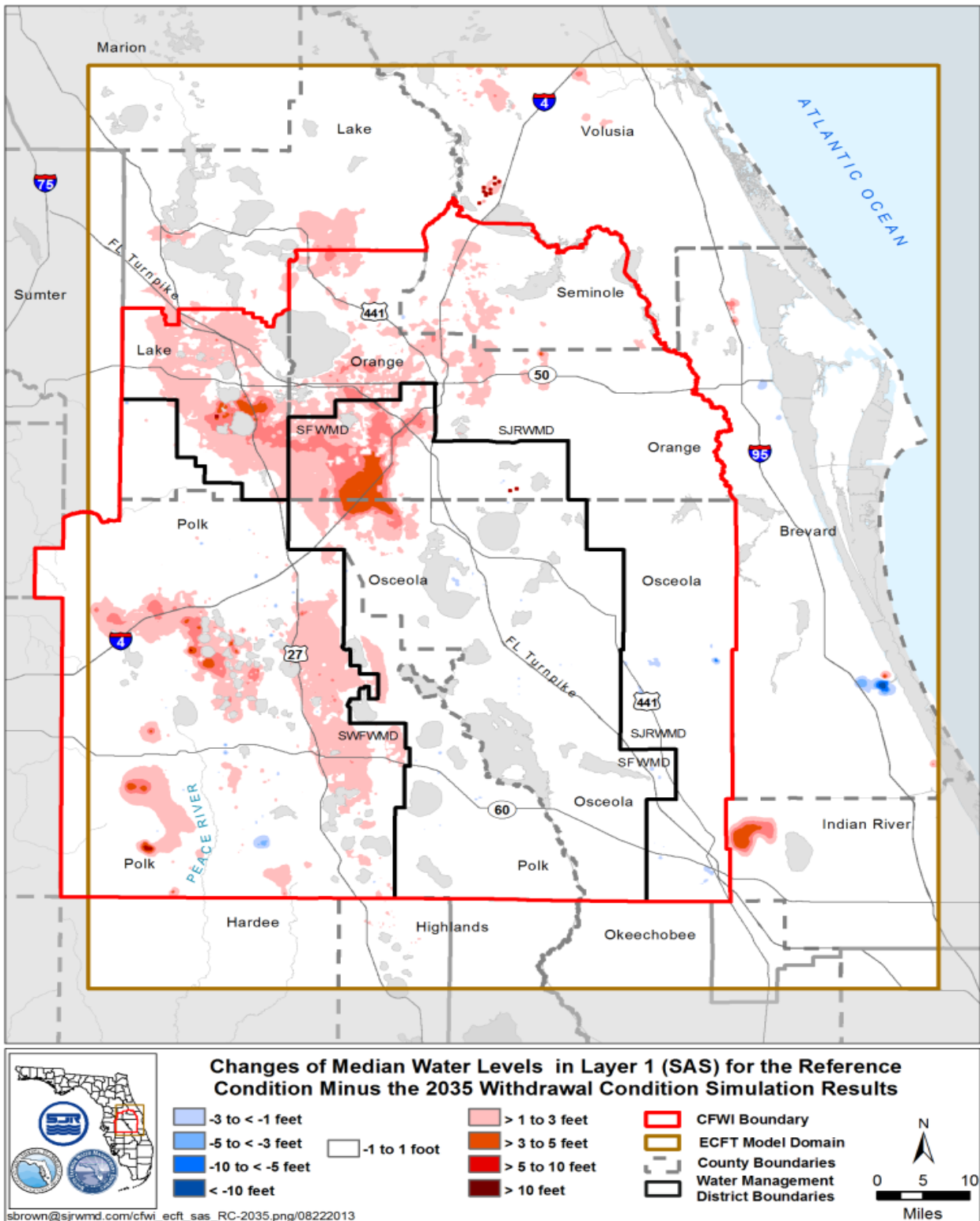


Figure 7. Change in surficial aquifer system (SAS) water levels between the 2005 Reference Condition and the 2035 withdrawal scenarios in the CFWI Planning Area.

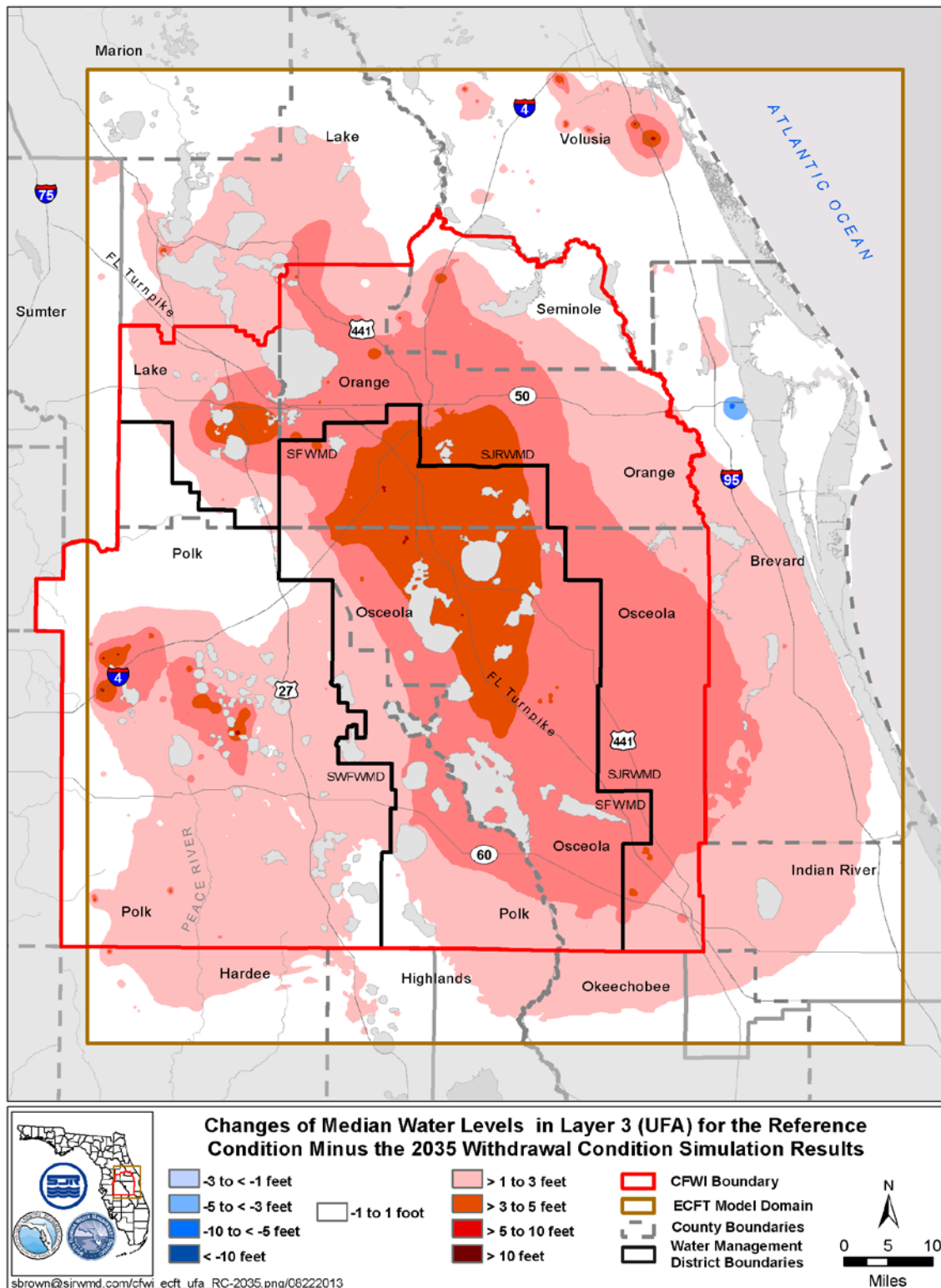


Figure 8. Change in Upper Floridan aquifer (UFA) water levels between the 2005 Reference Condition and 2035 withdrawal scenarios in the CFWI Planning Area.

Adopted and Proposed MFLs within the CFWI Planning Area Including the SWUCA SWIMAL

Using the ECFT groundwater model projected changes in water levels in the UFA, the remaining available UFA freeboard and the corresponding status of MFLs and other resource considerations was determined. **Table 14** summarizes results of these evaluations for MFLs constraints and other considerations for the Reference Condition (2005) and the 2035 withdrawal scenarios. Based on results for the 2035 withdrawal scenario and extrapolation of these results to additional MFL water bodies located near the evaluated sites, 25 water bodies within the CFWI Planning Area are projected to fall below adopted MFLs. These water bodies are located within the SJRWMD or the SWFWMD and include 17 lakes (Lake Bonnie, Lake Brantley, Cherry Lake, Eagle Lake, Lake Clinch, Crooked Lake, Lake Louisa, Lake Mabel, Lake McLeod, Lake Minneola, North Lake Apshawa, North Lake Wales, Pine Island Lake, Prevatt Lake, South Lake Apshawa, Lake Starr, Lake Wailes), 5 springs (Palm Spring, Rock Spring, Sanlando Spring, Starbuck Spring, Wekiwa Spring) and 3 river segments (Peace River at Bartow, Peace River at Ft. Meade, Wekiva River at SR 46). In addition to the 25 water bodies within the CFWI Planning Area where MFLs are not projected to be met for the 2035 withdrawal scenario, the SWUCA SWIMAL and target water levels for regulatory monitoring wells in the Lake Wales Ridge area associated with the SWUCA Recovery Strategy are projected to not be met for the 2035 withdrawal scenario. Results for the 2015, 2025, and EOP withdrawal scenarios are included in **Volume IA, Appendix C**.

Table 14. Summary status of MFL constraints and other MFL considerations for the Reference Condition (2005) and the 2035 withdrawal scenario in the CFWI Planning Area.

MFL Constraints^a and Other Considerations^b Status	Modeled Withdrawal Condition Scenario	
	2005 Reference Condition	2035 Scenario
MFLs Constraints^a		
Number Met	26	13
Number Not Met	5	18
Other MFL Considerations^b		
Number Met	12	4
Number Not Met	2	10
Combined MFL Constraints and Other MFL Considerations		
Number Met	38	17
Number Not Met	7	28

^a MFL constraints included adopted MFLs for lakes/wetlands within the CFWI Planning Area.

^b Other MFL considerations included: proposed MFLs for lakes within the CFWI Planning Area, proposed MFLs intended to replace currently adopted lake MFLs (re-evaluation MFLs); adopted MFLs for several river systems extending into the CFWI Planning Area; the adopted SWUCA SWIMAL for the MIA of the SWUCA; and regulatory monitoring wells supporting the SWUCA Recovery Strategy. Additional information on MFL constraints and considerations is provided in **Volume IA, Appendix B**.

In general, as groundwater withdrawals increase in the region, the ECFT groundwater model shows that potential impacts to MFLs water bodies and other resource concerns will occur and increase in severity. Areas where this is projected to occur include the physiographic ridges along US 27. **Figure 9** illustrates the simulated response of MFLs constraints and other considerations for the Reference Condition (2005) and 2035 withdrawal scenarios. Remaining freeboard values are expressed in feet (non-highlighted values) or cfs (yellow highlighted values), with Minimal Aquifer Connection (MAC), indicating that freeboard was not established due to MAC at the site and Not Determined (ND) indicating that freeboard was not determined. Two freeboard values are shown for four sites with adopted and proposed MFLs that were used respectively, as MFLs constraints and other considerations. Colored polygons in the lower portion of each panel identify sets of grouped considerations for the Peace River, Lake Wales Ridge target wells, and Upper Peace River target wells. A range of freeboard values are shown for each set of wells based on the method used for their derivation. A symbol for the southernmost of the Lake Wales Ridge wells grouped by the orange polygon is not shown in the mapped area.

Based on the current status assessment, the SWIMAL adopted for the SWUCA could be classified as not being met for the Reference Condition (2005). Changes in groundwater flows to this area in response to simulated increases in groundwater withdrawals within the CFWI Planning Area were of a magnitude that warranted concern for the adopted SWIMAL. Responses for this consideration for all scenarios were characterized as “not met” and were included in the summary results presented in **Table 14**. Based on sensitivity analysis using the ECFT groundwater model, the groundwater withdrawals that were determined to affect the SWIMAL were located primarily within the SWFWMD portion of the CFWI Planning Area.

Southern Water Use Caution Area Regulatory Well Targets

Regulatory well targets developed to support MFLs recovery in the SWUCA were considered to be met for the Reference Condition (2005). The target for wells associated with the upper Peace River MFL recovery strategy were also met for the 2035 withdrawal scenario and all other scenarios. In contrast, the target for wells associated with the recovery strategy for MFL lakes in the Lake Wales Ridge area were not met for the 2035 withdrawal scenario, as well as the other future and EOP withdrawal scenarios. Responses for the regulatory well target considerations were included in the summary results presented in **Table 14**, and status for the Reference Condition (2005) and 2035 withdrawal scenario is shown in **Figure 9**.

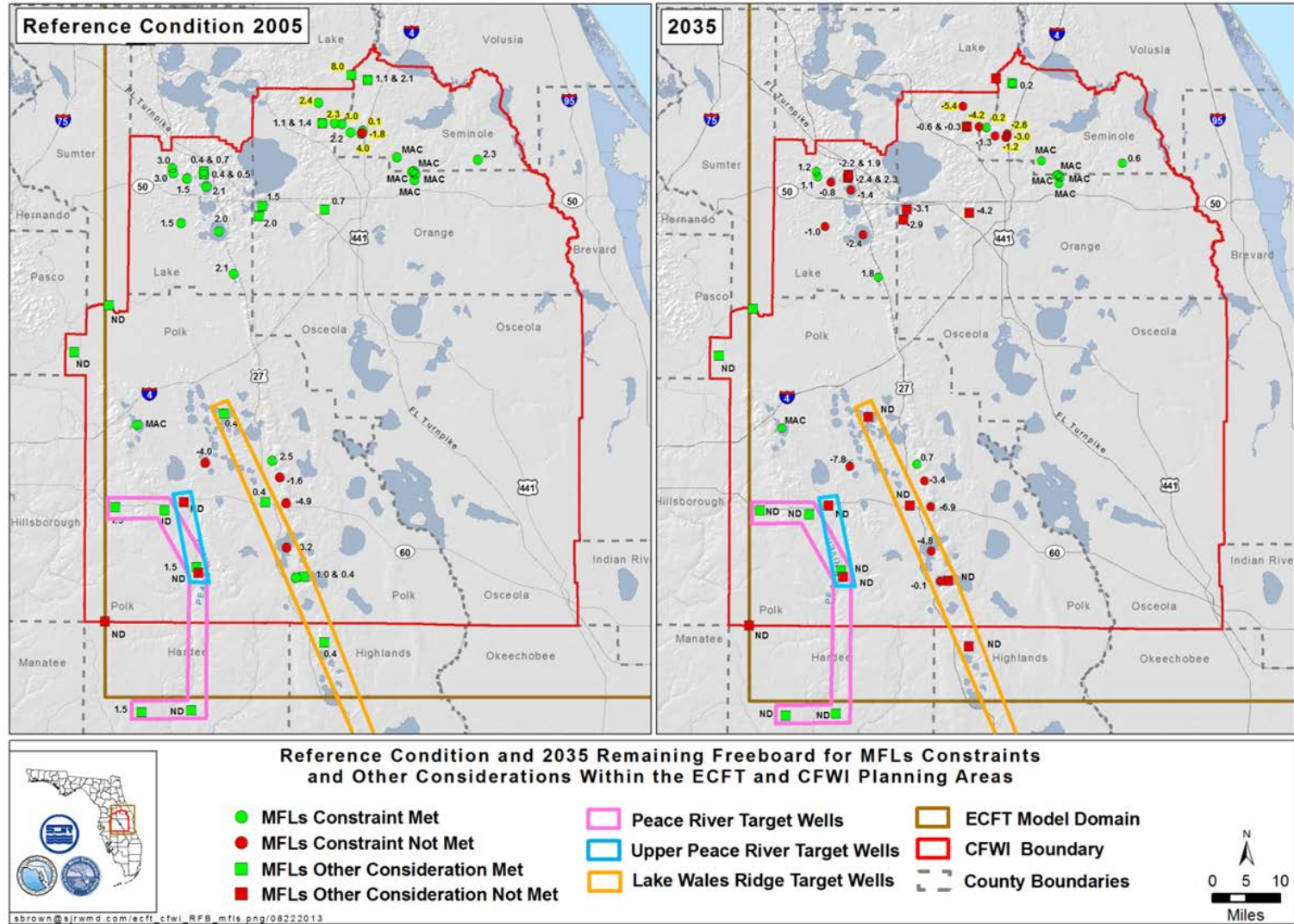


Figure 9. Status (met or not met) and remaining freeboard for MFL constraints and other considerations in the CFWI Planning Area for the Reference Condition (2005) and the 2035 withdrawal scenarios. Remaining freeboard values expressed in feet (non-highlighted values) or cubic feet per second (yellow highlighted values). MAC = Minimal aquifer connection; ND = Not determined.

Non-MFL Lakes and Wetlands

Overall, isolated Plains wetlands comprise approximately 8 percent and isolated Ridge wetlands comprise approximately 9 percent of the total acres of wetlands within the CFWI Planning Area. The isolated Plains wetlands showed relatively little response to the different groundwater withdrawal scenarios (**Volume IA, Appendix C, Table C-4**), an indication that the more highly confining conditions across most of the plains physiographic province tend to isolate these systems from Floridan aquifer changes. In contrast, isolated Ridge wetland systems showed a greater response to the different groundwater withdrawal scenarios (**Table 15**), which may be largely due to the leaky confining conditions that prevail in most of the ridge physiographic province, providing limited resistance to changes in water table elevations in response to changes in the potentiometric elevations of the underlying Floridan aquifer.

Table 15 shows that for both the Upper Floridan and Surficial aquifers, estimates predict increases in the area of stressed Ridge wetland systems for the 2035 withdrawal scenario. Results from these analyses showed a significant increase in the extent of stressed wetlands under the 2035 withdrawal scenario. Results for all withdrawal scenarios, in support of the estimate of groundwater available, can be found in CFWI 2013a.

Table 15. Summary of results for regional assessment of stress status change for isolated Ridge wetlands with Significant Hydrologic Alterations (SHA) in the CFWI Planning Area.

Aquifer Layer Used to Predict Wetland Water Level Change	Wetland Class	Area (acres)	Percentage of Stressed Wetlands Area Condition	
			2005	2035
Surficial aquifer system	Total for all Classes	92,000	45	55
Upper Floridan aquifer	Total for all Classes	92,000	45	75

Non-MFL Springs

Calculated discharges, or flows, for the three CFWI Planning Area springs without adopted MFLs are shown for the historical period of record, and the Reference Condition (2005) and 2035 withdrawal scenario simulations in **Table 16**. Reference Condition (2005) flows were similar to median values based on period of record measurements.

Table 16. Summary status of non-MFL springs within the CFWI Planning Area for the Reference Condition (2005) and the 2035 withdrawal scenario.

Spring Name	County	Period of Record (POR)	Number of Observations	Annual Median POR Flow (cfs)	Reference Condition Flow (cfs)	2035 Withdrawal Condition Flow (cfs)	Reference Condition to 2035 Change ^a (percent)
Apopka	Lake	1971-2012	2,923	28	25	17.8	-29
Clifton	Seminole	1972-2003	18	1.4	1.4	0.6*	-56
Island	Seminole	1982-2011	41	8.3	7.9	7.2*	-8

^a Small predicted changes in spring flow generally fall below the predictive accuracy of the ECFT groundwater model.

Water Quality

The ECFT groundwater model is discretized at a scale appropriate for a regional model rather than a scale suitable for accurate simulation of local-scale effects in the immediate vicinity of a withdrawal point. The results of the ECFT groundwater modeling can still provide useful insight on conditions that develop water level differences, which have the potential to drive additional vertical groundwater movement. An aquifer drawdown map between the Reference Condition (2005) and the 2035 withdrawal scenario for the UFA (Layer 3) was prepared showing the locations of the wellfields with this condition as shown in **Figure 10**. These wellfields lie in an area that is projected to experience between 1 and 3 feet of additional drawdown. This relatively small amount of additional drawdown would not likely lead to unacceptable additional water quality degradation because of the monitoring and management plans that are implemented through the permits.

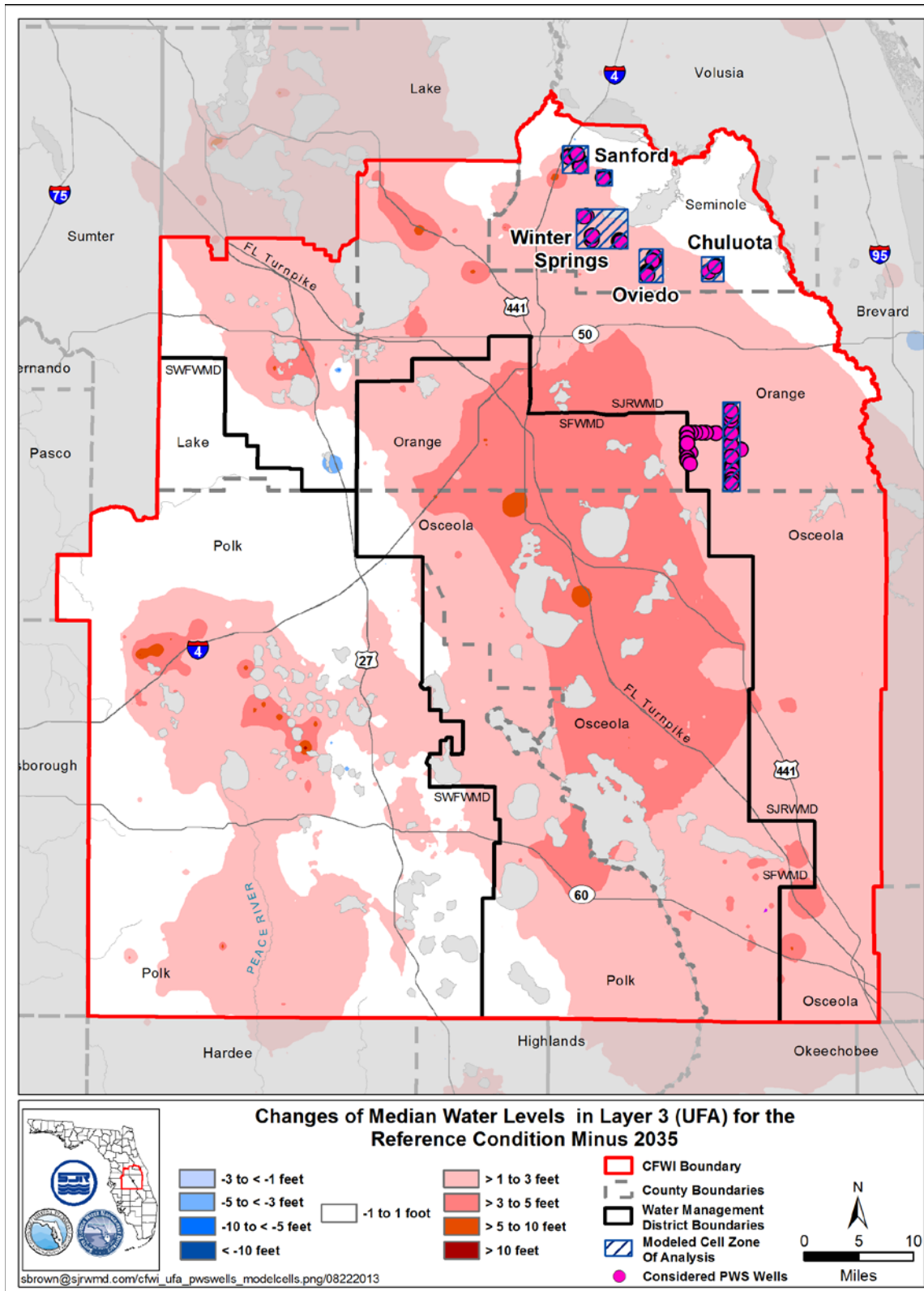


Figure 10. Projected drawdown in the UFA between the Reference Condition (2005) and the 2035 withdrawal scenario within the CFWI Planning Area.

Estimation of Groundwater Availability

The estimate of groundwater availability was obtained through evaluation of the modeled groundwater level changes between groundwater withdrawal scenarios and the Reference Condition (2005) as previously discussed. The first step in the process was to identify the number and locations of MFL measuring sticks projected to not be met for each scenario and by how much. The next step was to evaluate the projected status of the remaining environmental measuring sticks such as the SWUCA SWIMAL and regulatory monitoring wells, and non-MFL lakes and wetlands. Locations of sites projected not to be met for the withdrawal scenarios were mapped to determine the local-scale versus regional-scale nature of these occurrences. Local-scale occurrences were considered to be a few sites in proximity with smaller water level differences that could be managed through the individual consumptive use permitting process; whereas, regional-scale occurrences were considered to be more widely distributed sites with larger water level differences that could not be reasonably managed through the individual consumptive use permitting process.

When evaluating results it was apparent that as groundwater withdrawals increased there was a corresponding increase in hydrologic stress on environmental systems. The first evaluation was made by assessing effects of comparing the results of 2035 withdrawal scenario, which represented an increase of approximately 300 mgd above 2010 projected demands from all uses. Based on evaluation of these results, it was evident that impacts would likely occur over a major portion of the CFWI Planning Area. Several MFL measuring sticks were projected to not be met and a significant number of wetland acres would be subjected to an increased probability or chance of being stressed. It was decided that it was unlikely the projected increases in demands associated with the 2035 withdrawal scenario could be met solely by groundwater and that it would be necessary to assess effects of projected demands associated with the 2015 and 2025 withdrawal scenarios to determine a sustainable quantity of groundwater withdrawals for the area. These scenarios can be found in **Volume IA, Appendix C**.

Based on analysis of recent conditions, it was determined that there continue to be resource concerns associated with the SWUCA, including non-compliance with MFLs established for lakes along the Lake Wales Ridge in Polk County and the Upper Peace River, as well as the SWIMAL located outside the CFWI Planning Area but within the groundwater basin associated with western Polk County. Through implementation of the SWUCA Recovery Strategy, management efforts have been undertaken to stabilize and, where possible, reduce groundwater withdrawals in the area. When evaluating results of the 2015 withdrawal scenario (an increase of approximately 75 mgd above projected 2010 demands) it was found that resource concerns in the SWUCA did not improve and that spring MFLs in the area of the Wekiva River were beginning to fall below the adopted minimum flows. Results for the 2025 withdrawal scenario indicated further impacts to springs and lakes across the area were beginning to exceed the environmental thresholds.

Since there are many possibilities as to how future withdrawals can occur, model sensitivity runs were made to identify potential options for developing additional groundwater supply

while avoiding adverse environmental impacts. This information was used to provide general guidance to quantify groundwater availability. The sensitivity analyses indicated there are potential opportunities for shifting projected withdrawal increases to different areas within the CFWI Planning Area to minimize impacts to the springs associated with the Wekiva River. However, except for recharge scenarios that were evaluated, resource concerns in the SWUCA did not improve for the scenarios. Ultimately, it was determined that an increase of about 50 mgd above current groundwater pumping amounts could be achieved in the CFWI Planning Area with a relatively high level of confidence without causing unacceptable impacts. It is expected that this withdrawal quantity could be developed with no or minimal effect on MFL sites that are currently not meeting their levels and allow for additional groundwater supply. The availability of groundwater quantities beyond that amount however, would likely require more costly regional-scale management measures to avoid adverse environmental impacts.

Average total water use from 1995 through 2010 was approximately 800 mgd in the CFWI Planning Area. During this period, water use varied from approximately 730 mgd in 1995 and in 2010, to approximately 930 mgd in 2000. Annual water use differences are influenced by changes in population, rainfall, the economy, social awareness, and crop type. As a result, the CFWI Planning Area-wide water use values represent long-term average values, not single year values. Based on the evaluation of groundwater availability, it was estimated that the CFWI Planning Area could potentially sustain an additional estimated 50 mgd of groundwater use but coordinated management strategies will be needed (e.g., wellfield optimization, aquifer recharge and augmentation) to address unacceptable impacts.

In summary, the groundwater availability estimate was based on several key factors and assumptions, including

- ◆ Adopted and proposed MFLs and the SWUCA.
- ◆ Consumptive use permit management and mitigation measures can provide opportunities to avoid impacts from both existing withdrawals and additional withdrawals. Some local-scale and regional-scale management measures have already been implemented.
- ◆ Shifting withdrawals away from areas susceptible to groundwater withdrawals and/or recharge projects in the susceptible areas could help achieve greater groundwater availability.
- ◆ The non-MFL lake/wetlands methodology for calculating the probability of a shift from an unstressed condition to a stressed condition is a regional approach based on population-level statistics that are not applicable to assess the change of stress status of individual wetland sites.
- ◆ The groundwater availability estimate is intended to be used to assist in developing 20-year water supply plans that include groundwater supply, water conservation and reuse, other management activities, and alternative water supplies.

- ◆ Environmental monitoring can verify and refine model predictions and adjust the groundwater availability estimates for future RWSPs.
- ◆ Water quality changes to wellfields.

CONCLUSIONS

The CFWI Planning Area groundwater availability estimate recognized the limitations in the ECFT groundwater model and the analyses used for MFL water bodies and non-MFL lakes and wetlands. Details and limitations for each process are included in **Chapter 3** and **Volume IA, Appendices B and C**.

In evaluating groundwater availability, quantities were found to be limited primarily due to the spatial location and depth of groundwater withdrawals with respect to areas of environmental sensitivity. Primary areas or features of the region that appear to be more susceptible to the effects of groundwater withdrawals, and potentially limit additional groundwater development throughout much of the CFWI Planning Area are

- ◆ Wekiva Springs/River System
- ◆ West Seminole County/West Orange County
- ◆ South Lake County
- ◆ Lake Wales Ridge
- ◆ SWUCA

The environmental systems (i.e., lakes and wetlands) in these areas are generally more susceptible to withdrawals from the Floridan aquifer due to low or no confinement between the surficial aquifer (SAS) and the underlying UFA. Cumulative withdrawals throughout much of the CFWI Planning Area will impact these areas, not just those withdrawals in these susceptible areas. Consequently, when water is withdrawn from Floridan aquifer wells throughout the CFWI Planning Area, depressed water levels in the Floridan aquifer may cause drawdown in the SAS and adversely affect environmental systems. Flows from the springs are also susceptible to changes in the Floridan aquifer water levels because they are direct discharge points from the aquifer; lower water levels translate to lower spring flows.

Results of the 2035 and 2025 withdrawal scenarios using the measuring sticks indicated unacceptable impacts to natural systems. As such, it was estimated that a total withdrawal quantity, from all sources, of 850 mgd could be managed with existing consumptive use permit conditions and local management activities without exacerbating change to the current levels of lakes, springs, and wetlands in the susceptible areas. Discussion of a potential upper limit of groundwater availability through management strategies, which may be considered a water supply option by the Solutions Planning Team, can be found in **Volume IA, Appendix C**.

For the purposes of the CFWI RWSP, the amount of additional groundwater that may be available within the CFWI Planning Area was estimated to be 50 mgd greater than the current long-term average (1995 through 2010) total water use of approximately 800 mgd.

As described in this chapter, field assessment and results of analytical and modeling tools currently indicate the presence of “stressed” wetlands. This information, as well as other information generated by the CFWI effort, represents the best available technical information concerning current and projected water resource conditions. It is also worthwhile to note the stress described in this plan is not necessarily the same as harm as defined in the water management districts’ respective regulatory programs. In the near-term, the districts will, as part of the continued CFWI effort (Solutions Planning and Regulatory Teams) and their ongoing regulatory programs, consider all available information in evaluating harm to the water resources of the area (including wetlands). Specifically, the districts will utilize the CFWI information as they review applications for consumptive use permits and determine their associated duration. Moreover, the Solutions Planning and Regulatory Teams will, in part, identify regional water supply projects, develop options for a consistent regulatory definition of sustainable withdrawals and associated implementation strategies, and review management activities associated with permitted uses to maximize yield and minimize environmental impacts.



Sanlando Springs, a second magnitude spring in Seminole County

5

Water Conservation

INTRODUCTION

Water conservation is the prevention and reduction of wasteful or unreasonable uses of water to improve efficiency of use. Water conservation avoids using water for either unnecessary purposes or purposes that can be achieved reasonably without the use of water.

LAW/CODE

The overall water conservation goal of the state is to prevent and reduce wasteful, uneconomical, impractical, or unreasonable use of water resources. (Section 373.227(1), F.S.).

For water providers, including public supply utilities and other organizations that supply water to end users, a well-crafted water conservation/demand management plan can improve a provider's system-wide operational efficiency and reduce, defer, or eliminate the need for investments in new production capacity, which may include development of higher cost alternative water supply sources.

Individual homeowners, businesses, agricultural water users, and water providers can benefit greatly from conservation. However, it is the duty of state and local governments, as well as water providers, to educate, incentivize and, in some cases, require actions, which lead to conservation.

The Districts' broader perspective requires local governments and water providers to ensure that regional resources are utilized sustainably and do not exceed their capacity to provide water for growing demands into the future. Local governments and water providers are uniquely burdened by their responsibility to provide a service to their customers while simultaneously keeping short- and long-term costs low. However, local governments and water providers also are typically the first point of contact between the resource and the end users. Therefore, Districts are set to provide support to local governments and water providers in their efforts to promote, develop, and implement water conservation, in addition to their own direct efforts to reach end users. Maximizing water conservation has and will continue to require a cooperative and collaborative effort by all stakeholders.

The purpose of this chapter is twofold. First, is to provide the results of an analysis, which focused on quantifying potential future conservation-related water use reductions within

the CFWI Planning Area. The second purpose is to describe the tools, resources, and initiatives available to individuals, commercial and agricultural water users, local governments, utilities, and Districts to foster conservation and water use efficiency.

QUANTIFYING POTENTIAL WATER SAVINGS

There have been significant increases in water use efficiency and reductions in wasteful water use within the CFWI Planning Area over the last two decades. Opportunities for additional water savings through conservation remain and may even be improved upon as new technologies are developed. However, as efficiency improvements are made, finding ways to achieve even greater efficiency through conservation does become more challenging. Districts, local governments, water providers, and water users will need to work cooperatively toward further reducing water needs and increasing water use efficiency.

Current demand projections and the conservation potential for the region were calculated in an effort to gauge the future impact of conservation in the CFWI Planning Area. It is important to note that reductions in per capita water use resulting from current and historical water conservation efforts are reflected in the 2035 demand projections that were performed for this plan. Current demand projections are lower than projections that were previously developed for this region partly because of the ongoing effects of water conservation measures that have been implemented.

The amount of additional water conservation for six water use categories that reasonably can be achieved by 2035 under current circumstances in the CFWI Planning Area has been estimated by a water conservation subgroup consisting of representatives from the participating Districts, FDEP, FDACS, and the central Florida public supply utilities. The six water use categories, as defined in **Chapter 2**, analyzed were

- ◆ Public Supply
- ◆ Domestic Self-supply (DSS)
- ◆ Agriculture
- ◆ Landscape/Recreational/Aesthetic
- ◆ Commercial/Industrial/Institutional
- ◆ Power Generation

The Conserve Florida Water Clearinghouse conservation planning tool, the EZ Guide (Switt 2011), was used to calculate water savings for specific best management practices (BMPs) and to summarize estimates of indoor residential, outdoor residential, and publicly-supplied Commercial/Industrial/Institutional (CII) water use. Using the EZ Guide analysis output and separate estimates of agricultural water savings potential, an estimated 42.3 million gallons per day (mgd) or 3.9 percent of the projected demand for 2035 can be eliminated by water conservation. This estimate of water conservation potential is based on

voluntary consumer actions, with encouragement through education, and a level of financial incentives considered reasonable by the water conservation subgroup. The estimates of water conservation potential by each of the six water use categories are shown in **Table 17**. The EZ Guide results for outdoor and CII water use segments have been independently confirmed (Friedman et al. 2013; Morales et al. 2013) using model parameters adjusted for the CFWI Planning Area. Estimates of water conservation potential for DSS and CII, LRA, and Power Generation categories were based on various segments of the EZ Guide outputs for Public Supply. The methodologies used to estimate the water conservation potential for each water use category are described in the following sections.

Table 17. Projected 2035 water demand and water conservation potential within the CFWI Planning Area.

Water Demand Category	Projected 2035 Demand (mgd)	Projected 2035 Conservation (mgd)	Net Projected 2035 Demand with Conservation (mgd)
Public Supply	653.27	26.78	626.49
Domestic Self-Supply (DSS)	24.42	1.19	23.23
Agriculture	214.84	10.90	203.94
Landscape/Recreational/Aesthetic	72.18	2.02	70.16
Commercial/Industrial/Institutional	95.85	1.15	94.70
Power Generation	22.41	0.27	22.14
Total^a	1,082.97	42.32	1,040.65

Note: mgd = million gallons per day

^a Total includes rounding of decimal places to two significant figures.

Public Supply

The Conserve Florida Water Clearinghouse EZ Guide tool was used to estimate conservation potential for public supply. A detailed description of the EZ Guide is available in Switt 2011. Estimates of water conservation potential were calculated for a group of seven utilities (located throughout the CFWI Planning Area), which individually range in 2010 estimated population from approximately 4,000 to almost 500,000, and which collectively represent 53 percent of the 2010 CFWI Planning Area public supply demand. The resultant demand-weighted 4.1 percent average water conservation potential for these utilities was then extrapolated to the remainder of the study area by applying it to the projected 2035 public supply demand of 653.27 mgd, resulting in 26.78 mgd of public supply water conservation potential (**Table 17**).

The following parameters were used to ensure the calculation of reasonable estimates of water conservation potential:

1. Florida Water StarSM specifications were used for plumbing fixture BMPs.
2. A cost effectiveness cap of \$3 per 1,000 gallons, as defined by the EZ Guide, was used in BMP selection. This cost cap is consistent with the SWFWMD Regional Water Supply Plan (RWSP) (SWFWMD 2011d).
3. EZ Guide population was adjusted to be consistent with that used in CFWI Planning Area demand projections.
4. EZ Guide estimated water use was adjusted to reflect actual flows.
5. Participation rates (percentage of potential opportunities to implement a conservation practice realized through a water conservation program) were based on SWFWMD studies of actual projects and used in the SWFWMD RWSP (2011b). These rates are 23 percent for retrofit-based BMPs and 12.5 percent for BMPs that require another party to visit the site.
6. Effects of previous water conservation efforts on current and future conservation potential were included.

The EZ Guide was used to calculate BMP-specific water savings and summarized estimates of total savings for indoor residential, outdoor residential, and publicly supplied CII water use. Indoor residential BMPs included replacements of toilets, showerheads, and faucets. Outdoor BMPs included irrigation system audits with subsequent system improvements and soil moisture sensors. CII BMPs included replacements of pre-rinse spray valves, toilets, showerheads, faucets, urinals, and site specific water audits. Potential savings from water use efficiency improvements in cooling tower and CII process water use were not considered because of inadequate data and the highly specialized nature of individual CII processes.

A summary of the aggregate results for the seven sample utilities is provided in **Table 18**. The EZ Guide results for outdoor and CII water use segments have been independently confirmed by Friedman et al. (2013) and Morales et al. (2013) utilizing model parameters adjusted for the CFWI Planning Area.

Table 18. Aggregated water conservation demand for seven sampled public supply utilities within the CFWI Planning Area.

Water Use Segment	Demand-Weighted Average	Lowest (of 7 Utilities)	Highest (of 7 Utilities)
Potential SFR/MFR Indoor Conservation (gpd)	1,767,066		
Estimated Actual SFR/MFR Indoor Flow (gpd)	23,826,513		
Potential SFR/MFR Indoor Conservation (%)	7.4%	3.7%	11.4%
Potential SFR Outdoor Conservation (gpd)	210,537		
Estimated Actual SFR Outdoor Flow (gpd)	8,587,572		
Potential SFR Outdoor Conservation (%)	2.8%	0.5%	5.3%
Potential CII Conservation (gpd)	188,568		
Estimated Actual CII Flow (gpd)	18,055,571		
Potential CII Conservation (%)	1.2%	0.7%	2.4%
Potential Conservation (gpd)	2,166,170		
Actual Use (gpd)	53,489,678		
Potential Conservation (%) ^a	4.1%	3.1%	5.0%
Average Cost (\$/kgal) ^b from EZ Guide ^c	\$ 0.54	\$ 0.48	\$ 0.67

Note: CII = Commercial/Industrial/Institutional
 gpd = gallons per day
 kgal = thousand gallons
 MFR = Multi-Family Residential
 SFR = Single Family Residential

^a The 4.1% potential savings rate for the sampled utilities was applied to the projected 653.27 mgd of projected 2035 public supply demand to get the 26.78 mgd of conservation potential shown in Table 1 ($653.27 \times 0.041 = 26.78$).

^b The average cost per kgal includes BMPs costing up to \$3.00 per kgal.

^c Conserve Florida Water Clearinghouse EZ Guide (Switt 2011)

Domestic Self-supply

The water conservation potential for domestic self-supply (DSS) is assumed to be directly proportional to that of the residential part of public supply and its estimate is dependent on the calculation of public supply residential indoor and outdoor water conservation potential. After the aggregate estimate of residential indoor and outdoor water conservation for the seven utilities was completed, the total amount of potential public supply residential water conservation was divided by the aggregate service area population to yield a residential per capita water conservation potential of 5.57 gallons per day. This public supply per capita water conservation estimate was then multiplied by the projected DSS population of 213,350 to get the DSS water conservation estimate of 1.19 mgd (Table 17).

Agriculture

The estimate of reasonably achievable water conservation for agriculture was limited to crop irrigation. These estimates were based on mobile irrigation laboratory (MIL)

evaluations of farms that had follow-up evaluations after farmers had the opportunity to implement improvements recommended in initial evaluations. Data for farms in the CFWI Planning Area were given priority for this evaluation. Where CFWI area data were limited, the data were augmented from other regions. A summary of this analysis is provided in **Table 19**. Estimates of water conservation potential for agriculture assume implementation of the BMPs listed in **Volume IA, Appendix D**, or comparable practices for other specific crops. It should be noted that these estimates are conservative in that they consider only the BMPs listed in **Volume IA, Appendix D**, which are primarily management, and maintenance practices. Greater savings could be achieved through the implementation of additional BMPs outside of those listed in **Volume IA, Appendix D**; such as infrastructure changes. Additional details about implementing agricultural BMPs are available in FDACS 2012 and related FDACS publications. The estimated agricultural water conservation potential of 10.9 mgd shown in **Table 19** is based on the middle range participation rate of 12.5 percent.

Table 19. Agricultural water conservation estimates for 2035 in the CFWI Planning Area.

Crop Category ^a	Estimated 2035 acreage ^b	Actual Mobile Irrigation Laboratory (MIL) Data					Potential 2035 Water Conservation Savings (mgd) ^d
		Number of MIL Evaluations ^c	Actual Water Savings (mgd per acre)				
			High	Low	Mean	Median	
Citrus	101,064	34	0.00093	0.00004	0.00037	0.00014	14.4
Vegetables	34,172	10	0.00139	0.00003	0.00088	0.00131	44.8
Nursery	5,810	82	0.00844	0.00001	0.00133	0.00083	4.8
Berries	371	1	0.00025	0.00025	0.00025	0.00025	0.1
Sod/Pasture	24,603	3	0.01252	0.00025	0.00457	0.00094	23.1
Totals	166,020	130					87.2
Agriculture Participation Rates and Resulting Water Savings ^e							
Minimum Participation Rate			10%	Water Savings (mgd)			8.72
Middle Participation Rate			12.5%	Water Savings (mgd)			10.90
Maximum Participation Rate			15%	Water Savings (mgd)			13.08

Note: MIL = Mobile Irrigation Laboratory
mgd = million gallons per day

^a Crop categories are based on MIL crop categories.

^b Estimated 2035 acreage is based on projections from the CFWI Water Demands Projection Group. The acreage for SFWMD is for 2030: 2035 projections were not available.

^c MIL evaluations included some locations outside the 5-county CFWI Planning Area. These non-CFWI locations were added to get as many evaluations as possible.

^d The water conservation savings are based on the median water savings values. Median values were used because the differences between the maximum, minimum, and mean values were quite large and some of the crops with the greatest acreage had very few MIL evaluations. In addition, MIL water savings represent different years and different rainfall conditions.

^e Agriculture participation rates are based on providing no incentives or assistance to implement water conservation BMPs or activities.

Landscape/Recreational/Aesthetic

The estimate of water conservation potential for this category was derived from the percentage of water conservation estimated by the Conserve Florida Water Clearinghouse EZ Guide for publicly-supplied outdoor water use, including the use of participation rates derived from SWFWMD studies of actual projects, as used in the SWFWMD RWSP (SWFWMD 2011b). After the aggregate estimate of publicly supplied outdoor water conservation potential was completed (**Table 17**), the percentage of savings for that use type was applied to the 2035 projected demand for the LRA category ($72.18 \text{ mgd} \times 2.8\% = 2.02 \text{ mgd}$).

Commercial/Industrial/Institutional

The water conservation potential for Commercial/Industrial/Institutional (CII) supply is considered to be directly proportional to that of CII uses served by public supply systems. This estimate is dependent on the calculation of public supply CII water conservation potential, which was derived from the Conserve Florida EZ Guide tool. After the aggregate estimate of publicly-supplied CII water conservation potential was completed (**Table 17**), the percentage of savings for that use type was applied to the 2035 projected demand for the CII category ($95.85 \text{ mgd} \times 1.2\% = 1.15 \text{ mgd}$). This methodology focuses on the domestic indoor uses associated with CII facilities and does not account for potential savings of commercial and industrial process water. It was not feasible for this analysis to evaluate the conservation potential of the many varied commercial and industrial processes and it is assumed that the consumptive use permitting process and business economics already drive commercial and industrial establishments to minimize their use of process water. The results of this method have been independently confirmed by a separate analysis of combined publicly supplied and self-supplied CII water conservation potential in the CFWI Planning Area by Morales et al. (2013).

Power Generation

The estimate of conservation potential for Power Generation was derived from the Conserve Florida Water Clearinghouse EZ Guide estimate for publicly supplied CII water use. After the aggregate estimate of publicly supplied CII water conservation potential was completed (**Table 17**), the percentage of savings for that use type was applied to the 2035 projected demand for the Power Generation category ($22.41 \text{ mgd} \times 1.2\% = 0.27 \text{ mgd}$). This methodology focuses on the domestic uses associated with Power Generation facilities and does not account for potential savings of process water. It is assumed that the consumptive use permitting process and business economics already drive power generation establishments to minimize their use of process water.

Factors Affecting Estimates of Water Conservation Potential

Understanding the historically achieved quantities of water conservation and future reductions which can be achieved through a water conservation program is challenging because many water conservation actions are not directly measurable. The estimates of potential water conservation presented here are based on implementation of BMPs for which the water use reductions resulting from specific financial expenditures can be calculated. However, regulation and education also are considered important parts of a water conservation program because they enhance the effectiveness of more direct actions by increasing the participation rates of BMPs (the extent to which practices will be adopted through both active conservation programs and passive adoption), although their effects can be difficult to measure.

The participation rates for conservation programs cannot be known with certainty before a BMP program is implemented. Often the entity attempting to affect water conservation is not the end user of the water and can exert only indirect influence over the adoption of water conservation practices. The participation rate for voluntary adoption of conservation practices is highly dependent on the level of incentives available and promotion of the BMP. Additional conservation could be achieved with a higher level of incentives and promotion.

The cost of water is another factor that affects estimates of water conservation potential. The feasibility and attractiveness of spending more on water conservation becomes greater as the cost of water rises. All of the estimates of water conservation potential provided here, except that for agriculture, are limited by a maximum cost of \$3.00 per 1,000 gallons. Additional conservation may be achieved if the cost of new water supplies justifies spending more on water conservation. Even at present, the next increment of supply for some water providers may be higher priced than the limit used in this analysis, thus incentivizing those providers to achieve greater amounts of conservation.

MEASURING THE EXISTING EFFECTS OF WATER CONSERVATION IN THE CFWI PLANNING AREA

Current water use in the CFWI Planning Area reflects the effects of fifteen years of conservation initiatives and programs implemented by the districts, local governments, utilities, agriculture, and other end users to prevent or reduce wasteful and unnecessary use. As a result, per capita water use for the public supply sector has decreased steadily over time, as illustrated in **Figure 11**. Public supply utilities pumped a total of 379.56 mgd in 2010, with an estimated 255.21 mgd going to serve a residential population of 2,618,658, for a residential gallons per capita per day (gpcd) of 97. However, at the 1995 residential per capita use rate of 165 gpcd, 432.92 mgd would have been required to serve the same number of people, a difference of 177.71 mgd. Reclaimed water and conservation have played an integral role in this reduction. During that time, use of reclaimed water for public access reuse for landscape irrigation increased by 23.62 mgd. If a potable offset rate of

50 percent is assumed, this reclaimed water would have reduced potable water demand by 11.81 mgd, leaving a remainder of 165.9 mgd of reduction in public supply water demand. Much of this reduction may be attributed to water conservation, although an unknown quantity also may be attributed to a switch from public supply to private irrigation wells in some localities as well as the latest economic downturn.

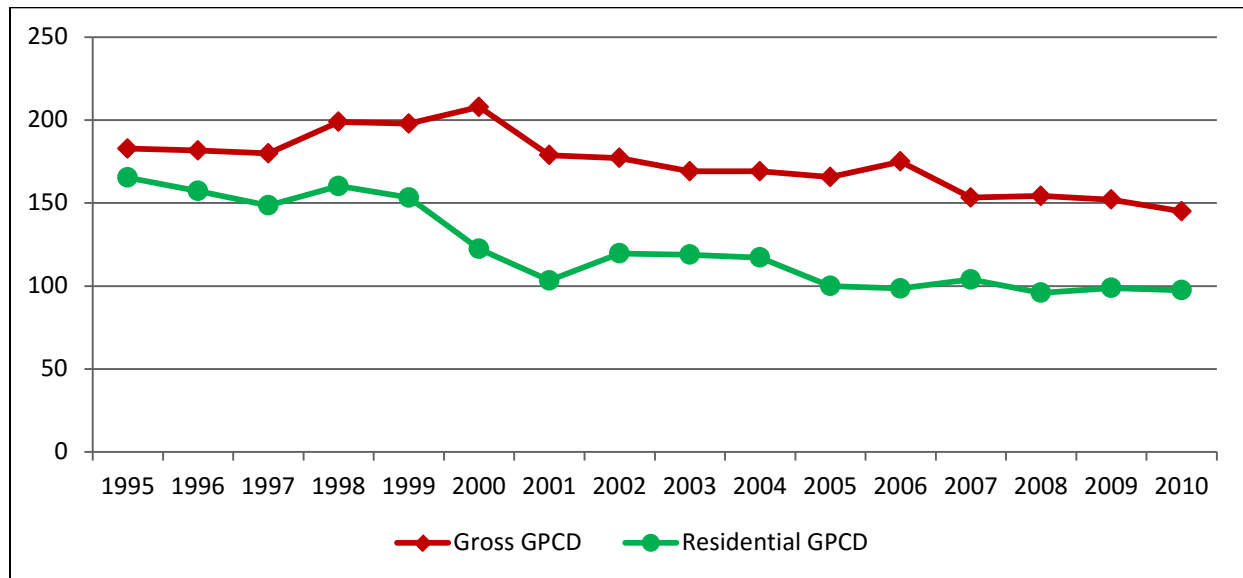


Figure 11. Gallons per capita per day (gpcd) water use in the CFWI Planning Area.

Trends in water use efficiency are most easily identifiable for public supply because of the availability of data and the nature of the water use. Other types of water use do not display the same price elasticity as residential public supply because those uses either are not subject to utility pricing or are not discretionary. Fluctuations in total water use resulting from weather and economic conditions for the DSS, CII, agriculture, landscape/recreation/aesthetic, and power generation water use categories and the lack of data for individual users make it impractical to estimate changes in efficiency for those uses.

Water use generally tends to increase during times of low rainfall and decrease during times of high rainfall (**Figure 12**). However, public supply use decreased in 2009 and 2010 in spite of dry conditions, indicating that factors other than rainfall were influencing it. This decline in water use coincided with the implementation of permanent landscape irrigation restrictions and an economic recession. Reductions resulting from landscape irrigation restrictions are expected to continue; however, some increase in water use may occur as the economy rebounds.

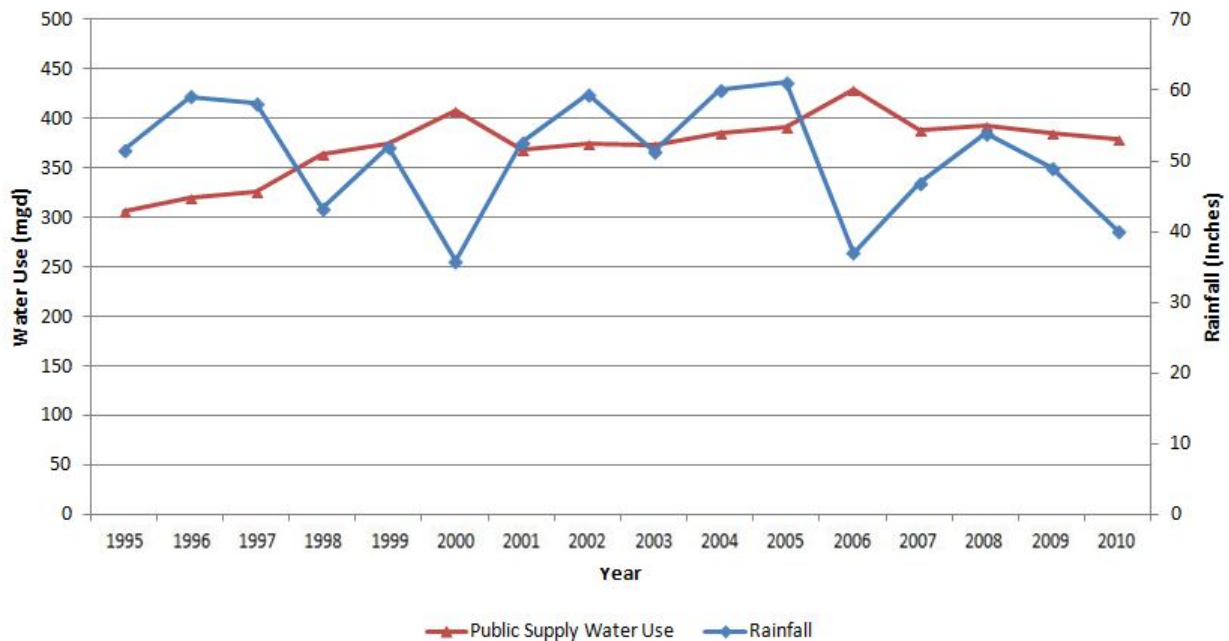


Figure 12. Public supply use (mgd) and rainfall (inches) in the CFWI Planning Area.

WATER CONSERVATION VERSUS DEVELOPMENT OF ADDITIONAL WATER SUPPLIES

Ensuring sustainable and reliable water supplies for the future will likely require a blend of traditional source use, alternative water supply development, and conservation. Many future water supply project options will require greater upfront investments and ongoing operations and maintenance costs than traditional groundwater sources. In some cases, water conservation can be a more cost-effective means of meeting water supply needs, particularly for alternative water supplies that require more costly treatment, such as reverse osmosis. Costs for alternative water supply projects can be found in **Chapter 7**.

CONSERVATION TOOLS, RESOURCES, AND INITIATIVES

As stated previously, the per capita water use rate in the CFWI Planning Area has been decreasing since 1995. This is due in large part to a blend of regulatory, voluntary, and education efforts implemented by local governments, utilities, and Districts to foster conservation and water use efficiency across all sectors of water use. The following section describes the tools, resources, and initiatives which have helped contribute to the CFWI Planning Area's declining per capita use. Further reductions in per capita water use in the CFWI Planning Area are expected contingent upon, and proportional to, the continued support and expansion of these tools, resources, and initiatives.

Building Codes and Land Development Regulations

Local governments can adopt or amend ordinances to improve water use efficiency in new construction and major renovations. These ordinances can require the use of plumbing fixtures that meet WaterStarSM or other standards that are more stringent than the Florida state building code. New or amended land development regulations can require more efficient outdoor water use. Those regulations can require water efficient landscape designs and, if irrigation is used, require irrigation systems to be designed to high efficiency standards and properly installed.

Urban and Residential Outdoor Water Conservation

Outdoor use includes the water used to establish and maintain healthy landscaping and recreational spaces such as parks, ball fields, and golf courses. In many parts of Florida, including the CFWI Planning Area, in-ground irrigation systems controlled by simple timers are common for managing the application of irrigation water. Automatic timers turn the irrigation systems on at pre-scheduled times regardless of whether the landscape actually needs water, resulting in inefficient water use. Substantial gains can be made in landscape irrigation water use efficiency by better irrigation timing management. Various, sophisticated types of irrigation controllers and timers, when installed and used properly, provide better management of irrigation which reduces unnecessary water use and improves overall outdoor water use efficiency. Mandatory measures limiting water use application times are another means of reducing outdoor water use in the CFWI Planning Area. Significant efforts also have been made to educate the public and provide plant stock through Florida-Friendly LandscapingTM (FFL).

Landscape and Irrigation System Design

The proper design of a landscape and an irrigation system are essential for water use efficiency. The overall landscape layout and the choice and placement of plants affects the quantity of water needed to keep the landscape healthy. Factors such as head spacing of sprinklers, using compatible heads in each zone, different types of emitters for lawn and shrubs, and the shape and size of irrigation zones, have major impacts on distribution uniformity and total system efficiency. FDEP, the Districts, and other concerned parties have developed a guidance document, Landscape Irrigation & Florida-Friendly Design Standards (FDEP 2006), for landscape and irrigation system designers and local governments who desire to develop ordinances to assure efficient landscape and irrigation design.

Irrigation System Controllers

Section 373.62, F.S. requires all new automatic landscape irrigation systems to be fitted with properly installed automatic shutoff devices. These devices override scheduled irrigation events when sufficient moisture is present at the site. Rain sensors typically are used for this purpose but advanced irrigation technologies, which have the potential for further improving water use efficiency, such as soil moisture sensors, evapotranspiration sensors, or weather-based shutoff devices, are evolving. Section 373.62, F.S., requires licensed contractors who install or work on automatic irrigation systems to test existing shutoff devices for proper operation before completing other work on the system and to replace any devices or switches that are not in proper working order. The statute also provides conditions for obtaining variances from applicable water management district day-of-week watering restrictions for users of smart irrigation systems meeting the specific requirements outlined in Subsection 373.62(7), F.S.



Irrigation Rain Sensor

Smart irrigation controller technologies improve the water use efficiency of irrigation systems while maintaining healthy landscapes under experimental conditions. Research in controlled settings confirms the water savings potential of properly installed and maintained automatic irrigation shutoff devices (Cardenas-Lailhacar et al. 2010). A University of Florida IFAS study involving 59 residential homes in Pinellas County demonstrated that soil moisture sensor irrigation systems realized significant water savings compared with automatic in-ground irrigation systems incorporating rain sensors and timed irrigation controllers (Dukes and Baum-Haley 2009). However, the adoption of more sophisticated technology does not guarantee more efficient water use. Proper ongoing maintenance and management are required to assure that these systems are working properly to meet their potential for improving water use efficiency.

Year-round Landscape Irrigation Restrictions

Implementation of the mandatory year-round landscape irrigation conservation rules [SJRWMD, 40C-2.042(2); SFWMD, 40E-24.201; and SWFWMD, 40D-22.201, F.A.C.] has reduced landscape irrigation water use throughout the CFWI Planning Area. These rules limit the time of day and the number of days per week during which landscape can be irrigated. The SJRWMD and SWFWMD rules allow two day per week irrigation during the warmer time of the year, when daylight savings time is in effect, and one day per week during the cooler months, when standard time is in effect. The SFWMD rule allows two day per week irrigation year-round. Some counties or municipalities within the CFWI Planning

Area cross District boundaries, creating a situation where parts of the county or municipality fall into different Districts and would have had to comply to different restrictions when standard time is in effect. Instead, to minimize confusion, the SFWMD allows a local government to adopt alternative landscape irrigation conservation measures as necessary to achieve a uniform schedule within its jurisdiction provided the measures are in accordance with at least one Districts' rules.

Florida-Friendly Landscaping™ (FFL)

FFL is a set of nine guiding principles which help protect natural resources. These principles encourage the efficient use of water and the smart use of chemicals and fertilizers. A variety of FFL principles are embedded in outdoor conservation programs such as Florida Water StarSM. The nine FFL guiding principles are

- ◆ Right Plant, Right Place
- ◆ Water Efficiently
- ◆ Fertilize Appropriately
- ◆ Mulch
- ◆ Attract Wildlife
- ◆ Manage Yard Pests Responsibly
- ◆ Recycle
- ◆ Reduce Stormwater Runoff
- ◆ Protect the Waterfront

The FDEP and the state's Districts provide a model FFL ordinance, Florida-Friendly Landscape Guidance Models for Ordinances, Covenants, and Restrictions (FDEP and University of Florida 2009) and technical support for local governments electing to adopt FFL ordinances. The Districts encourage local governments to adopt FFL ordinances.

Urban Mobile Irrigation Labs (MILs)

MILs provide on-site evaluations of irrigation systems. The Districts encourage public supply providers and local governments to support MIL programs. The mission of these programs is to educate urban water users how to irrigate efficiently and to evaluate the performance of irrigation systems for potential efficiency improvements. Various local governments in the CFWI Planning Area offer such irrigation system evaluations to their utility customers.

URBAN AND RESIDENTIAL WATER CONSERVATION

A variety of tools and resources for developing and enhancing water conservation programs are available primarily to municipalities and water providers. Efforts can vary between comprehensive goal-based programs and smaller scale or individual projects, such as incentivizing high efficiency plumbing retrofits and smart irrigation technology. Most, if not all, of the options available for public supply customers are also applicable for DSS users. The following section discusses these tools and resources, many of which have already been used in the CFWI Planning Area in varying degrees. Additional information about tools that may be used to reduce urban water use may be found in Vickers (2001).

Goal-based Water Conservation Planning

A goal-based water conservation plan allows utilities to achieve water conservation goals to help meet future water supply needs. A well-designed plan identifies a variety of methods and practices that decrease water demand to meet numeric goals. The elements of such a plan should reflect, among other parameters; population projections, existing per capita use, the ability of the population to make the necessary changes and the service area's water use profile. It is important for the plan to project the costs of supplying the additional water needed to meet water supply objectives. Regular review and analysis of the plan results allow for utilities to make program adjustments as needed to meet their water conservation goals. Section 373.227, F.S., allows a public supply utility to propose a goal-based water conservation plan that is tailored to its individual circumstances as part of an application for a consumptive use permit.

Water conservation planning tools are available to help public supply utilities develop water conservation plans with a numerical goal for achievable water savings. Several tools that have been designed to assist public supply utilities develop and/or track goal-based water conservation plans are described below.

Conserve Florida Water Clearinghouse EZ Guide

The Conserve Florida Water Clearinghouse EZ Guide (2009) is an online tool that public supply utilities may use to estimate the costs and resultant water savings associated with implementing water conservation BMPs. It has been developed jointly by the state's Districts, the FDEP, and public supply utilities for public supply water conservation planning.

The EZ Guide generates estimates of water use and savings for utility service areas using data from county property appraiser offices and the Florida Department of Revenue (FDOR), which provide detailed information on all land parcels in the state such as the age of a structure, number of bathrooms, total square footage of the parcel, and total square footage of the built structure on the parcel. This information, along with population estimates, are used to create estimates of water savings, costs, and net benefits for each

recommended water conservation option. The EZ Guide is available for utilities free from the Conserve Florida Water Clearinghouse website (<http://www.conservefloridawater.org>).

Alliance for Water Efficiency Water Conservation Tracking Tool

The Alliance for Water Efficiency's Water Conservation Tracking Tool is a Microsoft® Excel-based model, which uses baseline demand data for each water use category (or customer class) and avoided cost data to evaluate and design utility conservation programs. It contains a library of predefined water conservation measures users can select for evaluation. Water savings, costs, and benefits of each measure can be examined and tracked for each year of the proposed program. The tracking tool features comprehensive and highly developed economic analyses of each water conservation option accounting for program costs using time-valued dollars and utility revenue and rate impact calculations. The tool recently concluded a beta testing period and is now available free of charge to Alliance for Water Efficiency members from <http://www.allianceforwaterefficiency.org>.

SJRWMD Water Conservation Method

SJRWMD's water conservation method, formerly referred to as Florida Automated Water Conservation Estimation Tool, uses linear programming to process account-level billing data, county property appraiser information, and FDOR land use codes to develop customer water use profiles within utility service areas. Proxy data can be used to estimate consumption by individual accounts in the absence of actual billing data. The tool generates an optimized list of water conservation BMPs, as well as a Geographic Information System map of all customers in each consumption block. The tool can analyze a single homeowner's account, an entire apartment complex, or an entire public supply utility service area to determine the most cost-effective water conservation methods. This tool is available free to all users from SJRWMD.

Water Conservation Rate Structures

While the primary purpose of water pricing is to cover public supply utility costs, it can simultaneously be an effective means to promote water conservation through rate structure design. A water conservation-based rate structure provides a financial incentive for end users to reduce wasteful use. A structure that responsibly minimizes fixed charges, places more emphasis on volume-related charges, and has an inclining block rate structure will typically conserve more water than a flat or uniform rate structure that generates the same amount of revenue. Users faced with proper rate incentives will achieve water conservation by implementing a number of the conservation measures discussed in this chapter.

The majority of public supply utilities in the CFWI Planning Area have implemented an inclining block rate structure (also referred to as a "tiered" rate structure). The inclining block rate structure is generally expected to have the largest conservation impact on high irrigation use. The responsiveness of customers to water conservation rate structures depends on the existing price structure, incentives of the new price structure, the

socioeconomics of the customer base, and their water uses. The Districts generally encourage the implementation of inclining block rate structures for single-family residential customers as part of their consumptive use permitting process. Exclusive purview over actual rates and rate levels are left to the utilities unless they are privately owned, which are regulated by the Florida Public Service Commission.

The Districts have assisted utilities and their consultants in the development of water conservation rate structures through the development of water price elasticities specific to Florida and modeling tools (Whitcomb 2005) to ensure that revenue requirements are met when rates are restructured and water use estimates change.

Florida Water StarSM

Florida Water StarSM (FWS) is a point-based certification program that promotes water efficient household appliances, plumbing fixtures, irrigation systems, and landscapes. The program is voluntary and was created by SJRWMD in 2006. FWS was adopted by SWFWMD and SFWMD and became a statewide program in 2010. Residences, businesses, and communities can earn water conservation certification through meeting efficiency standards during new construction. A water conservation certification for retrofit projects is being developed.



The Florida Water StarSM Program offers three versions:

- ◆ Standard Silver and Gold certification for new residential structures
- ◆ Commercial/Institutional buildings (offices, retail and service establishments and institutional and non-industrial commercial buildings)
- ◆ Community (for master-planned communities)

A single family home built to meet FWS Silver criteria might use at least 40 percent less water outdoors and approximately 20 percent less water indoors than a home built to the current Florida Building Code. A single family home built to FWS Gold criteria uses at least 40 percent less water outdoors and at least 20 percent less water indoors than a home built to current Florida building standards. Savings rates for commercial and community developments are being evaluated. Also, there is an effort underway to develop a new 'Bronze' retrofit tier for existing structures.

Local governments that adopt FWS criteria as their standard for new construction can expect greater long-term savings to occur than for similar structures built to conventional standards. In addition, FWS is raising the performance bar for landscapers and irrigation contractors by accrediting professionals who have received training and passed a

competency examination in water use efficiency and FWS criteria. Many Florida municipalities have begun to take advantage of this pre-packaged and effective conservation program.

WaterSense®

WaterSense® is a program established by the United States Environmental Protection Agency (EPA) to promote water use efficiency and enhance the market for water efficient products, programs, and practices. WaterSense helps consumers identify water efficient products that meet rigorous efficiency and performance criteria. Products tested and proven to be at least 20 percent more efficient than those meeting current federal standards without compromising performance standards are awarded the WaterSense® label. More information about this program is available from the WaterSense website, <http://www.epa.gov/watersense>. The Districts support the WaterSense program and are official promotional partners.

Existing Plumbing Codes and Standards

The indoor water use category represents the water used within homes, businesses, and institutions for domestic purposes. Examples of indoor use include preparing food, washing dishes, bathing, and flushing toilets. Descriptions and analyses of indoor water use may be found in DeOreo and Mayer 2012 and in Mayer and DeOreo 1999. Newer plumbing fixtures and appliances use significantly less water than older models. Retrofitting older devices or replacing them completely with new, high efficiency models can lead to significant water savings.

No restrictions to plumbing flow existed prior to 1984 when a limit of 3.5 gallons per toilet flush became effective in the National Plumbing Code. That lasted until the National Efficiency Standards and Specifications for Residential and Commercial Water-Using Fixtures and Appliances, resulting from the Federal Energy Policy Act of 1992, became effective in 1994.

Newer devices provide significant water savings compared with older models. **Table 20** summarizes the flow rates over time of common plumbing fixtures and water using appliances. Annual savings from the use of high efficiency appliances in commercial applications can be even greater.

Table 20. Gallons of water consumed for common indoor water fixtures and appliances.

Code Era	Water Consumption					
	Toilets (gpf)	Showerheads (gpm)	Faucets (gpm)	Urinals (gpf)	Dishwashers (gallons per load)	Clothes Washers (gallons per load)
Pre-1984	5.0–7.0	5.0–8.0	4.0–7.0	5.0	14.0	56.0
1984–1993	3.5–4.5	2.8–4.0	2.8–3.0	1.5–4.5	10.5–12.0	39.0–51.0
1994 ^a and later	1.6	2.5 ^b	2.5 ^{b,c}	1.0	10.5	27.0 ^d
<i>WaterSense</i> [®]	1.28 ^e	2.0	1.5	0.5	--	--
<i>Highest Efficiency</i>	0.8–1.0	1.2–1.5	0.5–1.0	0.0–0.1 ^f	4.5–6.5	16.0–22.0

Note: gpf = gallons per flush
gpm = gallons per minute

^a Reflects fixture rates under the Energy Policy Act of 1992-94. Appliances not affected.

^b At 80 pounds per square inch or, for residential faucets, 2.2 gallons per minute at 60 per square inch.

^c 0.25 gallons per metering cycle for commercial faucets.

^d Post-1998.

^e 1.60 gallons per flush is recommended for most commercial applications.

^f Waterless urinals are only recommended under specific conditions.

In addition to reducing indoor water use in new structures since 1994, many pre-existing water using appliances and higher flow, pre-1994 plumbing fixtures have been supplanted by newer and more efficient hardware through passive replacement and incentive programs, further improving indoor water use efficiency over time. To help reduce indoor water use, the Districts support the efforts of municipalities and utilities to implement high efficiency indoor retrofit programs.

International Green Construction Code

The primary goal of the International Green Construction Code (IGCC) (International Code Council 2012) is to decrease energy usage and carbon footprints. However, it also addresses water conservation, rainwater collection and distribution systems, recycling, and site development and land use, including the preservation of natural and material resources. The IGCC emphasizes building performance, including program components such as a requirement for building system performance verification along with building owner education, to ensure the best energy-efficient practices are being carried out. A key feature of the code is a section devoted to “jurisdictional electives,” which will allow customization of the code beyond its baseline provisions to address local priorities and conditions.

Education and Outreach

Education and outreach are essential to change perceptions of the value of water. The Districts and public supply utilities support and implement programs that are designed to build a water conservation culture, instill a stewardship ethic, and permanently reduce individual and commercial water use. These programs include:

- ◆ Water Conservation Public Service Announcements
- ◆ WaterSense®
- ◆ Online conservation programs for elementary students
- ◆ District Water Conservation websites
- ◆ Teacher training
- ◆ ICI and Water Audit trainings for facility managers
- ◆ Student Field Study Programs and Service Learning
- ◆ Florida-Friendly Landscaping™ workshops
- ◆ Great Water Odyssey

Water Conservation Cost-Share Programs

The Districts implement cost-share programs designed to promote or enhance local water conservation programs. These programs support conservation and water use efficiency improvement projects implemented by utilities, cities, and other large water users. Examples of projects are toilet and bathroom fixture retrofit programs, irrigation system retrofits involving the use of microirrigation or the latest irrigation system controller technologies, landscape and irrigation evaluations and retrofits, automatic hydrant flushing devices that eliminate the need for manual line flushing, and low flow pre-rinse spray valve retrofits to improve water efficiency in commercial kitchens.

The Water Savings Incentive Program (WaterSIP) is the SFWMD's flagship funding assistance program. Through the WaterSIP, the SFWMD provides matching funds up to 50 percent or \$50,000, whichever is less, to water providers and users (e.g., cities, utilities, industrial groups, schools, hospitals, homeowners associations) for noncapital water conservation projects. Since 2003, SFWMD has awarded \$4.6 million in support of 161 such projects for a water savings of 7.3 mgd.

The SFWMD's Cooperative Funding Initiative (CFI) is a cost-share funding program that covers up to 50 percent of the cost of projects with local governments and cooperators that help create sustainable water resources, enhance conservation efforts, restore natural systems, and provide flood protection. Since the program's inception in 1992, approximately 517,000 conservation devices/services were implemented to help conserve over 14.5 mgd at a cost of \$24.3 million dollars.

The SJRWMD's Water Conservation Cost-Sharing program covers up to 50 percent of the cost of projects that improve water use efficiency. SJRWMD has awarded approximately \$3 million for water conservation cost sharing projects since the program's inception.

Leading by Example

The Districts have committed to leading state and local governments in water conservation. This "leading by example" initiative includes auditing water use and implementing water conservation measures at their own facilities. For example, SFWMD conducted comprehensive indoor and outdoor water audits of its own facilities in 2009. The audits evaluated water use and efficiency, and identified opportunities for water conservation. If all recommended improvements at the facilities are implemented, the SFWMD could save as much as 3.5 million gallons of water and \$8,700 annually for a total investment of \$63,000. The prescribed recommendations are being phased in as part of its regular maintenance program based on individual facility budgets. In addition, landscaping at nine SFWMD facilities have been certified by IFAS as Florida-Friendly Landscapes.

Low-flow plumbing fixtures have been installed and FFL principles are being implemented to improve outdoor efficiency at all SFWMD facilities. SFWMD's Building Two Tampa Data Center received Florida Water Star Gold Certification. The Tampa and Sarasota Service Offices have received the Florida Friendly Yard Gold Certification for use of microirrigation, landscaping, and recycling of yard wastes into compost for mulch beds. The Bartow Service Office has received the Florida Friendly Yard Silver Certification.

SJRWMD has replaced conventional water using urinals with waterless urinals and installed 0.5 gpm automatic shutoff faucets in all lavatory sinks and plans to retrofit its landscape irrigation system to improve efficiency.

Local Incentives

Water providers and local governments also can provide financial incentives for water conservation through reductions in connection fees, permitting fees, and taxes or by sharing the cost of plumbing or irrigation system retrofits.

COMMERCIAL AND INSTITUTIONAL WATER CONSERVATION

Improving water use efficiency at commercial and institutional (CII) facilities should be a part of any city or utility conservation program. This sector typically represents a relatively large portion of a public supply water use and is a relatively small number of users compared to residential use. The Districts offer technical assistance, cost-share funding opportunities, and incorporate regulatory measures to improve water use efficiency in this category. All applications for a consumptive use permit for the CII category use must demonstrate that the volume of water requested is reasonable and relates to planned facility operations. The request must contain a water balance for the complete operation that includes the needs of the production process, personal needs of the users and customers, and any treatment losses.

Water Audit Guidebook for Commercial and Institutional Water Users

In August of 2011, the SFWMD released the *Water Efficiency Self-Conducted Water Audits at Commercial and Institutional Facilities: A Guide for Facility Managers* (Guide). This Guide was developed to walk facility managers through self-conducted water use assessment procedures, in a detailed step-by-step manner, for the most common points of water use both indoors and outdoors at commercial or institutional facilities. The Guide is accompanied by a series of water use and savings calculators to help facility managers quantify potential water savings and investment recovery periods. Utilities and Districts are encouraged to incorporate this guide into their outreach efforts toward commercial and institutional water users. The Districts have links to this Guide on their websites.

Water PROSM

Water PROSM, sponsored by the SWFWMD, helps restaurants lower operating costs while conserving water. Water PRO supplies BMPs, other information and materials that save water and money. The BMPs also help restaurants reduce energy costs and staff time. The SWFWMD maintains a directory of Water PRO participating restaurants on its website to further promote the program and its participants.

Water Conservation Hotel and Motel Program (Water CHAMPSM)

Water CHAMPSM has been implemented at SFWMD and SWFWMD. This program recognizes lodging facilities that have taken steps to increase water use efficiency. Participating properties conduct voluntary linen and towel reuse programs and, in SFWMD, install high efficiency (1 gallon per minute) faucet aerators in guest bathrooms. Participation in the Water CHAMP supports the water conservation criteria needed to join the Florida Green Lodging Program (FGLP).

Florida Green Lodging Program (FGLP)

FGLP is a voluntary initiative of FDEP that designates and recognizes lodging facilities that make a commitment to conserve and protect Florida's natural resources. The program's environmental guidelines allow the hospitality industry to evaluate its operations, set goals, and take specific actions to continuously improve environmental performance. To receive designation, facilities must conduct a thorough property assessment and implement a specified number of environmental practices in areas of sustainable operations including waste reduction, reuse, and recycling; water conservation; energy efficiency; and indoor air quality.

Leadership in Energy and Environmental Design (LEED)

LEED is a program of the U.S. Green Building Council. LEED certification provides independent, third-party verification that a building, home, or community was designed and built using strategies aimed at achieving high performance in key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality.

Florida Green Building Coalition (FGBC)

FGBC is a nonprofit Florida corporation dedicated to improving the built environment. FGBC offers "a statewide green building program that defines, promotes, and encourages sustainable efforts with environmental and economic benefits." FGBC criteria include water conservation measures and integrates those of the Florida Water Star program. Program standards exist for residential and commercial properties as well as local governments.

AGRICULTURAL WATER CONSERVATION

Agriculture remains a significant water use category in the CFWI Planning Area. As such, the Agricultural water use category offers significant water conservation potential. In the consumptive use permitting process, water allocations for agriculture are based on a number of factors, including the crop type, growing and irrigation methods, and site-specific parameters, such as soil type. Demand reduction can be based only on factors that can be changed, such as irrigation and growing methods and adoption of BMPs.

Agricultural Best Management Practices

Agricultural BMPs are actions agricultural businesses can take to protect or improve water quality or to reduce water use while maintaining or even enhancing agricultural production. The FDACS and FDEP develop and adopt BMPs by rule for different types of agricultural operations. Most BMPs in the CFWI Planning Area are established to improve water quality; however, some contain an implicit water conservation component. **Volume IA, Appendix D** contains example irrigation BMPs for specific types of crops. Agricultural MILs assist farmers in identifying and implementing irrigation BMPs.

Tailwater recovery and irrigation efficiency are two BMPs identified as having implicit water conservation benefits. Tailwater recovery is a planned system to conserve irrigation water supplies through the capture and recycling of water that runs off the field while also improving off-site water quality. This system normally includes a combination of practices and equipment that collects, conveys, stores, and recycles irrigation runoff water and stormwater. Common components include pickup ditches, sumps, pits, pumps, and pipelines. Irrigation efficiency is defined as the proportion of the water that is beneficially used to meet the crop's water demands. Irrigation efficiency can be improved by either replacing an irrigation system or by optimizing the operation and maintenance of an existing irrigation system. The selection of a new system depends on the type of crop, soil, water source, and water availability. A review and correction of irrigation scheduling (time between irrigation events and amount of water applied) can also result in an increase of irrigation efficiency.

Growers and ranchers in the CFWI Planning Area commonly rely on visual inspections and climatic condition indicators, such as rainfall gauges, evapotranspiration, and weather forecasts to schedule their irrigation. Many farmers use soil moisture sensors to understand soil conditions for particular fields and crops. Soil moisture sensors can be valuable tools for agricultural irrigation scheduling. Districts recommend agricultural users investigate and implement BMPs appropriate for their crop and region.

Mobile Irrigation Laboratories (MIL)

Agricultural MILs assist farmers in identifying and implementing irrigation BMPs. These MILs provide free services to help irrigation system users improve system efficiency to conserve water and reduce environmental impacts. An MIL consists of one or more trained technicians who visit irrigation sites to analyze system efficiency and make recommendations for physical and operational improvements. The technician typically reviews system pressure, distribution uniformity data, and irrigation schedules. MIL recommendations may include modification of irrigation systems and equipment, alteration of irrigation scheduling, and other aspects of system management. MILs are supported by the Districts, FDACS, and the U.S. Natural Resources Conservation Service (NRCS).



Florida Automated Weather Network (FAWN)

FAWN, operated by the IFAS, provides weather information from a number of locations throughout the state at 15-minute intervals. FAWN management tools provide decision support functions to growers, using historical weather data and crop modeling technology to help in short- and long-term planning, thereby maximizing the efficiency of their irrigation practices. The University of Florida maintains several FAWN weather stations in the CFWI Planning Area. When funds are available, the Districts assist in expanding FAWN's scope within the CFWI Planning Area. Access to FAWN is available from <http://fawn.ifas.ufl.edu/data/>.

Environmental Quality Incentives Program

The Environmental Quality Incentives Program (EQIP), implemented through the National Resource Conservation Service (NRCS), was reauthorized in the Farm Security and Rural Investment Act of 2002 to provide a voluntary conservation program for farmers and ranchers. The program promotes agricultural production and environmental quality as compatible national goals. Financial and technical assistance is offered for eligible participants to install or implement structural and management practices that address impaired water quality and conservation of water resources on eligible agricultural land. For example, reduction of soil erosion and sedimentation can have a positive impact on water quality and improve irrigation efficiency.

SUMMARY

Water conservation and water use efficiency extend the available supply of water from existing sources to support growth and maintain natural resources. This chapter provided the results of an analysis, which quantified potential future conservation-related water use reductions within the CFWI Planning Area. This chapter also described the tools, resources, and initiatives available to and used by individuals, commercial, and agricultural water users, local governments, utilities, and Districts to foster conservation and water use efficiency.

There have been significant increases in water use efficiency and reductions in wasteful water use within the CFWI Planning Area during the past fifteen years. Opportunities for additional water conservation remain, but achieving further improvement will become more challenging. However, it is estimated that approximately 42.3 mgd of the projected demand for 2035 can be eliminated by water conservation. This estimate of water conservation potential is based on voluntary consumer actions which can be encouraged by education and reasonable levels of financial incentive. Adoption of conservation measures and actual water savings can be greatly enhanced with a higher level of incentives and promotion, and in some cases, implementation of additional BMPs.



Rainwater Holding Tank at Home Depot

6

Water Source Options

The CFWI Planning Area has primarily relied on water derived from the Floridan aquifer system (FAS) with minor uses from the Surficial aquifer system (SAS) and Intermediate aquifer system (IAS) and contributions of surface water from rivers, streams, and lakes to meet water supply needs, as well as reclaimed water. As demands increase, and withdrawals approach sustainable limits of traditional water supply resources, it is important to identify options for diversifying water supply sources. The sources of water potentially available to meet projected water demand in the CFWI Planning Area include fresh groundwater, brackish groundwater, surface water, seawater, and reclaimed water. Improvements in water storage capacity (i.e., Aquifer Storage and Recovery [ASR] and reservoirs) and in water conservation provide significant opportunities to manage or reduce water demands. Water conservation is discussed in detail in **Chapter 5**.

This chapter provides an overview of the water source options available to water users within the CFWI Planning Area. Where possible, planning-level estimates of the potential available yield for each source is characterized. These estimates address a number of factors including consideration of any established Minimum Flow or Level, potential impacts to water and environmental resources, the results of previous water resource evaluations permissibility, water source quality, consideration of existing legal users, and known engineering limitations. This information is provided for the following options:

- ◆ Groundwater
- ◆ Surface water
- ◆ Seawater
- ◆ Reclaimed Water
- ◆ Storage Capacity – ASR & Reservoirs

Fresh groundwater sources (i.e., surficial, intermediate, and Floridan aquifers) are considered traditional water sources whereas nontraditional or alternative water sources include brackish groundwater, surface water, seawater, reclaimed water, and water stored in ASRs and reservoirs. In addition, there are a number of management tools that can enhance the source of supply, sustain the water resources and related natural systems, or otherwise optimize supply yield. Examples of management tools include ASR, storage tanks and ponds/reservoirs, land-use transitions, avoidance of adverse impacts from withdrawals through wellfield optimization, and water resource augmentation and aquifer recharge.

Avoidance of impacts, system optimization, and source management techniques are not discussed in detail in this document. These are methods whereby the water user attempts to identify the maximum withdrawal capacity while minimizing the potential for adverse environmental impacts. Other available water supply options include potential augmentation/recharge to wetland systems and injection or recharge of water into the aquifer for replenishment to prevent adverse impacts.

GROUNDWATER

Local groundwater sources include the fresh and brackish portions of the FAS, the IAS, and the SAS. Groundwater from the Upper Floridan aquifer (UFA) and some select zones in the Lower Floridan aquifer (LFA) is the traditional source of water supply for all water use categories in the CFWI Planning Area. In 2010, an estimated 800 million gallons per day (mgd) of water was used within the CFWI Planning Area to meet demands. Of this volume, about 96 percent came from the surficial, intermediate, and Floridan aquifers. Surface water makes up approximately 4 percent of the total demand. An additional 178 mgd of reclaimed water was reused for residential, landscape, and green space irrigation; industrial uses; power plant cooling water; and aquifer recharge. While increased groundwater withdrawals are projected to be limited regionally, groundwater use is expected to remain the largest source of water in the future. Below is a brief description of each of the local aquifers, including the potential availability of groundwater sources for future use.

Surficial Aquifer System

The SAS is composed primarily of sandy sediments and can range in thickness from just a few feet to nearly 200 feet in the ridge areas of western Orange, Osceola, Lake, and Polk counties. It is difficult to quantify the potential availability of water from the SAS on a regional basis due to its variable structure and composition. Water supply availability from this aquifer typically has a limited yield and is best suited for use by homeowners and community associations for domestic and landscape irrigation purposes. Wells constructed into this aquifer are generally less than four-inches in diameter and have a consumptive use permit by rule. Well construction permits are often required by the local county governments, pursuant to a District delegation agreement, in addition to District consumptive use permits. The water quality within the SAS can contain elevated concentrations of iron, organic compounds, and sulfur that can cause staining, poor taste, and odor; thus SAS water would require treatment to be used for drinking water.

In the region of the Lake Wales Ridge in eastern Polk County, the SAS thickens to between 100 and 200 feet and becomes more favorable for water supply development. The largest number of permitted users within the aquifer is located along the Lake Wales Ridge areas in Polk and Lake counties. Within this area, about 90 percent of permitted withdrawals from the SAS are for agricultural irrigation. The remaining 10 percent is divided equally among domestic self-supply (DSS); landscape, recreational, aesthetics (LRA); and commercial, industrial, and institutional (CII) and Mining uses (SWFWMD 2012a).

Intermediate Aquifer System

The IAS, where it exists, is located between the SAS and the upper FAS. The IAS yields sufficient quality and quantity for DSS and LRA uses. Annual average water use from permitted withdrawals of the IAS in 2010 was 2.9 mgd in Polk County (SWFWMD 2012a). In eastern Orange County, the City of Cocoa has a permit to withdraw up to 3 mgd from the IAS. Due to its variable and comparatively low yields, the IAS will play a limited regional role in meeting future demands. Water quality is generally better than the SAS, but may still require treatment for iron, organic compounds, and sulfur if used for drinking water.

Floridan Aquifer System

The FAS underlies the entire CFWI Planning Area. It is the primary source of water in the planning region because of its good quality, high productivity, and wide-spread accessibility. The FAS spans four groundwater basins encompassing the CFWI Planning Area (**Figure 13**). The four major groundwater basins meet in north-central Polk County and in general this location represents an important area of recharge with groundwater flow radiating out in all directions.

The FAS is composed of sequential layers of limestone and dolomite and is traditionally subdivided into the Upper and Lower Floridan aquifers, which are separated by less productive horizons called the middle confining unit. Both the Upper and Lower Floridan aquifers are composed of multiple discrete, highly permeable zones; many characterized by karst solution and fracturing, separated by lower permeability units of various degrees of confinement. The yield from the FAS can be highly variable. Due to the highly transmissive nature of the FAS, the potential for impacts resulting from FAS use may project outward for extended distances over several months or years (Stewart and Langevin 1999). The FAS is often best evaluated as part of a regional assessment to achieve an accurate picture of the long-term influence of proposed cumulative withdrawals.

Within the CFWI Planning Area, recent publications separate the UFA into an upper section and the Avon Park permeable zone, separated by significantly lower permeability rock within the Ocala Limestone (Reese and Richardson 2007; Horstman 2011). The upper section and Avon Park permeable zones have different lithology and productive capacity, but similar water quality and hydraulic heads (water levels) lead to their grouping within the upper Floridan aquifer. The hydrology and quality of the water within the LFA varies significantly both vertically and horizontally within the CFWI Planning Area.

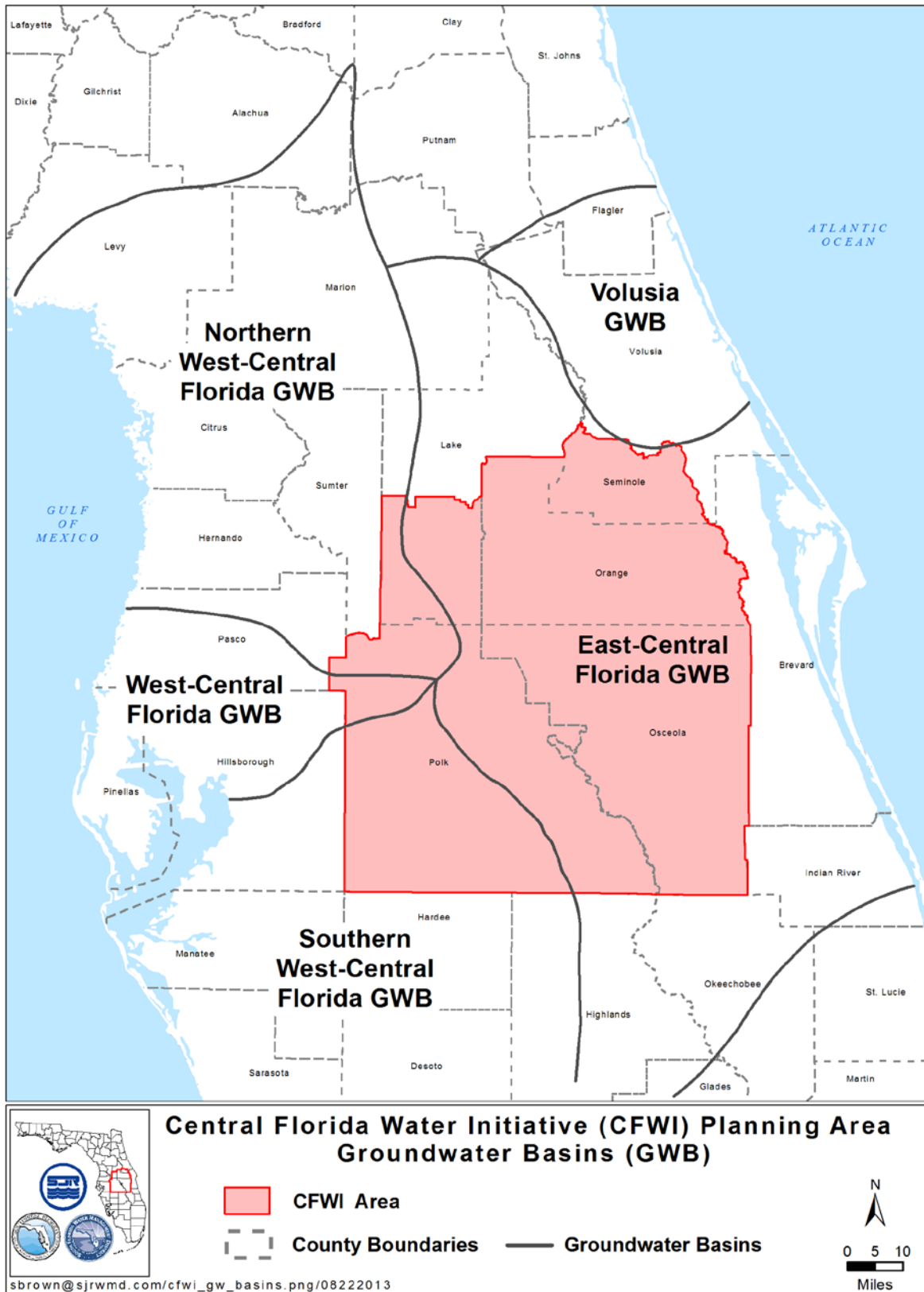


Figure 13. Groundwater basins included within the CFWI Planning Area.

Figure 14 shows a generalized hydrologic cross-section that displays the general relationship between the SAS, IAS (confining unit), and the FAS. The amount of confinement between the Upper and Lower Floridan aquifers is variable across the area (Miller 1986). Confining units shown as the middle confining unit I (MCUI) and middle confining unit II (MCUII) act to partially separate the upper and lower portions of the Floridan aquifer. However, throughout most of the CFWI Planning Area, all of these aquifers are sufficiently connected that pumping in one aquifer affects adjacent aquifers.

The base of the FAS is marked by beds of dolostone and anhydrite with low permeability within the Cedar Keys Formation, typically found about 2,000 feet below land surface in the northern CFWI Planning Area and dipping to 3,000 feet in the south (Horstman 2011; Reese and Richardson, 2013). The bedding in this unit is relatively impermeable, but some permeable zones containing saline water are present at depths over 4,000 feet, which have been utilized for industrial injection wells.

As discussed in **Chapter 4**, the ECFT groundwater flow model and other tools were developed as part of the CFWI planning effort to assess the extent to which current and future groundwater withdrawals, particularly from the FAS, can occur in a sustainable manner. Evaluations using these tools indicate that some additional traditional groundwater may be developed from the FAS, but the quantities that are available are near their sustainable limits. The amount of additional potential traditional groundwater development (availability), as described in **Chapter 4**, is highly dependent on the location and rates of the withdrawals. Opportunities exist to offset certain impacts locally, but future fresh water development within the CFWI Planning Area will require evaluation on an application-by-application basis to determine if unacceptable impacts to wetlands, established minimum flows and levels (MFLs), existing legal users, and water quality are projected to occur.

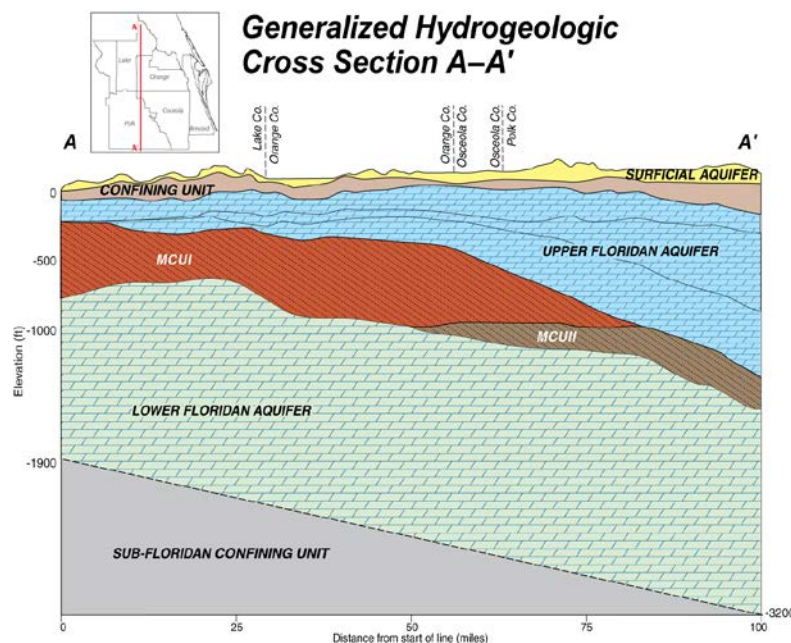


Figure 14. Generalized hydrogeologic cross-section through the CFWI Planning Area.

Brackish/Nontraditional Groundwater

Brackish groundwater exists in the lower portion of some areas of the FAS in the CFWI Planning Area and adjacent areas. The location of brackish water within the LFA is less defined in the CFWI Planning Area; but has been shown to exist in areas beneath eastern and southern Osceola County, eastern Orange County, northern Seminole County, and in areas just outside the CFWI Planning Area in southwest Volusia, Brevard, Okeechobee, Highlands, Hardee, Manatee, and Hillsborough counties. Brackish water, for alternative water supply planning purposes in the CFWI Planning Area for SJRWMD and SWFWMD, is generally defined as water with a total dissolved solids (TDS) concentration of greater than 500 mg/L. SWFWMD defines saline water, which includes brackish water, as water with chloride concentrations greater than 250 mg/L.

Numerous brackish water treatment facilities exist in Florida; however, few operate in the CFWI Planning Area. Concerns with the use of brackish groundwater include the potential movement of brackish water into the fresh water portions of the aquifer, concentrate disposal after treatment, and the increased treatment cost compared to fresh groundwater. **Figure 15** shows the generalized water quality of the LFA surrounding the CFWI Planning Area as defined by TDS concentrations.

The treatment of brackish groundwater may require the use of low pressure reverse osmosis (RO) or electrodialysis reversal (EDR); each method requires disposal of concentrate or reject water. Both RO and EDR treatment costs are higher than the treatment of fresh water sources. Additionally, the hydrologic connection between the brackish and fresh portions of the local aquifer horizons requires evaluation and may not offer sufficient hydrologic confinement to protect overlying aquifer systems from possible drawdown and saline water intrusion.

Currently, the Water Cooperative of Central Florida (WCCF) (a cooperative that includes Orange County Utilities, TWA, City of St. Cloud, and Polk County Utilities) and Reedy Creek Improvement District (RCID) are implementing the development of a nontraditional wellfield to withdraw water from sections of the LFA. The WCCF and RCID (as co-permittees) were recently granted a water use permit for the Cypress Lake Wellfield project to withdraw 37.5 mgd (30 mgd finished and 7.5 mgd treatment process reject) in central Osceola County. In addition, Polk County Utilities is implementing the Southeast Polk County Wellfield project and was granted a water use permit to withdraw 37.5 mgd (30 mgd finished and 7.5 mgd treatment process reject) of nontraditional LFA groundwater. Since only a limited number of data points exist to define the location and depth of brackish water, and even fewer aquifer performance tests have been completed to determine aquifer yields and assess water quality stability, it is difficult to estimate the potential yield of this source within the CFWI Planning Area. The limited number of investigations that have occurred and the ongoing testing by the Districts is encouraging, but the development of additional brackish water resources remains a case-by-case basis. Well drilling and water quality testing efforts to learn more about brackish water source options are discussed in **Chapter 8**.

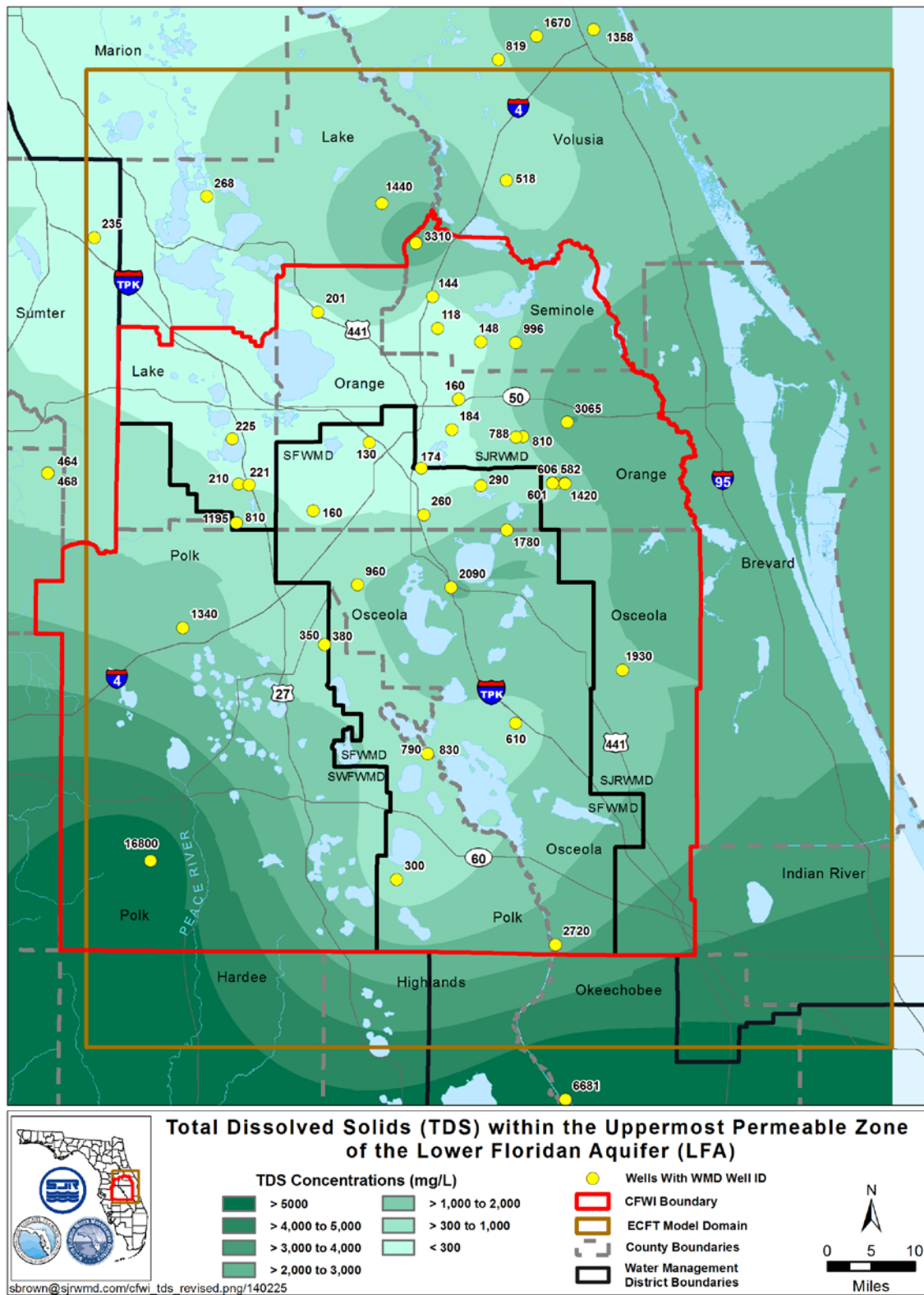


Figure 15. Generalized water quality within the Lower Floridan aquifer in the CFWI Planning Area.

SURFACE WATER

The CFWI Planning Area includes the headwaters for seven river systems; the Alafia, Peace, Hillsborough, and Withlacoochee rivers in the SWFWMD; Kissimmee River/Chain of Lakes in the SFWMD; and, the Ocklawaha and St. Johns Rivers within the SJRWMD. **Figure 16** shows the watersheds of these river basins within the CFWI Planning Area and surrounding areas. Opportunities exist for the development of water supplies from the lakes and rivers in or near the CFWI Planning Area that could supplement traditional groundwater supplies. Smaller, local lakes are generally considered a limited resource and often provide the local landowners with water for irrigation purposes. The capture and storage water from river/creek systems can supply significant quantities of water and could be a component of multi-source water supply development projects. Larger lakes may represent an opportunity for development of supplies, as they have larger, regional drainage basins to buffer the effects of withdrawals. The discussion below focuses on the potential for the development of supplemental surface water supplies from the larger regional systems. The Hillsborough River is not discussed in detail, as only a small portion of the watershed is within the CFWI Planning Area.

Lakes, rivers, and creeks in the CFWI Planning Area support significant ecological resources; which must be protected from harmful impacts of any proposed withdrawals or capture of flows from these systems. Capturing available flows from these surface water bodies for water supply, particularly to support conjunctive use projects, may be effective but can be expected to have varying levels of certainty, depending on climatic conditions. Further analysis should be conducted to ensure that hydrologic functions of lakes, and downstream environmental needs, are maintained when attempting to identify potentially available quantities of surface water.

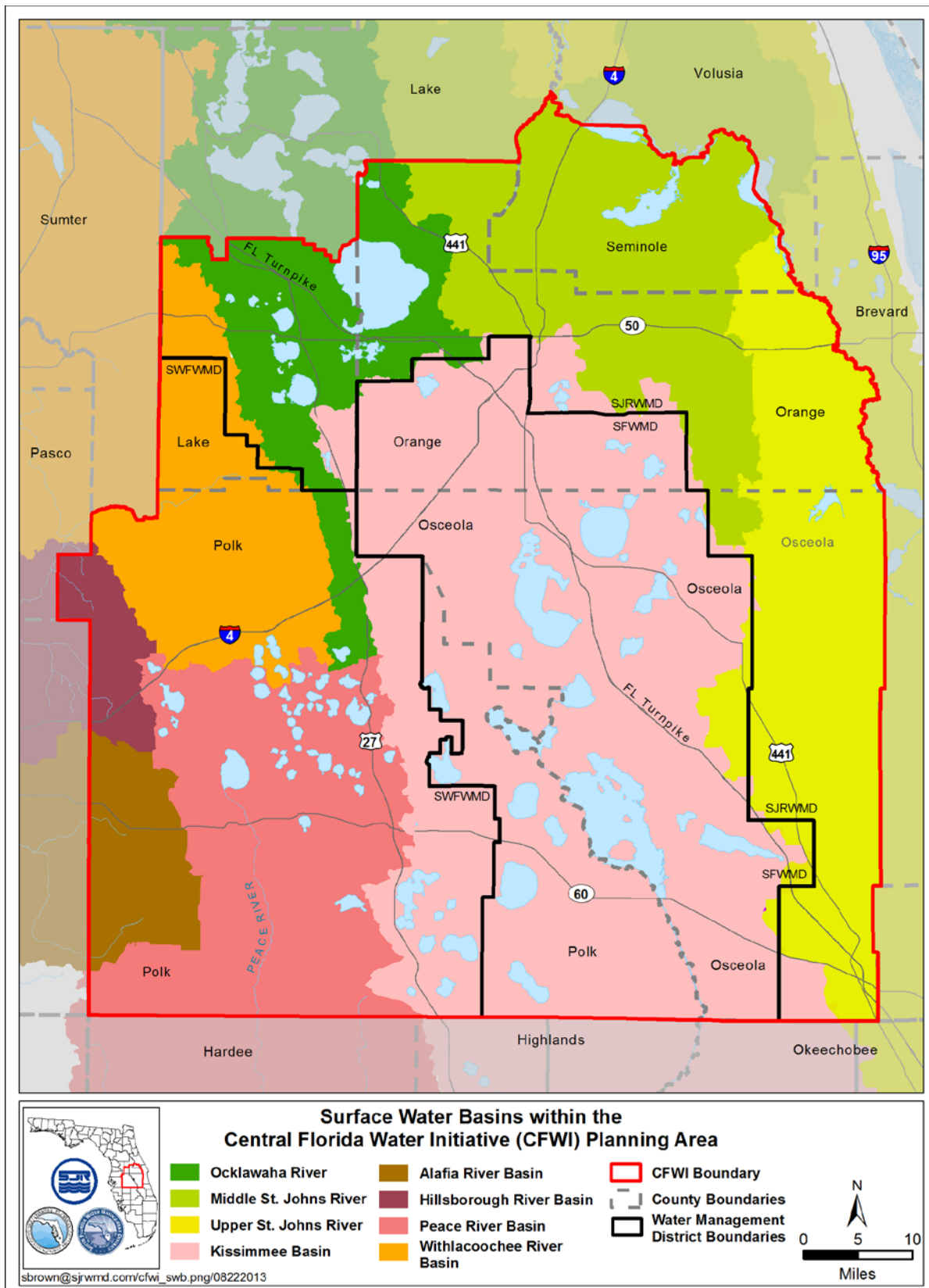


Figure 16. Locations of major watersheds and basins within the CFWI Planning Area.

Alafia River System

Although most of the Alafia River watershed is located in Hillsborough County, the headwaters are located in western Polk County where the land has been mined extensively for phosphate ore. The river extends 23 miles from its mouth at Hillsborough Bay eastward to the confluence of its two major tributaries, the North and South Prongs. Mosaic Fertilizer Inc. is permitted an annual average withdrawal of nearly 6 mgd from Lithia and Buckhorn Springs, which supply base flow water to the river. Tampa Bay Water (TBW) has an allocation from the Alafia River. Withdrawals are permitted according to a flow-based withdrawal schedule with an annual average limit of 18.7 mgd. It may be possible to develop additional water supply from the Alafia River through a surface water or downstream augmentation project to protect estuarine flows, reallocation of mining water supply quantities, or through partnerships with TBW.

Peace River System

The Peace River is the most prominent river system in the Polk County portion of the CFWI Planning Area and has two major tributaries. Peace Creek drains approximately 230 square miles in the northeast part of the watershed, serving as an outlet for several lakes near the cities of Lake Alfred and Haines City. Saddle Creek Canal drains approximately 144 square miles in the northwest portion of the watershed in Polk County, where the dominant drainage feature is Lake Hancock. Opportunities for developing water supply projects on the Peace River are available and have the added advantage of possible water storage on mined lands. Mined lands are well suited to water supply projects because of the large expanses of previous mine cuts and clay settling areas that offer cost advantages for development of surface water reservoirs. A complicating factor in developing these options is that river flows can be unreliable. The upper Peace River, between Bartow and Zolfo Springs, often does not meet its established MFL in the dry season and has occasionally ceased flowing entirely. The SWFWMD has ongoing projects to capture and store river flows during high flow periods in an effort to reestablish the upper Peace River minimum flow during low-flow periods. The projects may have residual benefits which could improve reliability in flow for public supply capture.

These projects include the Lake Hancock Lake Level Modification Project and the Upper Peace River Resource Development Project, as discussed in **Chapter 8**. Reservations of water for these projects may improve future surface water availability as projects are finalized. Several alternative water supply project options have been identified for the Peace River and the other rivers are presented in **Volume IA, Appendix F**. Some of the options are seasonal and when used in conjunction with existing wellfields, may reduce the demand from groundwater resources. A large share of available surface water in the Peace River (32.9 mgd annual average and a flow-based schedule) is allocated to the Peace River Manasota Regional Water Supply Authority (PRMRWSA) in SWFWMD's Southern Planning Region, although it is estimated that some water is available for Polk County in the future.

Withlacoochee River System

The Withlacoochee River originates in the Green Swamp in Polk County and flows northward for 157 miles where it discharges into the Gulf of Mexico near Yankeetown, Florida. The river crosses through or serves as the boundary of 8 counties and its watershed covers approximately 2,100 square miles. The river and its connected lakes and tributaries were designated as an Outstanding Florida Water Body in 1989. Upstream at the Compressco gauge, near the Pasco/Polk County border, the average stream flow is 152 cubic feet per second (cfs). The Withlacoochee River is not currently utilized for public supply. There are no water supply projects currently proposed to be served by the river in the CFWI Planning Area. The SWFWMD is scheduled to establish MFLs for the upper and middle portions of the Withlacoochee River in 2016.

Kissimmee River and Chain of Lakes

The Kissimmee Basin, north of the S-65 structure on Lake Kissimmee, encompasses approximately 1,633 square miles and includes more than two dozen lakes in the Kissimmee Chain of Lakes (KCOL), their tributary streams, and associated marshes. This basin forms the headwaters of the Kissimmee River, Lake Okeechobee, and the Everglades, and comprises the uppermost section of the historical Kissimmee-Okeechobee-Everglades system. Water released from the KCOL flows southward to Lake Kissimmee, the southernmost feature in the basin. Lake Kissimmee is the largest lake in the Upper Kissimmee Basin and acts as a buffer for flows before their release into the Kissimmee River at S-65.

The major streams feeding into the KCOL are Shingle Creek, Reedy Creek, and Boggy Creek. The headwaters for these creeks are located in urbanized portions of the Orlando metro area. Water control structures in the KCOL direct flows according to regulation schedules established by the United States Army Corps of Engineers (USACE) and managed by the SFWMD.

At the time of this CFWI RWSP, the Kissimmee River system is undergoing a major restoration effort which, when fully implemented, is anticipated to require water to be stored in and released from the KCOL and its tributaries as part of a management strategy balancing flood control and environmental restoration. The Kissimmee River Restoration Project is a large-scale, multi-phased ecosystem restoration effort. The project reestablishes the river-floodplain system's ecological integrity; provides the water storage and regulation schedule modifications needed to approximate the system's historical water levels and flow; and increases the quantity and quality of shoreline habitat for the benefit of fish and wildlife. In addition, the project ensures the maintenance of existing flood protection.

The SFWMD undertook the initial technical work in support of establishment of a water reservation for the KCOL and Kissimmee River beginning in 2008. A substantial ecologic and hydrologic analysis of this system was completed and documented in the draft Technical Document to Support Water Reservations for the Kissimmee River and Chain of

Lakes (SFWMD 2009b). This report included hydrologic modeling of the Kissimmee River and its tributaries. In October 2013, the SFWMD approved its 2014 Annual Priority Waterbody list, which included a reservation for the KCOL. In 2014, rulemaking was initiated to develop a water reservation rule for the river system, 19 lakes, and the associated floodplain in the CFWI Planning Area. The reservation is expected to restrict allocations from the listed reservation water bodies and major surface water contributors to these water bodies. There is an estimated 25 mgd currently permitted from the Kissimmee River and associated KCOL for water supply purposes. **Chapter 8** discusses those efforts of the SFWMD to develop tools to address the availability water supply from the Kissimmee River and KCOL.

St. Johns River System

Within the area served by the St. Johns River System, surface water is currently used to meet public supply, landscape irrigation, and agricultural irrigation needs. The SJRWMD 2004 DWSP Update identified five potential water supply projects using withdrawals from the St. Johns River. This builds upon an earlier alternative water supply strategies investigation (CH2M Hill 1996) that identified four possible withdrawal sites located on the St. Johns River. These projects were again identified in the SJRWMD 2005 DWSP Fourth Addendum (SJRWMD 2009b) and river withdrawals were simulated as part of the 2012 St. Johns River Water Supply Impact Study (WSIS; SJRWMD 2012).

Though the St. Johns River can supply a large quantity of raw water, this water varies in both quantity and quality throughout the year. The St. Johns River, like most rivers, is subject to floods and droughts. To accommodate these fluctuations of the availability, significant amounts of raw and/or finished water storage or conjunctive use of surface water with groundwater may be required to ensure a reliable water supply at some locations.

Water supply projects on the St. Johns River have been implemented by Seminole County at Yankee Lake, the City of Sanford at Lake Monroe, and by the City of Winter Springs at Lake Jessup. The Yankee Lake Regional Surface Water Treatment Plant is located in the northwest portion of Seminole County off of SR 46. This facility is currently operated by Seminole County to provide reclaimed water augmentation in their northwest service area. Seminole County currently holds a consumptive use permit for the use of the St. John's River as a water supply source. Potential water supply yield from the river is available up to 50 mgd at Yankee Lake as determined by the Water Supply Impact Study performed by the St. John's River Water Management District. The Yankee Lake Surface Water Treatment Plant site is currently built with a river intake capacity of 35 mgd, expandable to 50 mgd.

The City of Cocoa uses the Taylor Creek Reservoir (located in Osceola and Orange counties near the St. Johns River and SR 520) as a water supply source with treatment and blending with treated groundwater being accomplished at the city's Dyal Water Treatment Plant. The reservoir contains freshwater, which is of better quality than the St. Johns River. The source of water for the Taylor Creek Reservoir is stormwater/surface water runoff within its watershed. Taylor Creek is a tributary to the St. Johns River, collecting and contributing water to that river system. The potential water supply yield from the reservoir in its current configuration is approximately 15 mgd, which will vary depending on rainfall in the watershed and targeted reliability levels. However, with a recent study, funded by six utilities, SJRWMD, and SFWMD it was discovered the yield can be increased to 54 mgd above the City of Cocoa's existing withdrawals by pumping additional water from the St. Johns River near Lake Poinsett at SR 520 to the reservoir (CH2M/PB Water Joint Venture 2009) when the quality of the water in the river is acceptable to make the diversion. These changes in yield of the Taylor Creek Reservoir system also include raising and improving the L-73 berm that is currently under design by the SJRWMD. The changes to the berm, diversion from the river to the reservoir, and changes to the operations of the reservoir are in whole or in part contingent on federal approvals and water management of the reservoir must conform to the MFLs for Taylor Creek established by the SJRWMD to minimize downstream impacts. More information about this project is provided in **Volume IA, Appendix F**. As further described below, in the WSIS, the SJRWMD concluded that the St. Johns River could yield 55 mgd, on an average day withdrawal basis, near Lake Poinsett without unacceptable ecologic and hydrologic impacts.



SJRWMD has established MFLs for the St. Johns River just downstream from the Lake Washington Weir, at SR 44 near DeLand, and at SR 50 near Christmas (Chapter 40C-8, F.A.C.). Based on the adopted MFLs for the river and evaluations performed by SJRWMD

(Robison 2004), further analyses of water withdrawal capacities was performed as part of the WSIS. The goal of the St. Johns River WSIS, completed in 2012, was to provide a comprehensive and scientifically rigorous analysis of the potential environmental effects to the St. Johns River associated with annual average surface water withdrawals as high as 262 mgd (155 mgd from the middle and upper St. Johns River and 107 mgd from the Ocklawaha River). The four-year study, which was peer-reviewed by the National Research Council, resulted in the development of tools to help guide future decision-making regarding the increased use of surface water from the St. Johns River (SJRWMD 2012). The study confirms the findings of earlier investigations indicating that the St. Johns River can be used as an alternative water supply source with minimal to negligible environmental effects.

The WSIS included withdrawal scenarios that simulated the effects of future land use conditions (estimated 2030 land use), future sea levels, and completion of the Upper St. Johns River Basin restoration projects. The restoration projects are Phase I C-1 Re-diversion Project, Three Forks Marsh Conservation Area, and Fellsmere Water Management Area (SJRWMD 2013). Simulated withdrawals upstream of DeLand, which were sited at three locations considered suitable for water supply development, along with the maximum annual average withdrawal rates as follows

- ◆ Lake Poinsett (55 mgd) in the upper St. Johns River
- ◆ St. Johns River near SR 46 at Lake Jesup (50 mgd) in the middle St. Johns River
- ◆ Yankee Lake (50 mgd) downstream of Lake Monroe in the middle St. Johns River

Goals of the WSIS included identification of alternative water supplies that protect both groundwater and surface water resources. Similar to Robison (2004), the WSIS found that cumulative water level reductions due to a total of 155-mgd withdrawal (from one or more locations) are small (~4 centimeters / 1.6 inches) in the middle St. Johns River and essentially undetectable in the lower St. Johns River and Lake George. The most dominant effect on water level over the 1995 to 2030 period is the increased water level caused by sea level rise, estimated to be at least 14 centimeters or 5.5 inches.

The SJRWMD is in the process of developing MFLs for the St. Johns River at SR 520 (Lake Poinsett). Adoption of MFLs at this additional location will allow for more refined estimates of water availability for specific locations along the river. During low-flow periods, water in the St. Johns River is slightly to moderately brackish.

St. Johns River water along the east and part of the north boundaries of the CFWI Planning Area requires treatment processes to remove naturally occurring organic matter and sometimes naturally occurring dissolved salts and when the dissolved salts concentrations exceed drinking water standards RO treatment processes and subsequent concentrate management would also be needed. These treatment processes are different than those used to treat typical Floridan aquifer groundwater in central Florida and are less familiar to local water treatment plant operators. This combination of surface and brackish water, and the potential additional treatment to control unwanted disinfection byproducts adds

challenges to the development of projects utilizing the St. Johns River. SJRWMD has performed treatability studies of water from the St. Johns River. The studies indicate that several effective and efficient water treatment combinations can be used to treat water to a quality suitable for use in public supply systems and at an affordable cost (CH2M Hill 2004; Burton & Associates 2004).

Ocklawaha River

The Ocklawaha River watershed covers 2,769 square miles, from the Green Swamp in Polk County and Lake Apopka sub-basins north through the Rodman Reservoir to the river's discharge into the St. Johns River near the Town of Welaka. The Ocklawaha River emerges from Lake Griffin in the Upper Ocklawaha Chain of Lakes and flows north until it is impounded as Rodman Reservoir, also known as Lake Ocklawaha. The length of the river is approximately 96 miles and it is the largest tributary watershed of the St. Johns River.

The St. Johns River WSIS evaluated a potential 100 mgd water withdrawal near the lower Ocklawaha River at Rodman Reservoir. This level of withdrawal was based on a SJRWMD feasibility study performed for broad-scale water supply planning (Hall 2005). From the feasibility study, it was noted that a withdrawal of this quantity would have a safe yield without causing unacceptable environmental harm, providing water level regulation schedules for upstream lakes did not change; groundwater withdrawals equaled the 2010 predictions; surface water withdrawals upstream of Rodman Reservoir did not increase; and the existing surface water management plan for Rodman Reservoir was maintained. Project specific permissibility was not part of this study and therefore additional work would need to be performed to determine water availability at specified points of withdrawal. In addition, the WSIS supports the findings of the feasibility study.

SEAWATER

The use of desalinated seawater from the Atlantic Ocean and Gulf of Mexico is an additional water source option in the CFWI Planning Area. Seawater is an essentially unlimited source of water. However, desalination is required before seawater can be used for water supply purposes. Additionally, concentrate from the desalination process must be managed to meet regulatory and environmental criteria. In addition to treatment, pump stations and pipelines would be required to transport finished water from the coast to central Florida.

The use of seawater to meet public supply demands requires advanced treatment of the water by desalination technologies, which include distillation, RO, or EDR as options. Significant advances in treatment and efficiencies in seawater desalinization have occurred over the past decade. While seawater treatment costs are decreasing and capital costs are becoming competitive with above ground reservoir options, operational costs remain moderately higher than other water supply options.

Seawater is currently used by Tampa Bay and surrounding regions. In 2008, the 25 mgd Tampa Bay seawater facility was operating at a cost of \$3.38 per 1,000 gallons (Tampa Bay Water 2008). Special case situations, such as co-locating a seawater desalination plant with an electric power plant or sizeable reclaimed water discharge facility, may make this alternative water supply source more competitive with the development of other water supply sources. To understand location-based potential cost/savings factors, the SFWMD completed a feasibility study for co-locating seawater treatment facilities with power plants in south Florida (Metcalf & Eddy 2006). The SJRWMD, as part of its Water Resource Development Program, investigated the technical, environmental, and economic feasibility of co-locating seawater desalting facilities with specific electric power plants (Beck 2004; Applied Technology 2006). This investigation resulted in the identification of two potential 10 mgd seawater or intracoastal water supply projects that might be beneficial to the CFWI Planning Area by co-locating with existing power generation facilities and taking advantage of the existing utility corridors to transport the treated seawater inland to central Florida from the coastal area. Concentrate management, however, was identified as a significant challenge impeding project feasibility if the waste concentrate stream were discharged into the Indian River Lagoon.

Polk County Utilities and TBW have previously discussed the potential for the county to partner in an expansion of the 25 mgd Tampa Bay Desalination Facility. In exchange for a funding commitment, TBW could also supply a quantity of water to Polk County through a future interconnect.

Concentrate management solutions will pose significant challenges to implementation of seawater demineralization projects. SJRWMD has developed a demineralization concentrate management plan (Reiss Environmental 2003) as part of its previous planning efforts. This report addresses regulatory considerations, potential sources, concentrates disposal options and is a recommended resource of information before considering this alternative.

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. Reuse is the deliberate application of reclaimed water, in compliance with FDEP and District rules, for beneficial purposes. Reclaimed water utilization is a key component of water resource management in central Florida. For the past several years, reclaimed water use has been over 90 percent among many utilities operating within the CFWI Planning Area. Reclaimed water is used for non-potable purposes such as landscape irrigation, agricultural irrigation, aesthetic uses, groundwater recharge, industrial uses, environmental enhancement, and fire protection purposes. Reclaimed water is also being investigated for potable reuse, which is the process of treating reclaimed water to state and federal drinking water standards so that it can be recycled for potable water supply uses. Although direct potable reuse is not currently being implemented in the Districts, this method is used in other states and countries.

The State of Florida and the Districts encourage and promote the use of reclaimed water. The Water Resource Implementation Rule (Chapter 62-40, F.A.C.) requires the FDEP and Districts to advocate the reuse of reclaimed water as an integral part of water management programs, rules, and plans. The Districts require all applicants for water use permits to use reclaimed water to the maximum extent feasible.

In order to provide additional incentives for reclaimed water use, the Florida Legislature amended Section 373.250, F.S., in 2012. The amendments required the FDEP to initiate rulemaking to incorporate criteria for the use of “substitution credits” and “impact offsets” when a District is reviewing a consumptive use permit application. Impact offsets are derived from the use of reclaimed water to reduce or eliminate a harmful impact that has or would otherwise occur as a result of a surface or groundwater withdrawal. A substitution credit means the use of reclaimed water will replace all, or a portion of an existing permitted use of a resource-limited surface water or groundwater, allowing a different user or use to initiate a withdrawal or increase its withdrawal from the same resource-limited water resource. Districts’ rules will be modified, as needed, to be consistent with the amendments to Section 373.250, F.S., and amendments to FDEP’s Rule 62-40.416, F.A.C.



Reedy Creek Energy Service – Reclaimed Water Pump Station

Existing and Future Reuse in the CFWI Planning Area

In the CFWI Planning Area, wastewater generation has steadily increased along with population growth in the area. Wastewater management has transitioned from a means of simple disposal to uses that are recognized as a viable alternative water supply that need to

be managed and used appropriately. For decades, local utilities have recognized the value of reclaimed water, thus making the CFWI Planning Area a statewide leader in reuse.

In 2010, there were 80 wastewater treatment plants in the CFWI Planning Area including distribution facilities with permitted capacities over 0.1 mgd. These providers collectively generated 193 mgd of treated wastewater (2010 Reuse Inventory; FDEP 2011). Of that quantity, 105 mgd was treated and reused for irrigation and industrial uses and 73 mgd was reused for aquifer recharge and environmental enhancement. The remaining 15 mgd of treated wastewater was either discharged to surface water features or sent to percolation ponds in poor recharge areas and provided minimal or no benefit for recharge or offset to other uses. An additional amount of approximately 4 mgd of groundwater or stormwater was used to supplement reclaimed water supplies.

By 2035, wastewater utilities and the Districts are projecting the amount of wastewater collected will increase by 63 percent to an estimated 314 mgd from wastewater plants operating within the CFWI Planning Area. This represents a potential increase of approximately 121 mgd of reclaimed water between 2010 and 2035. With 29 mgd of supplemental supply and an additional 15 mgd of existing wastewater currently not being reused, reuse flows are projected to increase in 2035 by an additional 44 mgd to a total of 165 mgd. Estimates of potential wastewater generation were developed through a cooperative effort with local utilities. When 2035 utility estimates were not available, the Districts developed the estimates using actual 2010 wastewater flows and from information of anticipated population increases through the year 2035. Details on the methods of 2035 reuse projections are summarized in a reuse summary provided in **Volume IA, Appendix E**.

As noted previously in **Chapter 2**, public supply demand projections were developed assuming that past water use is predictive of future water use and incorporated the current economic conditions and current rates of reclaimed water use and water conservation into the future projections. As such, all of the total amount of additional reclaimed flow in 2035 (165 mgd including supplementation) may not result in a reduction in the future water demands.

Historically, only a portion of the wastewater treated for reuse is used to offset demands that would otherwise require use of a traditional water source. According to studies by the SWFWMD (2011c), the amount of potable-quality water offset that has historically been achieved utility-wide is on the order of 65 percent to 75 percent of reuse flows. This is utility dependent and can range downwards of 50 percent to as much as nearly 100 percent depending on the type of use being replaced. While the amount of potable-quality offset that is achieved by reuse is dependent upon a variety of factors, including the demographics of a particular utility's reuse customers and the rate charged for reclaimed water, it is important that wastewater and public supply utilities understand that the projected wastewater flows may not represent an amount equal to potable drinking water demand reduction. For this CFWI RWSP potable-quality water demand offsets are only considered for irrigation and industrial uses and do not include recharge and environmental enhancement. It is important to note that not all reclaimed water offsets are or will be associated with public

supply utilities. **Volume IA, Table E-2**, shows the 2010 to 2035 offset difference is 105 mgd using the different utilization types.

STORAGE CAPACITY – ASR AND RESERVOIRS

Aquifer Storage and Recovery

Aquifer storage and recovery (ASR) is the underground injection and storage of water into an acceptable aquifer (typically the FAS) and stored for withdrawal at a later date to meet demands when insufficient traditional supplies are available. The aquifer acts as an underground reservoir for the injected water. ASR provides for storage of large quantities of water for both seasonal and long-term storage and ultimate recovery that would otherwise be unavailable due to land limitations, loss to tides, or evaporation. While ASR is not in itself a new supply source, it provides for system reliability allowing for increased development of other sources of water. Some sources of supply, including many surface water supply options, can be intermittent and therefore unreliable. Other supply options such as reclaimed water have variable demand issues but have relatively consistent supply. In these instances, ASR systems play an important role to store large quantities of water for distribution during periods when the source or demand is variable. Currently, within the CFWI Planning Area, only the City of Cocoa uses ASR as a part of their water supply system. The Cocoa ASR system operation began in 1987, and now consists of ten ASR wells, completed in the FAS between depths of 280 to 300 feet below land surface, with a combined recovery capacity of 10 mgd (Pyne 2005). Pilot ASR projects have been implemented by Seminole County, Orange County Utilities, and the cities of Sanford and Deland to store potable water and continue to test the aquifer to establish operational parameters.

Permits to develop ASR systems must be obtained from the Districts, FDEP, and the Florida Department of Health. In the last decade, concerns over the mobilization of naturally occurring arsenic in the aquifer by the interaction of oxygen in the injected water with the aquifer's limestone matrix has become a significant hurdle in permitting ASR systems. In 2006, the EPA lowered the drinking water standard for arsenic from 50 micrograms per liter ($\mu\text{g/L}$) to 10 $\mu\text{g/L}$, resulting in many previously tested ASR locations having difficulty meeting the new standard. Current FDEP rule interpretation requires that the water meet drinking water standards prior to being injected into the ground and storage and recovery cycles cannot cause water quality in the aquifer to exceed drinking water standards. Recently, the FDEP has issued water quality criteria exemptions (i.e., Peace River ASR system) for arsenic associated with utility ASR systems, provided that the utility can demonstrate, among other things, that arsenic concentrations are decreasing during successive cycles of recharge-storage-recovery towards meeting the drinking water standard and that public health is maintained. Also, in recognition of the temporal nature of arsenic mobilization at most ASR sites, the FDEP has issued Administrative Orders, attached to construction permits, which allow operators to temporarily exceed the drinking water

standard while assessing the degree of arsenic mobilization at their facility and to evaluate means to reduce its concentration.

The Districts have funded several pilot projects to evaluate and resolve the arsenic issue. The research has shown that the arsenic is being released from pyrite, a mineral found in limestone in the FAS, due to the chemical differences between the injected water and the native aquifer water (Price and Pichler 2006; USF 2005). Additional studies indicate that arsenic mobilization may be more limited at distances greater than 200 feet from the injection point and arsenic concentrations decreased with successive cycles of use. Studies have also demonstrated that elevated dissolved oxygen (DO) concentrations in injection water oxidize more pyrite per cycle, which releases more arsenic. Therefore, removing DO from injection water may ameliorate high arsenic concentrations during ASR cycle testing (CH2M Hill 2007). The Districts have funded pilot studies for degasification pretreatment systems at select ASR sites to test the effects of pretreatment. Information regarding these studies can be found on the Districts' respective websites.

Recently, Reese and Richardson (2013) completed a hydrogeologic investigation of the middle and lower FAS in the vicinity of Lake Kissimmee. Several discreet, semi-confined intervals within the FAS were found between the depths of 500 to 2,500 feet below land surface that could be available for ASR development in the central region of the CFWI Planning Area.

Reservoirs

Surface water reservoirs provide storage of water, primarily during wet weather conditions, for use in the dry season. Water typically is captured, pumped from rivers or canals and stored in above- or in-ground reservoirs. Small-scale (local) reservoirs/ponds that can hold several hundred thousand gallons or more are used by farms and golf courses to store recycled irrigation water or collect local stormwater runoff. These reservoirs may also provide water quality treatment before off-site discharge. Large-scale (regional) reservoirs may hold up to several million gallons and are used for stormwater attenuation, water quality treatment in conjunction with stormwater treatment areas, and storage of seasonally available water for use during dry periods. Potential stormwater collection projects are discussed in more detail in **Chapter 7**. The potential yield of such reservoirs is directly related to the size of the reservoir and the size of the surface water capture area.

Mined lands in southeastern Polk County contain large expanses of mine cuts and clay settling areas that remain following mining activities that could be used, with modifications, as surface water reservoirs. Although the availability of water is greater in downstream portions of these rivers, developing reservoir systems in the upper Peace and Alafia River watersheds has the advantage of being located on mined lands, as well as reducing distribution costs by being closer to demand centers.

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Water Supply Development

Regional water supply planning is a critical tool for ensuring that existing and future water needs of the state are met while sustaining the water resources and related natural systems. An important part of this planning process is identifying water supply project options necessary to meet the anticipated water needs of the CFWI Planning Area for the 2010 to 2035 planning horizon. Water users are not limited to the projects listed in this CFWI RWSP; the list represents a set of projects that could supply a sufficient quantity of water to meet the projected demands if implemented.

Water supply development is defined in Section 373.019 (26), F.S. as 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. Water supply development projects are generally the responsibility of water users, such as utilities, and involve the water source options as described in **Chapter 6** to meet their needs.

The total water demand for the CFWI Planning Area is projected to increase by 40 percent, from 800 million gallons per day (mgd) in 2010 to an estimated 1,100 mgd by 2035 under average climatic conditions. A growing population and associated demand in the CFWI Planning Area drives the increased need for alternative supply development. As described in **Chapter 2**, the CFWI Planning Area's total population is expected to increase by about 49 percent, from approximately 2.7 million in 2010 to approximately 4.1 million by 2035.

Chapter 4 describes the availability of traditional groundwater to meet all the needs of future growth in the CFWI Planning Area as limited due to environmental and resource concerns and impacts to legal users. In order to supply the projected needs, development of alternative water sources is necessary to meet a portion of the total projected demands. It is expected that sources to be developed will include surface water and stormwater, brackish groundwater, seawater, and an increased use of reclaimed water. Water conservation and other demand management techniques are also expected to play a large role in meeting future water demands. Because of the projected limitations on groundwater, water suppliers located within the CFWI Planning Area were asked to identify potential alternative water supply project options which have a likelihood of being permittable and to estimate their construction and operation costs.

WATER SUPPLY PROJECT OPTIONS

A list of water supply project options for the CFWI Planning Area was developed in coordination with water suppliers and users. In preparation of this CFWI RWSP, the Districts circulated a questionnaire to solicit information from public supply utilities, agricultural, and other water users regarding the traditional and alternative water supply projects planned to meet water needs through 2035. This process allowed water users to provide input on the proposed water supply project options included in the CFWI RWSP (**Volume IA, Appendix F, Exhibits 1a and 1b**).

In developing the list of water supply project options, there was a consideration of how the public interest is served by the project or how the project will save costs overall by preventing the loss of natural resources or avoiding greater future expenditures for water resource development or water supply development. The identified projects will serve the public interest by providing, in an affordable manner, water to meet basic public health, safety, and welfare needs, as well as, providing water for agricultural, commercial, industrial, institutional, recreational, and other typical public supply system needs within the CFWI Planning Area. The projects will contribute to meeting the Florida Legislature's declared policy to promote the availability of sufficient water for all existing and future reasonable-beneficial uses and natural systems, as described in Paragraph 373.701(1), F.S.

A project identified for inclusion in this CFWI RWSP may not necessarily be selected for development by the water supplier. In accordance with Section 373.0361(6), F.S., nothing contained in the water supply component of a RWSP should be construed as a requirement for local governments, public or privately owned utilities, special districts, self-suppliers, multijurisdictional entities, and other water suppliers to select that identified project. If the projects identified in this CFWI RWSP are not selected by a water supplier, the utility may need to identify another source to meet its needs, advise the District of the alternate project(s), and a local government will need to include such information in its Water Supply Facilities Work Plan. However, the water supply project options included in this CFWI RWSP have been screened for feasibility and have a likelihood of being permittable. Nevertheless, the ability to permit a project will depend on its location and results of an impact evaluation.

To best manage the water resources in the CFWI Planning Area, this CFWI RWSP promotes the diversification of sources for the water supply projects. Proposed project options in this CFWI RWSP were evaluated for inclusion based on factors such as the potential to not adversely impact environmental resources and minimum flow and level (MFL) criteria or cause wetland harm, the level of detail provided in the project description regarding the project scope, cost, schedule, and whether a project is expected to actually contribute to new alternative water supply.

In an attempt for consistency in the preparation of costs, a guidance document was developed and made available to water users to assist in preparing estimates. Water users had the ability to follow the guidance document or use their own method. The project costs

developed by the water users are identified by footnotes in **Volume IA, Appendix F, Table F-1**. The cost estimates presented in this chapter are intended to provide a comparison of the general costs of one type of alternative supply relative to another. These cost estimates should not be viewed as a detailed evaluation of potential project costs that can vary significantly from the preliminary cost estimates shown in **Volume IA, Appendix F, Table F-1**.

Table F-1, Volume IA identifies 142 water supply project options (139 alternative water supply projects and three management strategies) to deliver water within the CFWI Planning Area. The project capacity listed in the table is related to the project's design to deliver water while the estimated water amount evaluates the project's ability to deliver "new" water as a result of project construction. For example, a pipeline constructed to deliver water to a new area would not generate water by itself. Many of the reclaimed water projects fall into this category. Other projects would be constructed to develop a previously unused source and would add new supplies to the water user.

For each project option identified, the following information for each project listed is provided pursuant to statutory direction:

- ◆ An estimate of the amount of water made available by the project
- ◆ A timeframe for project implementation
- ◆ An estimate of planning-level costs for capital investment and operating and maintaining the project
- ◆ An analysis of funding needs and potential sources
- ◆ Identification of the likely entity responsible for implementing each project

Groundwater Supply Development

Surficial and Intermediate Aquifer Systems (SAS and IAS)

The majority of water uses for these two aquifers fall into the domestic self-supply (DSS) and Landscape/Recreational/Aesthetic (LRA) water use categories. In general, these users have small-scale demands whose impacts, if observed, may be mitigated.

For these types of demands, reductions of water use are generally accomplished through water conservation or the application of reclaimed water. No water supply projects were identified using the SAS or IAS systems.

Floridan Aquifer System (FAS)

The majority of the 2010 public supply water demand was met by traditional groundwater from the FAS. Because environmental concerns are expected to limit the availability of future development of the FAS, consumptive use permits for additional water from the FAS

will be determined on an application-by-application basis. Additional withdrawals from the FAS could be permitted through the use of reclaimed water “substitution credits” or “impact offsets” as described in **Chapter 6**. By using reclaimed water to replace all or a portion of an existing permitted use, a different user or use could initiate an increase to its FAS withdrawal. This could occur, provided the withdrawal creates no net adverse impact on the limited water resource or creates a net positive impact if required by water management district rule as part of a strategy to protect or recover a water resource.

Upon expiration of the CFCA interim rule in December 2012, not all Districts continue to designate FAS sources in the CFWI Planning Area as “resource limited.” Therefore, while not



applicable on a regional basis, extensive portions of the CFWI Planning Area are considered to be resource-limited for both groundwater and surface water withdrawals due to environmental or MFL constraints. Furthermore, each District continues to consider the utilization of reclaimed water and its benefits in assessing proposed withdrawals during the water use permitting application process.

Brackish/Nontraditional Groundwater Projects

Brackish/nontraditional groundwater, for alternative water supply planning purposes in the CFWI Planning Area for SJRWMD and SWFWMD, is generally defined as water with a total dissolved solids (TDS) concentration greater than 500 mg/L. SWFWMD defines saline water, which includes brackish water, as water with chloride concentrations greater than 250 mg/L can be found in the Lower Floridan aquifer (LFA) within portions of the CFWI

Planning Area. Additionally, brackish groundwater has been identified at depths below the FAS in most areas of the CFWI Planning Area. Thirty-seven potential brackish/nontraditional water supply projects, mostly in Polk County, have been identified to generate water within portions of the CFWI Planning Area. As currently described, these alternative water supply (AWS) projects could generate an estimated 45 mgd of new groundwater. Projects are still being evaluated and could increase the amount of potential new brackish/nontraditional groundwater by an additional 30 mgd.

The Cypress Lake Wellfield and Southeast Polk County Wellfield projects (included in the AWS estimates above) have both been permitted by the SFWMD and are anticipated to provide new potable supply by tapping the LFA. The Cypress Lake Wellfield project in central Osceola County is being developed by the Water Cooperative of Central Florida (WCCF) and the Reedy Creek Improvement District (RCID). The Southeast Polk County Wellfield project is being developed by Polk County Utilities and is located west of the Kissimmee River near SR 27 and SR 60. A number of additional nontraditional groundwater projects are relatively small in size and are designed as blending projects with existing fresh groundwater sources.

Surface Water

The CFWI Planning Area contains the headwaters for seven river systems and a number of studies defining the potential of these river systems to provide supply recently have been completed. The river systems, related studies, and results are described in **Chapter 6**. While many of these surface water sources have significant flows during portions of the year, the flows are subject to climatic conditions and the systems are susceptible to environmental impacts. Smaller, local lakes represent a limited resource and are typically used for local irrigation.

Fifteen potential surface water supply projects have been identified to generate new water within the CFWI Planning Area and are shown in **Table F-1 in Volume IA, Appendix F**. Of these AWS projects, 11 propose to develop water from fresh surface water sources, and the other 4 projects propose to use the St. Johns River. It is estimated these projects, if implemented, could generate between 184 mgd and 209 mgd of additional water. Not all projects are exclusive of one another, and the total yield would depend upon which projects are developed first.

A number of the possible surface water supply projects involve the construction of new reservoirs to create additional storage capacity. One project would collect stormwater from retention ponds in and around the City of Kissimmee and route it to a surface storage basin for later potable and non-potable uses. These reservoir projects are more commonly related to agricultural activities and are addressed during permitting activities. One recent example is the permitting of the Latt Maxey Biofuel Corporation project located in southern Osceola County. Latt Maxey modified its existing consumptive use permit to an allocation for the production of 21,000 acres of a biofuel crop. The permit included construction of a storage reservoir to capture irrigation and stormwater runoff, which is recycled as an irrigation

source. There are a number of these water storage projects reviewed as part of the normal permitting activities, but none are identified as specific projects in this CFWI RWSP.

Seawater

Seawater is defined by the SJRWMD and SFWMD as water with a chloride concentration at or above 19,000 mg/L and by the SWFWMD as water with a total dissolved solids concentration greater than or equal to 10,000 mg/L. Seawater requires desalination treatment prior to being used for public supply or irrigation purposes. Desalination is the process of removing or reducing the dissolved ions to produce fresh water.



Seawater is currently used by several coastal utilities in Florida. Using seawater as a source for the interior parts of the state would require access to the coast and a delivery system for the water. Although SJRWMD has completed preliminary work to identify options for co-siting a seawater desalination plant with an electric power plant or a sizeable reclaimed water discharge facility, there are no new seawater desalination projects proposed by water users in this CFWI RWSP.

Polk County Utilities and Tampa Bay Water (TBW) have identified a partnership that would deliver 10 mgd through expansion of TBW's desalination facility or through the addition of a second reservoir at or near the Alafia River. The project is included in **Table F-1 (Volume IA, Appendix F)** as a surface water/seawater project because of the possible option of developing either or both water sources.

Reclaimed Water

In 2010, approximately 193 mgd of wastewater was generated by 58 service providers from a combined 80 wastewater plants (with permitted capacities over 0.1 mgd), including distribution facilities, within the CFWI Planning Area (FDEP 2011). The availability and increased flow of wastewater is projected to increase to 314 mgd by 2035, an approximate increase of 121 mgd from 2010. With 29 mgd of proposed supplemental supply and an additional 15 mgd of existing wastewater currently not being reused, reuse flows are projected to increase in 2035 by an additional 44 mgd to a total of 165 mgd. The method for determining the projected availability of wastewater and reuse supplied is described in **Chapter 6** and **Volume IA, Appendix E**.

Eighty-seven projects have been identified that distribute and use reclaimed water within the planning region. **Table F-1** in **Volume IA, Appendix F** provides a list of these projects. Projects identified include construction of treatment facilities, pipelines, use of surface/stormwater to supplement and increase the total reclaimed water availability during peak use periods and the interconnection of reuse systems to increase reclaimed water utilization and improve reliability. Of the potential 165 mgd of new reuse, it is estimated that an offset of 105 mgd of potable quality water could be achieved. The exact application and location of the reuse will determine how much offset might be achieved.



Reedy Creek Rapid Infiltration Basin in Southwest Orange County

New Storage Capacity

New storage capacity refers to projects that can capture stormwater or surface water during periods of excess rainfall for use at a later time. These types of projects are beneficial for agricultural operations and golf/landscape irrigation projects by storing reclaimed water or capturing surface runoff onsite for later use. Project types listed as surface water and reclaimed water projects frequently include storage as a component of a larger project. A conceptual level evaluation of the costs and reservoir sizing for the capture of surface/stormwater in the Upper Kissimmee Basin was addressed in the 2005-2006 Kissimmee Basin Water Supply Plan, Appendix F (SFWMD 2006b). Projects identified for new storage are discussed under the sections on surface and reclaimed water in this CFWI RWSP.

Water Management Strategies

Efforts to reduce water consumption or manage the water resources to minimize environmental concerns are also important components of increasing water supply. These include water conservation projects and piping interconnects between water users to manage supplies. The intent of these projects is to provide service reliability and maximize potential supply using permitted but unused capacity. Water interconnect projects are listed in **Volume IA, Appendix F, Table F-1** and water conservation efforts are discussed in detail in **Chapter 5**.

An additional option identified for fresh groundwater development in the SWFWMD portion of the CFWI Planning Area is through the management strategy of land use transitions. Land use transitions are the retirement of permitted/used water quantities associated with a historical land use, resulting in a net benefit to the water resource. The strategy can be applied to a variety of scenarios such as the rezoning and permit transfer of mining or agricultural lands to residential or commercial development with less associated water use per acre, or the retirement of water withdrawals through public lands acquisition for the benefit of water resources. While this option does not produce new water, it creates opportunities for the orderly reduction and transition of previously permitted water quantities to a new water supplier or the environment. The strategy allows for the avoidance of new potential impacts or the reduction of existing impacts by using a “balance sheet” approach, verified by groundwater modeling. Polk County has identified this as an option with a potential increase of water for their facilities of up to 30 mgd countywide (Reiss Environmental 2009).

SUMMARY OF WATER SUPPLY PROJECT OPTIONS

Table 21 summarizes by county the alternative water supply project options identified by water suppliers to meet the 2035 water demands. **Table F-1** in **Volume IA, Appendix F** provides a list of the individual water supply project options submitted by water users for inclusion in the CFWI RWSP.

Table 21. Estimated water supply capacity (mgd) of submitted water supplier projects by source type^a in the CFWI Planning Area.

County	Reclaimed Water ^b	Brackish Water	Surface Water	Management Strategies	Total
Orange	69	10	47	0.0	126
Osceola	35	17	30	0.0	82
Polk	30	48	15	6.0	99
Lake (southern)	7	0.0	5	0.0	12
Seminole	24	0.0	112	0.0	136
Total	165	75	209	6.0	455

^a Includes projects under evaluation.

^b Reclaimed water is represented as projected reuse flows, which include supplemental sources, and offset is dependent upon application.

The water supply project options summarized in **Table 21** are in addition to the water being used in 2010. The groundwater analysis discussed in **Chapter 4** suggests that up to an additional 50 mgd of groundwater may be available within the CFWI Planning Area beyond the average total water use of 800 mgd historically used in the region. This suggests that AWS, in an amount up to 250 mgd may need to be developed by 2035 to meet future water demands. For agriculture, as described in Section 373.709(2)(a)2., F.S., alternative water supply options for agricultural self-suppliers are limited. The additional water conservation, reclaimed water sources, and one of the AWS projects (Taylor Creek Reservoir) outlined in this plan will meet some of the projected future agricultural demand. For the remaining demand, this plan is not intended to preclude the development of additional groundwater so long as the proposed use meets the applicable consumptive use permitting criteria.

THE LINK TO PROJECT PERMITTING

Many of the project options included in the summary above will require a consumptive use permit (CUP) for use of the water source and/or another type of permit (Environmental Resource permit, Surface Water Management) for the project construction. Projects that use 100 percent seawater or reclaimed water are not required to obtain CUPs in the SFWMD and SWFWMD. In SJRWMD, a consumptive use permit may be required for withdrawals from estuaries, lagoons, rivers, streams, and intracoastal waters. A consumptive use permit is not required for the use of reclaimed water in the SJRWMD. As a part of the permitting

process, applicants must demonstrate that the proposed use meets criteria (see Section 373.223, F.S.)

- ◆ Proposed use is a reasonable-beneficial use of water.
- ◆ Proposed use does not interfere with existing legal users.
- ◆ Proposed use is consistent with the public interest.

Local governments and water providers are required to prepare a number of documents including comprehensive plans, facilities work plans, and consumptive use and other permit applications. Although these documents are drafted at different times, each uses the latest and best available data available at the time of preparation. Local economic conditions and population growth rates change frequently and may affect when water is projected to be needed and when projects need to be initiated. Future water supply development projects should be consistent with the most recently developed plans and permits where possible.

A FDEP (2012) guidance memo addresses coordination between District consumptive use permitting and water supply development staff on project options included in water supply plans. By increasing coordination during the water supply planning process, future consumptive use permit applicants who wish to construct identified water supply project options will be assured that District staff are familiar with the projects, have supporting data, and will be able to facilitate the permitting process. The proposed project options considered for the CFWI RWSP were reviewed by staff from Water Resources, Water Use Permitting, and Public Affairs Bureaus using the following set of questions:

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

REGIONAL AND LOCAL PLANNING LINKAGE

The water supply planning process of Districts is closely coordinated and linked to the water supply planning of local governments and utilities. Significant coordination and collaboration throughout the RWSP development and approval process is needed among all water supply planning entities. The regional and local water supply planning process is illustrated in **Figure 17**.

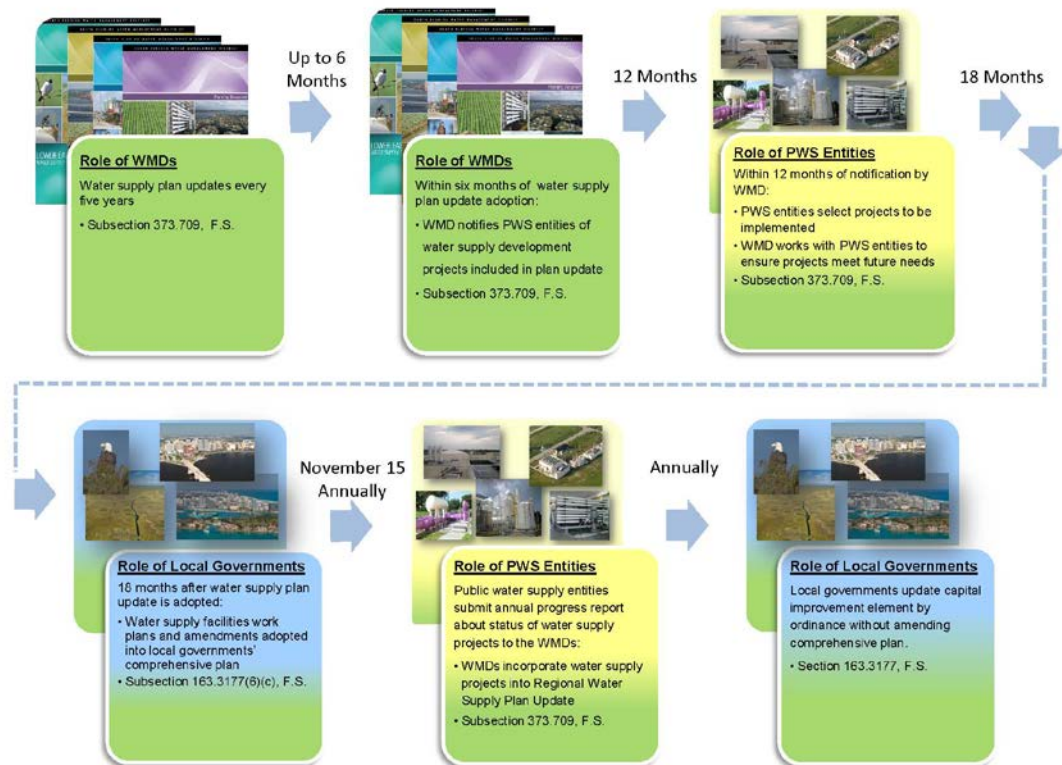


Figure 17. Planning process for linking regional water supply planning with local government comprehensive planning.

Districts are required to notify each water supply entity of the project options identified in this RWSP for consideration and to incorporate into its corresponding government's required water supply facilities work plan in meeting future water demands. This notification must occur within six months following approval of the RWSP. Once the notice is received, the water supplier must respond to the District within 12 months about their intentions to develop and implement the project options identified by the RWSP or provide a list of other projects or methods to meet these needs (Paragraph 373.709(8), Florida Statutes [F.S.]).

In addition to the requirements above, local governments are required to adopt water supply facilities work plans and related amendments into their comprehensive plans within

18 months following the approval of the RWSP. The work plans contain information to update the comprehensive plan's capital improvements element, which provides specifics about the need for and location of public facilities, principles for construction, cost estimates, and a schedule of capital improvements.

The local governments are required by Paragraph 163.3177(6)(c)3, F.S. to modify the potable water sub-elements of their comprehensive plan by

- ◆ Incorporating the water supply project or projects selected by the local government from those projects identified in the updated RWSP or proposed by the local government.
- ◆ Identifying water supply projects to meet the water needs identified in the updated RWSP within the local government's jurisdiction.
- ◆ Including a work plan, covering at least a 10-year planning period, for building public, private, and regional water supply facilities, including the development of AWS, which are identified in the potable water sub-element to meet the needs of existing and new development.

By November 15 of every year, all water suppliers are required to submit a progress report to the Districts about the status of their water supply projects (completed, underway, or planned for implementation). By December 1 of each year, local governments are required to submit updated capital improvements project information to the Florida Department of Economic Opportunity and to the Districts.

In Section 373.250(6), F.S., the Florida Legislature encourages Districts and local wastewater utilities to periodically coordinate and share information concerning the availability and distribution of reclaimed water. Through this existing and continued coordination, Districts can continue to increase their knowledge of proposed reuse activities. At the same time, wastewater utilities may be able to identify new areas where reclaimed water could be used based on the Districts' water supply planning efforts. This existing and continued regional-local coordination promotes the use of reclaimed water, a state objective, and is a key strategy of this RWSP.

IMPACT OF POLITICAL BOUNDARIES ON WATER SUPPLY PLANNING

Political boundaries should be recognized in the development of water supply projects. Although Chapter 373, F.S., does not prohibit transfers of water across political boundaries, it does specifically address water transportation across District and county boundaries. The following is a brief discussion of the potential issues that might be encountered in moving water across jurisdictional lines.

Transfers of Water Across District Boundaries

Section 373.2295, F.S., describes the process the Districts follow when reviewing applications for consumptive uses of water that involves the withdrawal of groundwater from one District for use outside that District in another county. Such transfers of groundwater are referred to as inter-district transfers of groundwater. It is not an inter-district transfer of groundwater if the withdrawal and use are located in the same county. Regardless of the location of the use, the permitting District must consider the projected populations of the area where the withdrawal is located, the projected population of the proposed use area, other evidence on future needs of the areas, and the District's consumptive use permit (CUP) criteria.

In addition surface water and groundwater transfers across District boundaries are governed by Rule 62-40.422(1) and (2), FAC. which states the transfer or use of surface water across District boundaries shall require approval of each involved District. The transfer or use of groundwater across District boundaries shall require approval of the District where the withdrawal of groundwater occurs.

Transfers of Water Across County Boundaries

The "local sources first" provisions found in Subsection 373.016(4), F.S., encourage the use of water from sources closest to the area of use before transferring water over long distances to meet demand in areas far from the water source. However, the Legislature acknowledged that under certain circumstances the need to transport water from distant sources might be necessary for environmental, technical, or economic reasons.

Section 373.223 (3), F.S., allows Districts to authorize the transport of ground or surface water across county boundaries, or outside of the watershed from which water was taken, as long as the transfer is consistent with the public interest. When determining whether a proposed transfer is consistent with the public interest, the Districts must consider

- ◆ The proximity of the proposed water source to the area of use or application.
- ◆ All water sources that are geographically closer to the area of use than the proposed source that are technically and economically feasible.

- ◆ All economically and technically feasible alternatives, including, but not limited to desalination, conservation, reuse of reclaimed water and stormwater, and ASR.
- ◆ The potential environmental impacts that may result from the transport and use of water from the proposed source, and the potential environmental impacts that may result from the use of alternative sources.
- ◆ Whether existing and reasonable anticipated sources of water and conservation efforts are adequate to supply water for existing legal uses and reasonable anticipated future needs of the region in which the proposed water source is located.
- ◆ Local governments affected by the use of the proposed transport and use.
- ◆ The value of the existing capital investment in water-related infrastructure made by the applicant.

Where district-wide water supply assessments and RWSPs have been prepared, the Districts shall use the assessments and plans as the basis for its consideration of the above listed factors. If the District's governing board determines that a transfer is consistent with the public interest, local governments cannot adopt or enforce any law, ordinance, rule, regulation, or order to the contrary.

The "local sources" provisions do not apply to water supplied from the Central and Southern Florida Flood Control Project, or water supplied exclusively for bottled water. Additionally, owners of contiguous private properties that cross District boundaries are exempt from this consideration.

PROJECT FUNDING

Currently, the Districts fund both water resource and water supply development projects. Water resource development activities are discussed in **Chapter 8** and are primarily the responsibility of the Districts. Water supply project options discussed in this chapter are primarily the responsibility of local water suppliers. Potential sources of funding for water supply and water resource development projects are discussed in **Chapter 9**.

8

Water Resource Development

This Chapter provides a summary of the water resource development activities and projects recently conducted and also planned over the next five years by the Districts within the CFWI Planning Area to enhance the amount of water available for both water users and natural systems. Water resource development is defined in Section 373.019 (24) F.S. as the formulation and implementation of regional water resource management strategies, including the collection and evaluation of surface water and groundwater data; structural and nonstructural programs to protect and manage water resources; the development of regional water resource implementation programs; the construction, operation, and maintenance of major public works facilities to provide for flood control, surface and underground water storage, and groundwater recharge augmentation; and related technical assistance to local governments and to public and privately owned water utilities.

The Districts are primarily responsible for identifying, funding, and implementing water resource development projects, with additional funding and technical support from state, federal, and local entities and water supply authorities. Water resource development efforts can take multiple forms including (but not limited to) district-wide data collection activities, flood control structures (not discussed in this chapter), restoration projects for impaired water resources, hydrogeologic studies, groundwater model development, and research projects. The categorization of water resource development efforts may vary slightly among Districts, where applicable, water resource development project options, which have a likelihood of being permittable, are identified. Descriptions of the efforts affecting the CFWI Planning Area are grouped below by Hydrologic Data Collection and Analysis; Agricultural Water Resource Projects; Minimum Flows and Levels (MFLs) and Reservation and Restoration Projects; Surface Storage and Recharge Projects, and Aquifer Storage and Recovery (ASR) Research and Pilot Projects; and Desalination Concentrate Disposal Investigations. Water conservation is also an important component to preserve water resources; these conservation programs (including mobile irrigation labs) are discussed in **Chapter 5**.

For water resource development projects, it may be difficult to identify all project components because of the variety of project types (data collection, studies, pilot projects, etc.). Project components include (1) An estimate of the amount of water made available by the project; (2) A timeframe for project implementation; (3) An estimate of planning-level costs for capital investment and for operation and maintenance costs; (4) An analysis of funding needs and potential sources; and (5) Identification of the likely entity responsible for implementing each project.

Table 22 shows the participants and magnitude of funding for water resource development projects and activities within the CFWI Planning Area historically and over the next five-year period. Additional information is published annually in each District's Water Resource Development Work Program, a statutory report (373.536(6), F.S.) that provides a five-year projection of water resource development expenditures.

Table 22. Actual and projected funding for water resource development activities and projects benefiting the CFWI Planning Area.

Project/Activity Description	Funding/In-Kind Participants	Funding (Million \$)	
		Actual FY05 - FY11	Projected FY12 - FY16
CFWI Planning Area Specific Planning, Modeling, and Research Activities	All Districts, USGS	1.37	0.24
Water Conservation Incentive/Cost Share Programs	SFWMD, SJRWMD, SWFWMD	3.05	1.00
Agricultural Water Resource Projects	SJRWMD, SWFWMD, FDACS, State, Private Farms	18.43	29.84
Hydrologic Data Collection and Analysis - including weather and monitor well networks, database maintenance, studies	All Districts, USGS, Local Governments and Partners	92.75	62.08
Lower Floridan Aquifer Investigations	SFWMD, SWFWMD	1.99	8.19
MFL/Reservation Establishment and Management Activities (including other watershed management programs)	All Districts, USACE, Local Governments and Partners	329.90 ^a	99.38
MFL Recovery/Prevention Strategy Projects	SJRWMD, SWFWMD, State, FEMA, Local Governments	44.30	22.71
Abandoned Well Plugging Programs	SJRWMD, SWFWMD, Federal, State, Local Governments and Partners	6.09	2.52
Surface Water Storage/Treatment Research Projects	SFWMD, SJRWMD, EPA, Local Governments and Partners	8.14	0.74
Aquifer Recharge Projects	SJRWMD, SWFWMD, State, Local Governments	18.01	0.21
ASR Research and Pilot Projects	All Districts, State, Local Governments	35.38	1.97
Other AWS Research Projects	All Districts, State, AwwaRF, Local Governments and Partners	0.58	6.72
Funding Total (Million \$)		559.99	235.60

Note: AWS = Alternative Water Supply
 ASR = Aquifer Storage and Recovery
 AwwaRF = American Water Works Association's Water Research Foundation
 EPA = U.S. Environmental Protection Agency
 FDACS = Florida Department of Agriculture and Consumer Services
 FEMA = Federal Emergency Management Act
 MFL = Minimum Flows and Levels
 USACE = U.S. Army Corps of Engineers
 USGS = U.S. Geological Survey

^a Estimated funding for Kissimmee River Reservation.

PLANNING AREA SPECIFIC PLANNING, MODELING, AND RESEARCH ACTIVITIES

Surface and Groundwater Modeling

Collaborative modeling efforts for the CFWI Planning Area are being conducted by the District's in cooperation with USGS, FDEP, FDACS, and regional utilities. These efforts include conducting predictive simulations to estimate water demands and the effects of withdrawals on wetlands, springs, lakes, saltwater intrusion, and water users in the CFWI Planning Area as described in **Chapter 4**, the East Central Florida Transient (ECFT) groundwater model was used to conduct simulations to provide planning level estimates on groundwater availability and possibly for regulatory purposes in the future. Additional modeling efforts ongoing within the CFWI Planning Area include SWFWMD's District-wide Regulation Model Simulation; the SJRWMD East Central Florida (ECFT) groundwater model; and the Agricultural Field Scale Irrigation Requirement Simulation model (AFSIRS).

WATER CONSERVATION INCENTIVE / COST SHARE PROGRAMS

As discussed in **Chapter 5**, reducing water demands prolongs the availability of water resources and is typically more cost effective than developing new water supplies. Water conservation programs for reducing residential and commercial water use can delay the need for utilities to develop new potable water supply infrastructure. Improved efficiencies in agricultural, recreational, and landscape irrigation directly benefit both surface and groundwater resources, help prevent wetland impacts and sinkhole formation, and improve water quality. Districts sponsor demand management projects through their cooperative funding programs, which are typically budgeted as water supply development assistance.

AGRICULTURAL WATER RESOURCE PROJECTS

These projects use agricultural water conservation strategies to increase efficient water use for agricultural operations. The projects have the added benefit of reducing agricultural impacts to surface water features. Additional projects are also discussed in detail in **Chapter 5**.

Facilitating Agricultural Resource Management Systems Program (FARMS)

The SWFWMD's FARMS program provides incentives to the agricultural community to implement agricultural best management practices (BMPs) through cost-share reimbursement (SWFWMD 2006). The BMPs provide water resource benefits including improved water quality, reduced Upper Floridan aquifer (UFA) withdrawals, surface and groundwater use sustainability, and enhancements to ecology. The BMPs may include tailwater recovery systems and reservoirs to capture runoff, precision irrigation systems with integrated weather stations, and frost/freeze protection alternatives to high volume withdrawals. FARMS program staff work closely with individual farmers and farm corporations to develop appropriate BMPs. FARMS program staff will conduct site visits, manage construction activities, and coordinate administrative and financial aspects of reimbursement for the farmer. After construction, staff will continue to work with the farmer during the operational phase to document water resource benefits. In Polk County, 20 FARMS program projects have been implemented at a total cost of \$3.3 million and offsetting an estimated 1.2 million gallons per day (mgd) of groundwater withdrawals.

HYDROLOGIC DATA COLLECTION AND ANALYSIS

The Districts conduct a variety of data collection and analysis to monitor the functionality of natural systems and support the sustainable development and use of water resources. Most of these scientific activities are district-wide throughout the year. Each District maintains a comprehensive database storing both historical and current information from thousands of water monitoring stations. The databases are accessible online for use by water suppliers, local governments, and the general public. As part of the CFWI planning effort these databases are being collectively inventoried and the inventory will be made available online in the future.

Hydrologic Monitoring

The Districts have comprehensive programs to monitor hydrologic conditions. The programs include data collected by District staff, permittees, and the USGS. Data collected allow the Districts to evaluate functionality natural systems, monitor trends in conditions to the water resource, identify and analyze existing or potential resource problems, and develop programs to prevent or correct problems. The primary hydrologic data that are collected include rainfall; evapotranspiration; lake levels; discharge and stage height of major streams, rivers, springs, and groundwater levels; water use; and various water quality parameters. The Districts also monitor ecological conditions as they relate to both potential water use impacts and changes in hydrologic conditions. Hydrologic data submitted by permittees are reviewed to ensure compliance with consumptive use permit conditions and to assist in monitoring hydrologic conditions.

USGS Hydrologic Studies

The Districts have long-term cooperative funding programs with the USGS to collect hydrologic data and prepare regional hydrogeologic investigations. The programs monitor changes in the hydrologic systems and improve the understanding of cause and effect relationships. District funding is generally on a 50/50 cost-share basis, although shares may vary based on additional project participants, special assignments, or if non-routine data collection is requested. The USGS also performs regional hydrogeologic investigations that focus on developing analytical tools to be used in resource evaluations. These investigations include development of computer models of the regional groundwater flow systems and hydrologic assessments for surface water bodies.

LOWER FLORIDAN AQUIFER INVESTIGATIONS

Exploratory Well Drilling and Aquifer Testing

Each District conducts exploratory well drilling and testing programs to increase understanding of the aquifer systems. The programs improve the accuracy of groundwater models and enhance decision making during review of consumptive water use permit applications. Geophysical logging and other tools, such as pump and packer testing, provide hydrogeologic and water quality data that are stored in the District databases. Impacts resulting from increased groundwater withdrawals over four decades have been documented and assessed through analysis of data collected from the well networks. These data directly support the Districts' water supply planning and regulatory rules and policies.

Investigations of the Lower Floridan Aquifer (LFA)

As mentioned in **Chapter 6**, the LFA generally exists 1,000 to 3,000 feet below land surface throughout the CFWI Planning Area. Data and analyses on the LFA dating back to the 1930s were focused primarily on oil exploration and waste injection (Miller 1986). Historical drilling investigations did not evaluate the LFA as a water supply source because the water in the aquifer was assumed to be brackish or saline, and because of the additional cost to complete a well to these depths and the specialized equipment needed to survey these depths. Since that time, increasing water demands in the CFWI Planning Area merited additional studies of the LFA from a production and water quality perspective, as well as the potential impact of withdrawals on the overlying UFA and natural systems. A more comprehensive evaluation of the LFA aquifer was proposed by the SFWMD in 2011, and two sites



in Polk and Osceola counties were investigated as part of that effort. The SWFWMD is exploring the LFA as part of a continuing data collection effort at key locations in Polk County in order to improve knowledge of the LFA, increase data available for groundwater models, and quantify the water potentially available from the LFA to meet future water demands. Polk County, the Water Cooperative of Central Florida (WCCF), and Reedy Creek Improvement District (RCID) have installed LFA production and monitor wells at the proposed Southeast Polk wellfield and the Cypress Lakes wellfield, respectively. The historical and more recent data will help determine the productive capacity and water quality of the LFA in these areas, and evaluate its potential as a water source. Because of the limited geographic extent of available LFA wells data, additional well sites are required to provide the site-specific data necessary to evaluate future LFA sites. If the tests indicate that water quality and productivity are suitable for production, the test wells may be converted to production wells.

MINIMUM FLOW AND LEVEL / RESERVATION ESTABLISHMENT AND MANAGEMENT ACTIVITIES

Florida law, Chapter 373.042, F.S., requires the Districts or FDEP to establish MFLs for aquifers, rivers, streams, springs, and lakes to identify the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area. The process for establishing MFLs includes data collection and analysis, documentation of findings, independent, scientific peer review of findings, and public review for interested stakeholders, all of which are considered by the Districts' governing boards when deciding whether to adopt a proposed MFL. Monitoring programs provide data for evaluating compliance with the adopted MFLs, determining the need for prevention and recovery strategies, and analyzing the recovery of water bodies where significant harm has occurred.

Kissimmee Basin Modeling and Operations Study

The Kissimmee Basin Modeling and Operations Study (KB MOS) is the first comprehensive review of water management operations for the Kissimmee Basin in more than 30 years. Its goal is to evaluate alternative operations for Central and Southern Florida Project water control structures throughout the Kissimmee Basin to align upstream and downstream operations with Kissimmee River Restoration Plan headwater discharges at S-65 and enhance/sustain habitat conditions for fish and wildlife throughout the Kissimmee Chain of Lakes (KCOL). The tools developed under KB MOS are available for future establishment of a KCOL water reservation or a set of MFLs and would allow for a determination on water available for consumptive uses.

Kissimmee River Restoration Project

The Kissimmee River system is undergoing a major restoration effort which, when fully implemented, is anticipated to require water to be stored in and released from the KCOL

and its tributaries as part of a management strategy balancing flood control and environmental restoration for the Kissimmee system as well as downstream waterways and Lake Okeechobee. The Kissimmee River Restoration Project is a large-scale, multi-phased ecosystem restoration effort. The SFWMD undertook the initial technical work in support of establishment of a water reservation for the KCOL and Kissimmee River beginning in 2008. A substantial ecologic and hydrologic analysis of the region/system/area was completed and documented in the draft 2009 Technical Document to Support Water Reservations for the Kissimmee River and Chain of Lakes (SFWMD 2009b).

In 2014, rulemaking was initiated to develop a water reservation rule for 19 lakes, the Kissimmee River system, and its associated floodplain in the CFWI Planning Area. The draft rule and technical document for the proposed reservation was published in 2015. As part of this rulemaking effort, the SFWMD will identify the water needed for the protection of fish and wildlife while achieving the approved restoration goals for the Kissimmee River and Headwater Revitalization Projects.

Watershed Investigations

Each District develops watershed management plans in cooperation with local governments to address issues including flooding, withdrawal impacts, and land alterations. The plans evaluate the capacity of a watershed to protect and enhance water quality, natural systems, and achieve flood protection. Topographic information is used to delineate surface features and understand the boundaries of each watershed. The watershed is then evaluated to determine if water flows and quality are adequate for the environment, flood protection, and water supply. The plan may identify BMPs for the Districts and local governments to improve the watershed's hydrologic functions. Flood hazard information generated by watershed evaluations is used by the Federal Emergency Management Agency (FEMA) to revise flood insurance maps.

Peace Creek Canal Watershed Management Project

This is a multiyear project to collect topographic information, evaluate the watershed, and develop and conduct elements of the Peace Creek Canal Watershed Management Plan (SFWMD 2001). In 2005, the SFWMD agreed to maintain and improve the water conveyance and storage capabilities of the Peace Creek Canal. The Watershed Management Plan identifies projects to restore lost basin storage, improve water quality, provide flood protection benefits, and improve natural systems. The plan assists local governments with their land management responsibilities, provides watershed model simulations for floodplain management, and helps achieve water quality management for National Pollution Discharge Elimination System permit requirements. The Watershed Management Plan also defines lake management levels for storage and flood protection of the Winter Haven Chain of Lakes, assesses the impacts of new surface water storage sites, and analyzes the potential for ecological restoration at sites located along the canal.

MFL RECOVERY/PREVENTION STRATEGY PROJECTS

When a water body falls below its MFL threshold, a recovery strategy is developed to protect the habitat and water resource. In the CFWI Planning Area, only the SWFWMD has developed MFL recovery/prevention strategies for two water bodies within the Peace River watershed. Over the past 150 years, substantial land use changes have occurred in the watershed by clearing lands for residential and commercial use, transportation, agriculture, recreation, timbering, power generation, mineral extraction, and other land uses. These land use changes have required withdrawals of groundwater that have resulted in significant declines in the water level of the UFA, resulting in saltwater intrusion near the Gulf coast, lowered lake levels along the Highlands Ridge recharge area, and loss of flow in the upper Peace River. The SWFWMD has two large water resource development projects addressing the recovery strategies for this watershed.

Lake Hancock Lake Level and Wetland Treatment Modification Projects

The Lake Hancock Lake Level Modification project is part of a MFL recovery strategy for the upper Peace River (SWFWMD 2006). The upper Peace River has been severely impacted by land use changes and has stopped flowing at times. Historically, Lake Hancock fluctuated more than one foot higher than it has during the past several decades. The project raised the controlled elevation of Lake Hancock from 98.7 feet related to the 1929 National Geodetic

Vertical Datum (NGVD) to 100.0 feet NGVD by modifying an outfall structure. The change allows the storage of water to be slowly released during the dry season to help meet the minimum flow requirements in the upper Peace River between Bartow and Zolfo Springs. The Lake Hancock Wetland



Lake Hancock Lake Level Modification Project

Treatment Modification project uses a wetland treatment system to improve lake water quality prior to discharge. Raising the Lake Hancock operating level also restores the wetland function for several hundred acres of lands contiguous to Lake Hancock, and provides recharge to the Upper Floridan aquifer through exposed sinkholes along the upper Peace River.

ABANDONED WELL PLUGGING PROGRAMS

Each District has or has had in the past, programs to back-plug or abandon flowing wells and wells that interconnect aquifer horizons. The Districts give financial and technical assistance to back-plug active agricultural irrigation wells that produce highly mineralized groundwater. Currently only SJRWMD and SWFWMD have active well plugging programs. Proper plugging of unused flowing or sub-standard constructed wells addresses both water conservation and environmental improvement priorities of the Districts. Prior to plugging an abandoned well, geophysical logging is performed to document the current well condition, collect geophysical data, and determine



Plugging an Abandoned Well

the proper plugging method. Many times the Districts pay part or all of the cost to abandon the well. Growers experience several advantages from well back-plugging including increased crop yields due to the reduced salt concentrations in irrigation groundwater, decreased soil-water requirements and pumping costs, and reduced corrosion and fouling of irrigation equipment. The SWFWMD back-plugging program averaged a 60 percent reduction in chloride concentrations in rehabilitated wells, while retaining an average 78 percent of well volume yield. SFWMD requires permit holders, as a part of the water use permit, to properly abandon unused wells.

SURFACE WATER STORAGE / TREATMENT RESEARCH PROJECTS

The seasonal storage of surface water and the augmentation of groundwater resources through recharge systems are water resource development options that may increase the quantity of water available to meet future growth in the CFWI Planning Area. The Districts conduct the feasibility studies to determine the benefits, costs, and potential environmental effects of these projects.

St. Johns River/Taylor Creek Reservoir (TCR) Projects

The SJRWMD is evaluating options to generate additional public supply through seasonal water storage in Taylor Creek on the St. Johns River (SJRWMD 2012). The ongoing project (levee improvements) is designed to change the current operating schedule and make structural improvements to increase the year-round operating pool level by up to three feet. Raising the pool level as a result of improvement may create a potential water supply yield in the existing watershed of about 14 to 16 mgd at 80 percent reliability. If proposed levee improvements are made, the potential yield increases to approximately 20 to 22 mgd at 80 percent reliability (<http://floridaswater.com/watersupply/AWSprojects.html>). Proposed project descriptions can be found in **Volume IA, Appendix F**.

Investigation of Public Supply System Augmentation with Surface Water/Stormwater Sources

The SJRWMD has conducted multiple feasibility studies in cooperation with public supply utilities to investigate the use of local surface water and stormwater sources, including stormwater ponds, drainage canals, and other naturally occurring or manmade water bodies to augment public supply systems. These sources may be relatively small, but with adequate storage and treatment they could supplement public supply systems. The investigations address technical, environmental, and economic feasibility considerations at site specific locations (Burton & Associates 2004; CH2M Hill 1996, 2004; Hall 2005; SJRWMD 2012, 2013).

AQUIFER RECHARGE PROJECTS

Polk County Groundwater Recharge Investigation

This project with Polk County Utilities and SWFWMD includes an indirect aquifer recharge feasibility study and field pilot testing for applying highly-treated reclaimed water to a rapid infiltration basin (RIB) in northeast Polk County (Jones Edmunds & Associates 2013). Information gained from the project will be used to quantify the effects of recharging the surficial and FAS and determine the additional groundwater supplies that could potentially be available through permitting credits. If viable, it would enable Polk County to beneficially use 100 percent of their excess reclaimed water while providing opportunities to develop additional water supplies in areas where options are limited.

Winter Haven Reclaimed Water for Aquifer Recharge

The City of Winter Haven recently completed a desktop feasibility study to evaluate the benefits of applying approximately 4 mgd of reclaimed water into conceptual RIBs near one of the city's wastewater treatment facilities (Parsons Brinckerhoff 2013). The RIBs could

potentially increase FAS water levels, provide benefits to lakes and other natural systems, and mitigate additional water withdrawals. The study included assessing permitting requirements, quantifying water level improvements, and performing an economic cost analysis.

AQUIFER STORAGE AND RECOVERY (ASR) RESEARCH AND PILOT PROJECTS

As discussed in **Chapter 6**, ASR systems use injection wells to store seasonally available water supplies underground and recover water from these same wells when needed. ASR systems can function like an above-ground storage reservoir, but at less cost and much smaller geographic footprint. Currently, within the CFWI Planning Area, only the City of Cocoa utilizes ASR as a significant part of their water distribution system. Seminole County, Orange County, and the cities of Sanford and Deland have implemented pilot ASR projects to store potable water and continue to test the aquifer to establish operational parameters (BFA Environmental Consultants 2012; Cardno Entrix 2012; CDM 2012a, 2012b; SJRWMD 2005c). A primary hurdle in utilizing ASR systems has been the mobilization of arsenic within the aquifer caused by interactions between relatively high oxygen levels in the injected water and naturally occurring pyrite within limestone. Arsenic can be removed from recovered water through conventional treatment, but the contamination of underground potable water sources must be prevented. Recognizing that arsenic levels typically decline during successive cycles of storage and recovery from ASR systems, FDEP has issued water quality criteria exemptions to ASR facilities when utilities can demonstrate that public health is protected. The Districts co-fund and participate in several research and pilot projects that investigate methods to control the mobilization of arsenic in aquifers that may occur during ASR cycles of injection and recovery.

City of Bradenton Pilot Degasification Project

This is an ongoing pilot project to design, permit, and construct a degasification system to remove dissolved oxygen from the injection water prior to storage at the City of Bradenton's ASR site. Although not located in the CFWI Planning Area, the project is co-funded by the Districts and is expected to develop technical expertise for many future ASR projects. The pilot degasification system is capable of handling water flow rates as high as 1.1 mgd at 99.98 percent dissolved oxygen removal. Cycle testing with degassed water is ongoing.

Evaluation of Pre-Treatment Techniques and Operational Strategies for Controlling Arsenic Mobilization

This project, funded by the Comprehensive Everglades Restoration Plan (CERP) ASR Regional Study, evaluated pretreatment methods to control arsenic mobilization during ASR

and from artificial recharge systems. The project involves development of a computer model to assess methods to minimize mobilization of arsenic in the storage aquifer.

ASR Treatment Cost Effectiveness Study

This SWFWMD project identifies and tests cost-effective options for improving the treatment efficiency associated with removing dissolved oxygen from different sources of injection water including reclaimed water, direct surface water and conventionally treated potable water. Early degassing systems have struggled with clogging and fouling of the equipment. Methods to minimize this fouling and remove it as it occurs are being developed and improved to make pretreatment systems more viable. Additional dissolved oxygen removal methods are being tested that may provide better performance or address unique water quality characteristics found at different facilities.

OTHER AWS RESEARCH PROJECTS

Desalination Concentrate Disposal Investigations

One option in the CFWI Planning Area is to use brackish water from the LFA. A primary obstacle to the desalination of brackish water is the disposal of the concentrate generated in the treatment process. Many coastal utilities in Florida already treat moderately brackish levels with low-pressure membrane systems at reasonable operating costs. These facilities dispose of saline concentrate by coastal surface water discharge, dilution in wastewater systems, or by injection to non-potable aquifers. These methods may not be readily available for desalination systems in the CFWI Planning Area, due to protection of inland water bodies discussed in **Chapter 6** and the depth to a viable non-potable aquifer. The Districts have sponsored technological investigations to increase the treatment options available to utilities. The Districts, Orlando Utilities Commission, and Tampa Bay Water contributed to a Water Research Foundation (2011) study on zero-liquid discharge technology. The study concluded that an advanced electro-dialysis process to precipitate salt solids was an economical alternative to thermal dehydration systems when source water total dissolved solids are below 5,000 mg/L. The SJRWMD has also partnered with several county and local governments to investigate seawater demineralization feasibility for a coastal desalination facility that may serve Seminole, Orange, and Osceola counties (CH2M Hill 2008).

As noted above, concentrate disposal via deep injection wells into saline aquifers (e.g., the Boulder Zone) is a traditional method for coastal utilities where coastal surface water discharge is environmentally infeasible and where wet-weather disposal capacity is required. Limited hydrogeologic data at these depths indicate that disposal horizons like that found in the Boulder Zone may not exist throughout the CFWI Planning Area. Exploratory wells may need to be constructed and tested to confirm the presence or suitable disposal zones required for an economically viable deep injection well system.

SUMMARY

Each District contributes a significant amount of funding and technical expertise to water resource development to increase the amount of water available for water supply and for natural systems. Water resource development consists of district-wide activities such as the collection of hydrologic data and groundwater modeling, as well as project-oriented efforts including conservation initiatives and water treatment feasibility studies. The water resource development activities and projects support water supply development by local utilities.



Kissimmee River Restoration Area – Floodplain and River Channel

9

Funding for Water Supply and Water Resource Development Projects

Water supply and water resource development projects for the CFWI Planning Area are described in **Chapters 7 and 8**. In accordance with Section 373.709, F.S., water supply plans are to include an analysis of funding needs and sources of possible funding options for these projects. This Chapter addresses funding for water supply and water resource development projects.

Florida water law identifies two types of projects to meet water needs: water resource development projects and water supply development projects. Water resource development projects are generally the responsibility of Districts. These water resource projects support water supply development and are intended to ensure the availability of an adequate supply of water for all competing uses deemed reasonable and beneficial, including maintaining the functions of the natural systems. Water supply development projects are generally the responsibility of the local users such as water suppliers. Typical water supply development projects are related to facilities that collect, produce, treat, and distribute water for sale or end use including alternative water supply projects. Currently, the Districts fund both water resource and water supply development projects.

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 Districts have, in the past, provided funding assistance to local water suppliers developing alternative water supplies (AWS) and measurable water conservation programs through the Water Protection and Sustainability Program (WPSP). Identification of an AWS project in this CFWI RWSP makes that project eligible for future funding, although funding is not guaranteed per Subsection 373.707 (8)(h), F.S.

In addition to the WPSP, the Districts provide funding for AWS and measurable water conservation through a number of programs; these are described later in this chapter. Projects that are not listed in this CFWI RWSP but are consistent with the goals of plan and meet the program requirements are also eligible for funding consideration. An application must be submitted and processed for the determination of an award for funding.

Subsection 373.705, F.S., describes the responsibilities of the Districts, local governments, regional planning authorities, and utilities concerning funding water supply development projects:

(1)(a) The proper role of the water management districts in water supply is primarily planning and water resource development, but this does not preclude them from providing assistance with water supply development.

(1)(b) The proper role of local government, regional water supply authorities and government-owned and privately owned water utilities in water supply is primarily water supply development, but this does not preclude them from providing assistance with water resource development.

(2)(b) Water management districts take the lead in identifying and implementing water resource development projects, and they are responsible for securing necessary funding for regionally significant water resource development projects.

(2)(c) Local governments, regional water supply authorities and government-owned and privately owned utilities take the lead in securing funds for and implementing water supply development projects. Generally, direct beneficiaries of water supply development projects should pay the costs of the projects from which they benefit, and water supply development projects should continue to be paid for through local funding sources.

Section 373.707(2)(c), F.S., describes the responsibilities of the local governments and water providers in regard to providing funding for the development of alternative water supplies:

Funding for the development of alternative water supplies shall be a shared responsibility of water suppliers and users, the state of Florida and the water management districts, with water suppliers and users having the primary responsibility and the state of Florida and the water management districts being responsible for providing funding assistance.

In accordance with statute, the direct beneficiaries of water supply development projects generally should bear the costs of projects from which they benefit. Because of the upfront cost of many projects, the projects are financed through bonds. The revenue to meet the water supply development costs can come from base charges, volume charges, and impact fees, as appropriate.

Water conservation and nontraditional or alternative water supply development projects have previously been funded by the Districts. Potential sources of funding for water supply and water resource development projects are described in the next sections.

WATER UTILITY REVENUE FUNDING SOURCES

Water supply development funding has been, and will likely remain, the primary responsibility of water utilities. Increased demand generally results from new customers that help to finance source development through impact fees and utility bills. The financial structure of utility fees can be highly variable and reflect the needs of each utility. Water utilities draw from a number of revenue sources such as connection fees, tap fees, impact fees, base and minimum charges, and volume charges. Connection and tap fees generally do not contribute to water supply development or treatment capital costs. Impact fees are generally devoted to the construction of source development, treatment, and transmission facilities. Base charges generally contribute to fixed customer costs such as billing and meter replacement. However, a base charge or a minimum charge, which also covers the cost of the number of gallons of water used, may contribute to source development, treatment, and transmission construction cost debt service. Volume charges contribute to both source development/treatment/transmission debt service and operation and maintenance.

Community development districts (CDDs) and special water supply and/or sewer districts may also develop non-ad valorem assessments for system improvements to be paid at the same time as property taxes. CDDs and special district utilities generally serve a planned development in areas not served by a government-run utility. In general, all utilities have the ability to issue and secure construction bonds backed by revenues from fees, rates, and charges.

Regional water supply authorities are wholesale water providers to utilities and do not have retail customers. An authority's facilities are funded through fixed and variable charges to the utilities they supply, which are in turn paid by the retail customers of the utilities. Counties, municipalities, and special districts are encouraged by the legislature to create regional water supply authorities under Section 373.701(3), F.S. in a manner that is cost effective and reduces the environmental effects of concentrated groundwater withdrawals. Regional water supply authorities are granted multiple rights and privileges pursuant to Section 373.713, F.S. including the ability to levy taxes, issue bonds, and incur debt to develop water supplies. Authorities may also receive preferred funding assistance from the state and Districts for the capital costs of new alternative water supplies and regional infrastructure.

There are a number of methods available to mitigate the impact of higher costs to customers. Many of these are addressed in the American Water Works Association publications *Avoiding Rate Shock: Making the Case for Water Rates* (AWWA 2005a) and *Thinking Outside the Bill: A Utility Manager's Guide to Assisting Low-Income Water Customers* (AWWA 2005b).

WATER MANAGEMENT DISTRICT FUNDING OPTIONS

The Districts provide financial assistance for water conservation and alternative source development projects through cooperative funding programs. Financial assistance is provided primarily to governmental entities, but private entities are also eligible to participate in these programs. Funding options and programs for the Districts are described below.

SFWMD Funding Options

Alternative Water Supply Program

The SFWMD AWS Program provides up to 40 percent of the project's fiscal year (FY) construction cost. The maximum funding allowance is dependent upon the capacity created and type of alternative supply. Since 1997, the SFWMD, in cooperation with the state, approved \$190.9 million for construction of 482 AWS projects district-wide. These projects created 436 million gallons per day (mgd) of additional water supply capacity. Between FY 2007 and FY 2012, the SFWMD awarded \$10.4 million for 17 CFWI Planning Area AWS projects.

Water Resource Development Work Program

The SFWMD has allocated \$106 million in FY 2013 for water resource development projects (described in **Chapter 8**) district-wide and anticipates spending \$515.3 million on these projects (described in **Chapter 8**) over the next five fiscal years (FY2013–FY2017). The FY2013 funding includes \$96 million for a portion of the Central and Southern Florida project system operation and maintenance budget district-wide that contributes to protecting and enhancing the region's water supply. Other projects include groundwater monitoring, groundwater modeling, resource assessments, water conservation, and water resource protection activities.

Water Savings Incentive Program

The SFWMD Water Savings Incentive Program (WaterSIP) provides reimbursement up to 50 percent or up to \$50,000, whichever is less, to water providers and users (i.e., cities, utilities, industrial groups, schools, hospitals, and homeowners associations) for installation of water-saving technologies. These technologies include automatic line-flushing devices for hydrants, indoor plumbing retrofits, large area irrigation controls, and soil moisture and rain sensor technology for irrigation systems. Since 2003, the SFWMD approved \$4.6 million for 161 WaterSIP projects, with an estimated water savings of 7.4 mgd of water per year district-wide. Between FY 2007 and FY 2013, the SFWMD awarded \$224,300 for nine CFWI Planning Area WaterSIP projects, representing a projected savings of 0.3 mgd.

SJRWMD Funding Options

Water Resource Development Work Program

The SJRWMD developed a Water Resource Development Work Program, which describes the implementation strategy and funding plan for water resource, water supply, and AWS development components (described in **Chapters 7 and 8**). The following projects are identified for potential funding opportunities: artesian well plugging; investigation of the augmentation of public supply systems with local surface water/stormwater sources; North Florida Aquifer Replenishment Initiative; regional water supply planning; Upper St. Johns River Basin Project; water conservation programs; water resource development components of water supply development projects; water resource development MFLS prevention/recovery strategy projects; water resources information (formerly hydrologic data collection); and district-wide strategic initiatives.

In FY 2012–2013, SJRWMD budgeted \$19.8 million for water resource, water supply, and AWS development programs (described in **Chapters 7 and 8**). SJRWMD has budgeted \$8.3 million in FY 2013–2014. The projected five-year budget for all programs related to water supply, AWS, and water resource development is approximately \$123.3 million through FY 2016–2017.

Last year, SJRWMD also contributed funding for the construction of five reclaimed water projects to reduce dependency on groundwater by 4.6 mgd. SJRWMD anticipates these projects will benefit impacted minimum flow and level (MFL) water bodies by reducing groundwater withdrawals. At the end of FY 2012, over \$1.2 billion of SJRWMD, sponsor, and WPSP monies has been spent on construction of 43 AWS projects. These projects already have made available almost 83 mgd of water, and SJRWMD estimates they will produce over 193 mgd by 2030.

SWFWMD Funding Options

FARMS Program

The SWFWMD Facilitating Agricultural Resource Management Systems (FARMS) program assists agricultural operations in offsetting groundwater withdrawals for irrigation and frost/freeze protection. This program also supports water resource development projects by providing financial incentives to private agricultural operations to implement production-scale agricultural best management practices (BMPs). The FARMS program has initiated 147 projects within the SWFWMD that enhance surface water quality and reduce the amount of groundwater used for irrigation and frost/freeze protection.

Cooperative Funding Initiative

The SWFWMD's primary funding mechanism for water supply development is the Cooperative Funding Initiative (CFI), which includes the Cooperative Funding program for local projects and the Water Supply and Resource Development (WSRD) program for larger, regional projects (described in **Chapters 7 and 8**). SWFWMD jointly participates with local governments and other entities to ensure proper development, use, and protection of the regional water resources. The CFI is a matching grant program that funds projects of mutual benefit generally at 50 percent by SWFWMD and 50 percent by the public or private cooperators. Any state and federal funds received for the projects are applied directly against the project costs, with both parties benefitting equally. Since 1988, the CFI has provided approximately \$1.3 billion in incentive-based funding assistance for a variety of projects addressing water supply, natural systems, flood protection, and water quality. SWFWMD grant funding for AWS projects (averaging \$36 million annually over the past 10 fiscal years) is anticipated to continue.

Water Resource Development Work Program

The FY 2013 SWFWMD budget for Water Resource Development (WRD) Data Collection and Analysis activities and WRD projects (described in **Chapter 8**) was approximately \$37 million. This is a 40 percent increase from FY 2012, but less than prior years. Funding for data collection and analysis is expected to remain constant over the next five years, with the exception of data collection associated with MFLs establishment, which is projected to meet its goals by FY 2017. The multi-year WRD projects for the recovery of the Upper Peace River will likely be completed in FY 2013. Future WRD project funding needs are projected for Upper Myakka River restoration. The SWFWMD plans to continue implementing FARMS projects at a cost of approximately \$6 million each year, and to investigate the Lower Floridan aquifer water resources in Polk County at \$2 million a year through FY 2018.

Other Initiatives

SWFWMD initiatives are also funded in cases where a project is a priority to a region. SWFWMD may increase their percentage match and, in some cases, may provide total funding for the project. An example of one initiative is the Leak Detection Program, which conserves water by providing SWFWMD staff to inspect and detect leaks in public water system pipelines at no cost to the utility. Since the program's inception, approximately 1,100 leaks of various sizes have been located saving an estimated 5.6 mgd at an estimated cost of \$0.08 per thousand gallons conserved, which is very cost-effective. By comparison, the estimated capital cost to develop new AWS is \$2 to \$3 per thousand gallons.

STATE FUNDING OPTIONS

State of Florida Water Protection and Sustainability Program

The Water Protection and Sustainability Program (WPSP) was created by the Florida Legislature in 2005. The program funds several environmental programs including the AWS Program. In the WPSP, alternative water supplies include reclaimed water, brackish water, seawater, and surface water captured during wet season flows (described in **Chapter 7**). For 2006, the first year of funding, the Legislature allocated \$100 million for AWS development assistance for all five Districts. Funding for the program has decreased each subsequent year.

In 2009, the Legislature re-created the WPSP Trust Fund as part of Chapter 373, F.S., indicating the state's continued support for the program. However, from FY 2010 through FY 2013, the Legislature did not appropriate funding for the program. The reduced funding was related to the state's budget constraints resulting from the economic downturn and the declining real estate industry. It is anticipated that the state will resume its funding for the program when economic conditions improve. The Legislature has established a goal for the three Districts to annually contribute funding equal to 100 percent of the state funding for AWS development assistance. All three Districts have exceeded this annual amount in the past. If funding is continued by the Legislature, the state's WPSP could serve as a significant source of matching funds to assist in the development of AWS. Applicants that receive funding assistance pursuant to the WPSP shall, at a minimum, be required to pay 60 percent of the project's construction costs.

Drinking Water State Revolving Fund Program

The Drinking Water State Revolving Fund (DWSRF) Program provides low interest loans to eligible entities for planning, designing, and constructing public water facilities. Cities, counties, authorities, special districts, and other privately owned, investor-owned, or cooperatively held public water systems that are legally responsible for public water services are eligible for loans. Loan funding is based on a priority system, which takes into account public health considerations, compliance, and affordability. Affordability includes the evaluation of median household income, population affected, and consolidation of very small public water systems, which serve a population of 500 people or fewer.

Funds are made available for pre-construction loans to rate-based public water systems, construction loans of a minimum of \$75,000, and pre-construction grants and construction grants to small, financially disadvantaged communities. The loan terms include a 20-year (30-year for financially disadvantaged communities) amortization and low interest rates. Community assistance is available for small communities having populations less than 10,000. Fifteen percent of the annual funds are reserved exclusively for small communities. In addition, small communities may qualify for loans from the unreserved 85 percent of the funds.

Florida Forever Program

Florida Forever is Florida's conservation and recreation lands acquisition program. The Florida Forever Act, passed in 1999, was a \$10 billion, 10-year, statewide program. Eligible projects under the Florida Forever Program include land acquisition, land and water body restoration, ASR facilities, surface water reservoirs, and other capital improvements (described in **Chapters 5, 7, and 8**). The Florida Forever Program was extended in 2008, continuing the Florida Forever Program for 10 more years at \$300 million annually and reducing the annual allocation to Districts from \$105 million to \$90 million, subject to annual appropriation. For FY 2010, the Legislature did not appropriate funding for the Florida Forever Program, other than for the state's debt service. For FY 2011 and FY 2012, the Legislature appropriated \$15 million in each year. Future funding for the Florida Forever Program will depend on improvement in the economy and stabilization of the documentary stamp tax-funding source.

SWFWMD West-Central Florida Water Restoration Action Plan

The West-Central Florida Water Restoration Action Plan (WRAP) is an implementation plan for components of the SWUCA recovery strategy adopted by SWFWMD. The WRAP document outlines the strategy to ensure that adequate water supplies are available to meet growing demands, while at the same time protecting and restoring the water and related natural resources of the area. In 2009, the Legislature officially recognized the WRAP through Senate Bill 2080, creating Section 373.0363, F.S., as the SWFWMD's regional environmental restoration and water resource sustainability program for the SWUCA. In FY 2009, the SWFWMD received \$15 million in funding for the WRAP from the state. Due to economic conditions, no new funding was provided for FY 2010 through FY 2013. It is anticipated that the state will again provide funding for the WRAP as the economy stabilizes.

FEDERAL FUNDING

Environmental Quality Incentive Program

The Environmental Quality Incentive Program (EQIP) provides technical and financial assistance through the Natural Resources Conservation Service (NRCS) to eligible farmers and ranchers for the installation or implementation of structural and management practices (described in **Chapters 5 and 8**) to improve environmental quality on agricultural lands. Workgroups, convened by the local Soil and Water Conservation Districts, identify the specific resource concerns to be addressed, set priority area goals, select cost-share practices, establish ranking criteria for evaluating applications, and set their own schedule for approving applications. The program provides assistance to farmers and ranchers to comply with federal, state of Florida, and tribal environmental laws. The program is implemented primarily in priority areas such as watersheds, regions, and/or multistate

areas where significant resource concerns exist. Water supply and nutrient management through detention/retention or tailwater recovery ponds can also be implemented through this program.

Agriculture Water Enhancement Program

In addition to EQIP, partnerships with cost-share funding are available with NRCS to implement projects through the Agriculture Water Enhancement Program (AWEP) (described in **Chapters 5 and 8**). The AWEP was created with similar goals as EQIP, including conserving and/or improving the quality of groundwater and surface water. By entering into a partnership agreement, the Districts and NRCS can leverage existing cost-share funds toward mutual water conservation goals and provide project funding.

State and Tribal Assistance Grants

Forging strong partnerships is an important aspect of the EPA enforcement and compliance assurance program. States and tribes play a crucial role in the implementation of the nation's environmental laws and regulations. Strengthening these relationships through improved coordination, joint work planning, and specialized assistance promote greater compliance. One key partnership with states involves work planning and support through cooperative agreements, referred to as State and Tribal Assistance Grants (STAG). Each year for the past several years, the SJRWMD has requested federal funds through the STAG program to support water supply development projects (described in **Chapter 7**). From 2000 to 2005, SJRWMD received \$9.7 million in STAG appropriations. These funds are available through the EPA; local government cooperators who wish to participate must provide approximately 45 percent in matching funds. The SJRWMD assists in this program by identifying appropriate local government cooperators and assisting them with the EPA application process. To date, the SJRWMD has contributed a modest level of in-kind services to support the acquisition and use of these revenues, but has not contributed any cash to the required match. For the St. Johns River/Taylor Creek Reservoir Water Supply Project, the SJRWMD proposes to contribute \$300,000 to \$500,000 in in-kind services, in the form of project administration, to the required STAG cooperator match. This contribution represents about 10 percent of the cost of plan development for this project. This same approach could be used on other future water supply development projects if the need arises.

PUBLIC-PRIVATE PARTNERSHIPS, COOPERATIVES, AND OTHER PRIVATE INVESTMENT

As lower-cost, traditional water sources become more scarce, more expensive AWS sources must be developed. Public-private partnerships offer the economies of a scale enjoyed by regional or national construction/operation firms and may reduce costs and are becoming more common.

Public-private partnership projects can require technical expertise and financial risk beyond the expertise and risk tolerance of many utilities and water supply authorities. A range of public/private partnerships and risk options is available to provide this expertise. These options range from all-public ownership to all-private ownership of facility design, construction, and operation. Additionally, some of the risk may be shifted to the private firms providing goods and services. Aside from financial risk reduction, competition among private firms desiring to fund, build, or operate water supply development projects could reduce project costs, potentially resulting in lower customer charges.

An issue for small utilities is that they may not have the resources or project sizes sufficient to attract private interest. One solution could be participation in multi-utility agreements, cooperatives, or in a regional water supply authority. Cooperatives allow multiple self-supplied water users to pool their resources to construct water facilities that they could not undertake on their own. Members cooperatively fund the construction of transmission and distribution facilities from the purchase point and pay for the purchased water. Cooperatives also benefit individual members by spreading the risks among users.

Private investors may also identify an unserved group of potential customers and develop water resource and/or water supply facilities to meet these needs. This approach may be an effective means to develop alternative water supplies. The cost of the alternative sources developed and the amount of public funding and participation will vary for each project.

SUMMARY OF FUNDING MECHANISMS

There are many potential institutions and sources of funding for water resource and water supply development, although some past sources are currently limited by economic conditions. Public supply utilities and water supply authorities will likely have the least difficulty in securing funding due to their large and readily identifiable customer bases and associated revenue streams to service any debt. Funding mechanisms are already established for many District water supply and resource development projects. The most difficult challenge will be identifying cost-effective and economically efficient methods of meeting the needs of new self-supplied users (whose ability to pay ranges widely) when the traditional, lower cost sources of water are no longer readily available.

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Conclusion

Water supply plans are developed by the Districts to ensure that an adequate supply of water exists to meet existing and future reasonable-beneficial uses while protecting water resources and natural systems. The CFWI RWSP was prepared by the Districts in coordination with stakeholders and is consistent with the water supply planning requirements of Chapter 373, Florida Statutes. The CFWI RWSP concludes that the current and future water demands of the CFWI Planning Area can be met through the 2035 planning horizon, while sustaining the water resources and related natural systems, through conservation, implementation of management measures, and implementation of water resource development and water supply projects identified in this CFWI RWSP. Challenges in water resource development and natural resource protection require concerted efforts to monitor, implement, and characterize current hydrologic conditions and project future conditions. Successful implementation of this CFWI RWSP requires close coordination with regional and local governments, utilities, agriculture, commercial, industrial, and other water users. Collaboration among stakeholders is also essential for directing implementation of CFWI RWSP recommendations and guidance. Public and private partnerships can ensure that water resources in the CFWI Planning Area are prudently managed and available to meet future demands.

Total water demands by all water use categories are projected to increase from an estimated current use of 800 million gallons per day (mgd) to almost 1,100 mgd in 2035.

AS DESCRIBED IN THIS CFWI RWSP, TRADITIONAL GROUNDWATER RESOURCES ALONE CANNOT MEET PROJECTED FUTURE WATER DEMANDS OR CURRENT PERMITTED ALLOCATIONS WITHOUT RESULTING IN UNACCEPTABLE IMPACTS TO WATER RESOURCES AND RELATED NATURAL SYSTEMS.

In some areas, utilization of traditional groundwater has already reached, exceeded, or is near the sustainable limits. Based on the evaluation of groundwater availability, it was estimated that the CFWI Planning Area could potentially sustain an additional estimated 50 mgd of groundwater. This estimate is predicated on the implementation of certain local management measures to address existing impacts related to the current withdrawals (800 mgd). Based on the projected 2035 demands, the resulting deficit is 250 mgd.

Primary solutions identified for meeting the future water demands while protecting the environment are: demand-side initiatives (water conservation), supply-side initiatives

(alternative water supply [AWS]), and water resource development projects. Limited localized opportunities exist for additional traditional groundwater withdrawals to meet future demands through 2035. The few opportunities for increased traditional groundwater withdrawals generally include local areas where groundwater withdrawals have not been fully optimized. Options for obtaining new water supplies to meet existing and future demands from both conventional and alternative sources must comply with applicable consumptive use permit rules and conditions. In addition, there may be limited opportunities to utilize traditional groundwater seasonally in conjunction with alternative supplies such as above ground and below ground storage (aquifer storage and recovery [ASR]).

Water Conservation and Alternative Sources

Water conservation is an important element in meeting future water needs. For all water use categories in the CFWI Planning Area, it is estimated that an additional 42 mgd could be saved with increased conservation, reducing the projected 250 mgd deficit to 208 mgd. Of this 42 mgd, 64 percent could be conserved by public supply utilities and 26 percent by agricultural operations. The remainder would be conserved by other water use categories.

The CFWI RWSP identified 142 potential water supply project options that could potentially provide up to 455 mgd of additional water supply, including maximized use of reclaimed water, increased water storage capacity, limited use of fresh and brackish groundwater, use of surface water, and use of desalinated seawater. These quantities are planning level estimates as permitting studies and project reviews are ongoing for some specific AWS projects. The total potential water supplied by the water supply project options exceeds the groundwater deficits; in addition increased water conservation and reclaimed water utilization for beneficial purposes could help to offset the groundwater deficit. Specific source options, including conservation potential, will have to be tailored to each user due to the high variability of projects.

Minimum Flows and Levels (MFLs) and Wetlands

MFLs have been established for 46 water bodies in the CFWI Planning Area. All 46 water bodies are located in the SJRWMD and SWFWMD. Currently, the assessment of MFLs as part of this CFWI RWSP identified 10 water bodies that are currently below their established MFLs and an additional 15 water bodies that are projected to fall below their established MFLs within the planning horizon. In addition, the Southern Water Use Caution Area (SWUCA) Saltwater Intrusion Minimum Aquifer Level and water levels in regulatory wells in the Lake Wales Ridge area associated with the SWUCA Recovery Strategy are also not currently being met and are projected to not be met under future demand scenarios. Current SWFWMD recovery and prevention strategies are included in this CFWI RWSP, ensuring recovery to the established MFLs as soon as practicable or preventing the existing flows or levels from falling below the established MFLs. In addition, SJRWMD development of MFL prevention and recovery strategies are planned for MFL lakes and MFL springs where they have not already been developed. These strategies must include provisions to

provide sufficient water supplies for all existing and projected reasonable-beneficial uses and may include the development of additional water supply and water resource projects.

Results from recent field assessments of non-MFL wetlands and water bodies, and analysis of future modeled water levels indicated that adverse impacts from withdrawals are currently occurring in several areas and this is projected to increase in future scenarios. The existence of adverse wetland impacts has been documented through field work. Some wetland impacts are most probably the result of multiple factors, including groundwater withdrawals. In some cases, where the cause has been determined, mitigation measures have been implemented.

Uncertainty

Uncertainty is inherent in the resource analyses associated with the CFWI RWSP. The Districts have considered major sources of uncertainty including water demand estimates and projections, groundwater models, climate variability, and water resource constraints. At a regional level, the best strategy for dealing with this uncertainty is the implementation of water demand management strategies and a diversity of AWS development project options. Uncertainty also exists regarding the degree to which the proposed solutions contained in this plan may be implemented. The variety of options used in the plan to address impacts and unmet demands does not include agreements or commitments between users and the agencies. Current permits and laws limit the scope of regulatory actions that can be taken to impose specific solutions on users. Budgetary constraints and uncertainties of both users and agencies are challenges to assuring specific solutions will be economically feasible and affordable. Finally, there is uncertainty associated with the actual performance of many of the options in meeting plan objectives. Examples include some aspects of water conservation where voluntary behavioral changes of large populations of end users are involved and the supplementation of reclaimed water with conventional water supply sources.

Stakeholder Review

The CFWI RWSP (Volumes I and IA) has gone through an extensive public review process, beginning on November 26, 2013 and ending on February 20, 2014. All comments were reviewed and considered, and where appropriate, changes were made to the CFWI RWSP. A CFWI Comments / Responses Document has been developed and can be found at cfwiwater.com.

Solutions Planning Phase

The CFWI Solutions Planning Team (SPT) consists of representatives from the Districts, FDEP, and FDACS, as well as public supply utilities, the agricultural industry, environmental groups, business representatives, and regional leaders. The SPT used this CFWI RWSP to further develop WSPOs to meet water demands by optimizing the use of existing

groundwater and by identifying viable conservation and other management strategies, viable alternative and nontraditional water supplies, areas that may require recovery or resource protection and areas where regulatory and water resource protection strategy consistency may be needed.

The final work product of the SPT is the Solutions Strategies document (Volumes II and IIA), which is part of the CFWI RWSP. The Solutions Strategies provides relevant project information to further develop specific water supply projects through partnerships with water users. The document includes project cost estimates, potential sources of water, feasibility and permissibility analysis, identification of governance structure options.

Conclusions from the Solutions Planning Phase along with recommendations in **Chapter 11** will guide future water supply solutions in the CFWI Planning Area to ensure that future water demands can be met without resulting in unacceptable impacts to water resources and related natural systems.

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Recommendations / Future Direction

This CFWI RWSP concludes that the current and future water demands of the CFWI Planning Area can be met through the 2035 planning horizon, while sustaining the water resources and related natural systems, through conservation, implementation of management strategies and measures, and implementation of water supply projects identified in this CFWI RWSP. However, for water resource sustainability to be realized, many actions by the Districts and stakeholders will have to occur. Recommended actions for implementation and future direction for this CFWI RWSP are included in the following categories:

- ◆ Water Conservation
- ◆ Groundwater
- ◆ Reclaimed Water
- ◆ Surface Water
- ◆ Seawater
- ◆ New Storage Capacity
- ◆ Minimum Flows and Levels and Water Reservations
- ◆ Water Supply Development Projects
- ◆ Water Resource Development Projects
- ◆ Consumptive Use Permitting (CUP) Process
- ◆ Intergovernmental, Water Supplier, and Public Coordination
- ◆ Demand Estimates and Projections
- ◆ Climate Change

WATER CONSERVATION

The Districts' water conservation programs are described in **Chapter 5**. The reduction in per capita water consumption rate throughout the CFWI Planning Area demonstrates that the implementation of a variety of water conservation programs offers the potential to reduce future water demand. All water suppliers and users are encouraged to continue implementation of water conservation measures to reduce water supply demands and defer the construction of capital-intensive projects.

Recommended actions for water conservation include the following

- ◆ Implement water use efficiency goals in water supply planning and water use regulation programs for all water users.
- ◆ Determine the water conservation potential of public supply utilities and assist utilities with analytical work contributing to the development of goal-based water conservation plans.
- ◆ Support the use of analytical conservation planning tools, such as Conserve Florida, for the development of effective standard or goal-based public supply water conservation plans.
- ◆ Determine the water conservation potential of the domestic self-supply water use category and assist local governments to target conservation initiatives for that use class.
- ◆ Determine the water conservation potential of the agricultural water use category and assist agricultural CUP holders to target conservation initiatives for that use class.
- ◆ Enforce landscape irrigation restrictions.
- ◆ Promote Florida Water StarSM water efficient construction standards.
- ◆ Promote water conservation cost-share projects for all water users groups.
- ◆ Provide water conservation technical assistance to local governments.
- ◆ Promote Florida-Friendly LandscapingTM principles.
- ◆ Assist public supply utilities in identifying and targeting of customers with excessive water use through cooperative projects and utility outreach.
- ◆ Promote the implementation of meaningful utility conservation rate structures.



Water Conservation – Low Flow Showerhead

- ◆ Assist local governments with developing ordinances or conditions of service furthering water conservation.
- ◆ Identify nonpublic supply consumptive use permittees with excessive water use and encourage efficient use.
- ◆ Promote agricultural mobile irrigation laboratories and other water conservation efforts.
- ◆ Revise and enhance water conservation requirements in District permitting rules.
- ◆ Assist utilities with conservation efforts including tiered conservation rates.

GROUNDWATER

Models predict that increased withdrawal of traditional groundwater sources to meet future demands in the CFWI Planning Area will be insufficient to meet the entire 2035 water demands and current consumptive use permit allocations based upon the current and proposed withdrawal locations. Groundwater availability is highly dependent on location, aquifer zones and associated permeability, source limitations, and proximity and hydraulic connection to natural systems including MFL water bodies and wetlands. Alternative withdrawal locations and depths and mitigation options such as the use of reclaimed water, may increase groundwater availability. Measures and costs to develop additional groundwater resources will be considered by the CFWI Solutions Planning Team.

Recommended actions for groundwater development include the following

- ◆ Collaborate with local water users and utilities developing Floridan aquifer system (FAS) well drilling programs with the appropriate District. Water quality, water level, and hydrogeologic data from these wells can increase the understanding of the FAS and be utilized in improving models and our predictive capabilities.
- ◆ Expand reclaimed water systems and other alternative water supplies to minimize the use of Floridan aquifer groundwater.
- ◆ Continue coordination of monitoring between Districts, the USGS, utilities, and other governmental agencies is essential to ensure resource protection and use of the FAS.
- ◆ Continue data collection, investigations, and evaluation to better understand the relationship between the Lower Floridan and Upper Floridan aquifers as well as the overlying Surficial aquifer system.
- ◆ Evaluate local and regional wellfield management options that minimize or reduce existing and projected impacts on the water resources, wetlands, water quality, and MFLs. Where existing environmental impacts are deemed unavoidable, explore the use of other mitigation options to offset impacts.

- ◆ Investigate options for brackish groundwater development in prescribed locations as a means to avoid or minimize future environmental impacts.
- ◆ Conduct optimization of groundwater withdrawals using the East Central Florida Transient (ECFT) groundwater flow model.

RECLAIMED WATER

In the CFWI Planning Area, over 90 percent of the wastewater generated is currently reused for irrigation and aquifer recharge efforts. Reclaimed water is used for landscape irrigation, industrial uses, groundwater recharge, and environmental enhancement. Future reclaimed water and reuse is anticipated to continue to play a critical role in meeting future water needs.

Recommended actions for reclaimed water include the following

- ◆ Local governments, as appropriate and applicable, should consider requiring construction of reclaimed water infrastructure in new developments and establishing mandatory reuse requirements. Districts will provide technical assistance to local governments in establishing mandatory reuse zones.
- ◆ Support the development of additional reclaimed water distribution and transmission lines for green space irrigation, such as residential lots, medians, common areas, and golf courses.
- ◆ Review the location of future reuse applications to maximize aquifer recharge benefits from irrigation and rapid infiltration basins.
- ◆ To promote efficient use of reclaimed water, utilities should consider, where appropriate, strategies to extend the reclaimed water supply, such as metering for residential customers, tiered rate structures, limiting days of the week for landscape irrigation, pressure regulation, and facilitating interconnects with other reclaimed water utilities.
- ◆ Providers may consider the use of supplemental water supplies to meet peak reclaimed system demands. Supplemental water may enable a utility to extend its supply of its reclaimed water over a larger area. However, during times of drought, availability of supplemental water sources, such as surface water, groundwater, or stormwater, may be limited in some areas. Permit criteria that identify under what conditions supplemental water is reasonable and beneficial should be developed.
- ◆ The FDEP completed rulemaking on Chapter 62-40, F.A.C., to incorporate amendments to Section 373.250, F.S., which recognized the use of “substitution credits” and “impact offsets” to promote increased availability and distribution of reclaimed water. As required, Districts should amend criteria to reflect statutory and FDEP amendments.

SURFACE WATER

There are opportunities for the development of surface water supplies from the lakes and rivers in or near the CFWI Planning Area. Smaller, local lakes are generally considered a limited resource and often provide the local landowners with water for irrigation purposes. The capture and storage of water from river/creek systems during times of high flow can supply significant quantities of water and could be a conjunctive use component of many multi-source water supply development projects. Larger lakes may represent an opportunity for development of supplies as these have larger drainage basins to buffer the effects of withdrawals. Lakes, rivers, and creeks in the CFWI Planning Area support significant ecological resources that must be protected from harmful impacts of any proposed withdrawals or capture of flows from these systems. Capturing peak flows from these surface water bodies for water supply, particularly to support conjunctive use projects, may be effective but can be expected to have varying levels of certainty, depending on climatic conditions. Further analysis should be conducted to ensure that hydrologic functions of lakes, and downstream environmental needs, are maintained when attempting to identify potentially available quantities of surface water.

Recommended actions for surface water include the following

- ◆ Conduct analyses to ensure that hydrologic functions of lakes and downstream environmental needs are maintained when attempting to identify potentially available quantities of surface water.
- ◆ Create additional storage capacity for excess surface water for water supply purposes, when feasible.
- ◆ Consideration must be given to the availability of the lowest quality source of water to meet any particular demand. Blending multiple alternative water sources to achieve acceptable water quality is a prudent approach to water supply.
- ◆ Initiate/continue/complete work associated with MFLs and water reservations pursuant to each District's annual priority list.

SEAWATER

The Atlantic Ocean and Gulf of Mexico are essentially unlimited sources of seawater. Desalination is required before seawater can be used for water supply purposes. Use of desalinated seawater would require a transmission pipeline from the coast to the CFWI Planning Area. Where appropriate, utilities should consider the feasibility of desalinated seawater as an additional water source option for the CFWI Planning Area.

NEW STORAGE CAPACITY

In the CFWI Planning Area, potential types of water storage include reservoirs, Aquifer Storage and Recovery (ASR) wells, and smaller onsite surface water impoundments. Proposed projects that develop new storage and create additional water supply consistent with Florida statutes may be considered alternative water sources.

Recommended actions for new storage capacity include the following

- ◆ Construction of new or retrofitted surface water reservoirs for agricultural operations, utilities, and other irrigators that could provide additional supply.
- ◆ The use of ASR, reservoirs, and other storage options to capture wet weather flows when available for use at a later time should continue to be evaluated. Storage extends water supplies for use during peak demand periods.
- ◆ Districts, FDEP, and utilities should continue studies and regulatory strategies to address implementation of ASR and related issues, such as subsurface arsenic mobilization, while protecting public health.
- ◆ Evaluate the potential and locations for reservoirs to store excess water in the wet season for future use to recharge aquifers, provide additional water to wetlands and MFL lakes, and provide water supply.

MINIMUM FLOWS AND LEVELS

The Districts' MFLs programs are described in **Chapter 3**. The Districts and FDEP publish an annual, approved priority list and schedule for establishment of MFLs and water reservations.

Recommended actions for the MFLs program include the following

- ◆ Consider water supply sources identified in the CFWI RWSP as part of the prevention and recovery strategies.
- ◆ Continue establishing MFLs and water reservations in accordance with the approved priority lists and schedules.
- ◆ Perform ongoing monitoring compliance evaluations of MFLs.
- ◆ Adopted MFLs should be reevaluated periodically and revised as necessary.
- ◆ Continue to develop and refine groundwater and surface water models to better predict established MFLs exceedances.
- ◆ Expediently develop and implement the recovery and prevention strategies identified in Chapter 3 and others as additional MFLs are developed, and continue to implement the strategies identified in the Southern Water Use Caution Area (SWUCA) Recovery Strategy.

- ◆ Determine the effect of water users on MFL water bodies that are in MFL prevention and recovery.

NON-MFL WATER BODIES

Non-MFL water bodies include lakes, wetlands, and springs without established MFLs. The Districts non-MFL programs regarding these water bodies are described in **Chapter 3**. Recommended actions for the non-MFLs program include the following

- ◆ Continue to monitor, study, and evaluate non-MFL water bodies, including wetlands, lakes, and springs within the CFWI Planning Area and include wetlands studied during this CFWI RWSP and those that may be affected by consumptive use withdrawals.
- ◆ Complete an extended evaluation of wetland systems that were identified as having existing stress and those deemed to be at risk from future withdrawals.



Rock Springs in Orange County

WATER SUPPLY DEVELOPMENT PROJECTS

Water supply development is defined in Section 373.019 (26), F.S. as 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.

The CFWI RWSP identifies 142 water supply project options, consisting of 37 brackish groundwater, 15 surface water, 87 reclaimed water, and 3 management strategy projects as outlined in **Chapter 7**.

- ◆ Continue to assist in identifying water supply project options through direct communications with water supply users and other means as appropriate.
- ◆ Incorporate the planning-level models used in development of this CFWI RWSP to evaluate water supply project options' ability to address existing or projected impacts as part of an overall solution strategy and prioritize project options.
- ◆ Encourage and look for opportunities for multi-jurisdictional partnerships to implement projects that have regional benefits that reduce existing impacts or develop new supplies that do not impact environmental systems beyond permittable considerations.
- ◆ Work with water users to identify the specific projects they will pursue to meet their projected needs, resolve existing harm, or prevent future harm to water resources.
- ◆ Encourage funding for construction of alternative water supplies. Funding for several programs described in Chapter 9 are dependent on annual allocations in State and District budgets. Since 2009, the Water Protection and Sustainability Program has not received funding from the Florida legislature. Promote allocation of these funds to cost-share alternative water supply project options that have the greatest certainty in supplying the projected demands through the 2035 planning horizon, such that the following occurs

Recommended actions for water supply development include the following

- ◆ Existing or projected water resource problems are solved or avoided.
- ◆ Priority funding is provided to support projects that will provide significant quantities of new sources of water to users within areas of existing or projected water resource problems.
- ◆ Assist in implementing water supply project options through technical assistance and other cooperative funding approaches via the CFWI Solutions Planning Team.

WATER RESOURCE DEVELOPMENT PROJECTS

Water resource development is defined in Section 373.019 (24) F.S. as the formulation and implementation of regional water resource management strategies and includes 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. Proposed and recommended water resource development projects are described in **Chapter 8**.

CONSUMPTIVE USE PERMITTING

Both the water supply planning and CUP programs are tools that the Florida Legislature has provided to the Districts to ensure that sufficient water will be available for existing legal uses and reasonably anticipated future needs and to sustain the water resources and related natural systems. A successful planning process provides a roadmap for the development and operation of regional water resource development projects, beneficial water supply development projects, and the foundation for specific regulations needed to ensure reasonable beneficial needs for water supplies are met while protecting and sustaining water resources of the State.

The water resource constraints used in the planning process are not direct substitutes for the Districts' CUP criteria and some of those criteria (e.g., water conservation) are not included in the planning-level assessment performed under this effort. Therefore, the planning-level estimates for groundwater availability are only estimates and are subject to change as part of the post-planning efforts for the CFWI Planning Area. Additionally, the water supply options included in the CFWI RWSP have undergone a planning-level analysis, which is a useful tool for future CUP applicants. The information gained through this CFWI Planning Process represents the best available information for this planning region and the most comprehensive technical evaluations completed for this region to date. This technical information should be beneficial for future water users seeking to pursue options that have been identified as sustainable water sources.

Recommended actions to help ensure that the processes for water supply planning and CUPs are complementary include the following

- ◆ Make all data, scientific analyses, modeling, and other information developed in the CFWI RWSP process available in readily usable formats for use by permit applicants as part of establishing that their water use meets the applicable CUP criteria.

- ◆ Make available the planning-level modeling tools and datasets used in this CFWI RWSP to water users to support detailed analysis for a CUP application. Assist CUP applicants, where appropriate, in transitioning the planning-level modeling tools and datasets used in this CFWI RWSP to support detailed analysis as part of their CUP application.
- ◆ Identify specific regulations, if any, that are needed to ensure the reasonable-beneficial needs for water supplies are met while protecting and sustaining water resources of the state in the CFWI Planning Area as part of the overall implementation strategy.
- ◆ Encourage a transparent process of regulatory review and modifications such that the use of modeling tools and information compiled for this planning effort are consistent among the Districts within the CFWI Planning Area.
- ◆ Ensure coordinated review of CUP applications that are in proximity to District boundaries.
- ◆ Continue efforts to define the causes of existing impacts within the CFWI Planning Area and seek resolution of these impacts through both a local and regional approaches.
- ◆ Support continuing efforts to refine and update the ECFT groundwater model so that it may be used as a permitting tool in the future.

INTERGOVERNMENTAL, WATER SUPPLIER, AND PUBLIC COORDINATION

This CFWI RWSP was developed by the Districts, in consultation with FDEP, utilities, FDACS, industry, and other stakeholders through a public process, which enhanced the involvement of local governments, government-owned and privately owned utilities, self-suppliers, and other interested and potential parties who may be affected. The Districts recognize the need for continued coordination in association with its CFWI RWSP development and implementation efforts.

Recommended actions for continued coordination between the Districts, FDEP, utilities, FDACS, industry, and other stakeholders include the following

- ◆ Continue active participation in the State's Water Planning Coordination Group (WPCG).
- ◆ Continue coordination of CFWI RWSP water supply planning activities.
- ◆ Closely coordinate CFWI RWSP Solutions Planning Team activities and findings with MFL prevention and recovery strategy development.
- ◆ Continue current and develop new coordination strategies as necessary.
- ◆ Continue water user entity notification and response process.

- ◆ Continue active participation in statewide and regional reclaimed water and conservation coordination groups.
- ◆ Encourage water supply entities to participate in a regional decision-making process in those areas important to the successful future development of regional public water supplies.
- ◆ Encourage funding allocation for construction of alternative water supplies for programs described in Chapter 9.

Recommended actions for coordination with local government include the following

- ◆ Continued coordination through decision-making processes.
- ◆ One-on-one meetings with elected officials.
- ◆ Presentations to city/county commissions.
- ◆ Review of comprehensive plan amendments.
- ◆ Assistance to local governments and utilities with development of Water Supply Facilities Work Plans, that are due within 18 months of the approval of this CFWI RWSP. Local governments and utilities must provide linkage to and coordination with this plan update and the local government water supply-related components of comprehensive plans.
- ◆ Continued coordination in local and regional water supply planning efforts.

Recommended actions for coordination with the federal and state government include

- ◆ Continue to actively seek federal and state funding for identified water supply and water resource and water supply development projects.
- ◆ Continue to coordinate with the U.S. Department of the Interior, U.S. Environmental Protection Agency, FDACS, and FDEP to improve the ability to implement identified water supply project options while ensuring necessary water resource protection.

Recommended actions for coordination with other parties who are affected and the public include the following

- ◆ Continue to maintain the Districts' and CFWI websites, updating as necessary with pertinent water supply planning information.
- ◆ Continue the public workshop process for development of future updates of the CFWI RWSP.
- ◆ Continue the public stakeholder meetings for the development of MFL prevention and recovery strategies.

DEMAND ESTIMATES AND PROJECTIONS

For future updates to the CFWI RWSP, it is recommended that a consistent methodology for all six water use categories be developed and used in consultation with FDEP, utilities, FDACS, and industry stakeholders to determine demand projections. Items to consider include

- ◆ Public supply – Methodology should consider options to incorporate functional population cohorts and changing utility demographics.
- ◆ Domestic self-supply (DSS) – Methodology should consider projection consistency for small utilities (<0.1 mgd). While FDEP guidance includes small utilities as part of the DSS water use category, two Districts calculate projections for and disaggregate small utilities from DSS.
- ◆ Agricultural – Methodology should consider pending CUP information, consistent crop types, and improved monitoring, and miscellaneous uses. During the CFWI RWSP development, the Population and Water Demand Subgroup and FDACS coordinated to create a standard list of crop types divided into crop categories. Although this standard list was not used in the CFWI RWSP, it is anticipated that the list can be used by the CFWI Solutions Planning Team and in future CFWI RWSP efforts. The standard list created can be found in Volume IA, Appendix A, Table A-20.
- ◆ Assist FDACS in implementing the 2013 statutory changes and the addition of paragraph 373.709(2)(a)1.b. that states agricultural demand projections used for determining the needs of agricultural self-suppliers must be based upon the best available data. In determining the best available data for agricultural self-supplied water needs, the Districts shall consider the data indicative of future water supply demands provided by the FDACS pursuant to Section 570.085, F.S.
- ◆ Landscape, recreational, and aesthetic – Methodology should consider projection consistency for miscellaneous use (additional irrigation demand), which is currently done by one District.
- ◆ Re-evaluate the relationship between reclaimed water use and the projection methods of new water demands for golf course and large landscape projects.

CLIMATE CHANGE

Climate change has the potential to significantly impact the sustainability of water supplies throughout the state. Long-term data show increasing worldwide temperatures and a corresponding sea level rise and change in rainfall patterns, among other changes in climate patterns. Regional impact varies and the degree and rate of change remains uncertain. In addition, comprehensive monitoring is needed to accurately characterize and measure aquifer conditions including saltwater movement and declining water levels in aquifers.

The following direction and guidance is provided for climate change:

- ◆ Maintain awareness by soliciting regular updates from the scientific community regarding climate change projections, estimated changes in precipitation regimes, and other effects and research to strengthen water resource and utility planning in central Florida.
- ◆ To stay current and to further strengthen partnerships, local governments and utilities should continue to share information about projected effects of climate change and adaptive measures and, when warranted, use information gathered through cooperative forecasting to refine water demand projections during the 5-year planning updates.



Residential Development near Lake Tohopekaliga

Glossary

1-in-10 Demand Demand that occurs during a 1-in-10 year drought.

5-in-10 Demand Demand that occurs during an average or normal rainfall year.

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

Acre-foot, acre-feet (ac-ft) The volume of water that covers 1 acre 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 (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 estimating irrigation demands that estimates demand based on basin-specific data. The AFSIRS model calculates both net and gross irrigation requirements for average and 1-in-10 year drought irrigation requirements. A crop's net irrigation requirement is the amount of water delivered to the root zone of the crop, while the gross irrigation requirement includes both the net irrigation requirement and the losses incurred in the process of delivering irrigation to the crop's root zone.

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

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 stormwater, surface water, groundwater or reclaimed water, which is appropriately treated to potable standards and injected into an aquifer through wells during wet periods. The aquifer acts as an underground reservoir for the injected water, reducing water loss to evaporation. The water is stored with the intent to retrieve it later as needed.

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.

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

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

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

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

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

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

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

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

Brackish water Brackish water, for alternative water supply planning purposes in the CFWI for SJRWMD and SWFWMD, is generally defined as water with a total dissolved solids (TDS) concentration of greater than 500 mg/L. SWFWMD defines saline water, which includes brackish water, as water with chloride concentrations greater than 250 mg/L.

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

Central Florida Coordination Area (CFCA) A two-phase plan implemented by SJRWMD, SWFWMD, and SWFWMD to address the short-term and long-term development of water supplies in the central Florida area (Orange, Osceola, Polk, Seminole, and southern Lake counties).

Central Florida Water Initiative (CFWI) This is a collaborative effort among the SJRWMD, SWFWMD, and SWFWMD and other state agencies and stakeholders that builds on the prior work of the CFCA. The goal is to implement effective and consistent water resource planning, development, and management in the central Florida area.

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 (1) Water-bearing stratum of permeable rock, sand, or gravel overlaid by a thick, impermeable stratum. An aquifer that contains groundwater that is confined under pressure and bounded between significantly 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. (2) Also known as artesian or pressure aquifer, the confined aquifer exists where the groundwater system is between layers of clay, dense rock, or other materials with very low permeability. Water is under more pressure in a confined aquifer than in an unconfined aquifer. Thus, when tapped by a well, water is forced up, sometimes above the soil surface. This is how a flowing artesian well is formed.

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.

Connate water Residual seawater in the upper Floridan aquifer.

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.

(Water) Demand The quantity of water needed to fulfill a requirement.

Demand management Also known as water conservation, demand management involves reducing the demand for water through activities that alter water use practices, improve efficiency in water use, reduce losses of water, reduce waste of water, alter land management practices, and/or alter land uses.

Desalination A process that treats saltwater water to remove or reduce chlorides and dissolved solids, resulting in the production of fresh water.

Discharge The rate of water movement past a reference point, measured as volume per unit of time (usually expressed as cubic feet per second or 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, but are not limited to, chlorination, ultraviolet radiation, and ozonation.

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

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

Drainage basin Land area where precipitation runs off into streams, rivers, lakes, and reservoirs. It is a land feature that can be identified by tracing a line along the highest elevations between two areas on a map, often a ridge. The drainage basin is a part of the earth's surface that is occupied by a drainage system, which consists of a surface stream with all its tributaries and impounded bodies of water. It is also known as a watershed, a catchment area, or a drainage area.

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

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

East Central Florida Transient Groundwater Model (ECFT) a groundwater model for the CFWI Planning Area that simulates transient groundwater flow in the surficial aquifer system and the Floridan aquifer system.

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.

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

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

Electrodialysis Dialysis that is conducted with the aid of an electromotive force applied to electrodes adjacent to both sides of the membrane.

Elevation The height in feet above mean sea level according to the National Geodetic Vertical Datum of 1929. May also be expressed in feet above mean sea level as reference datum.

End-of-Permit The date at which a consumptive water use permit expires.

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

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

Existing legal use of water A water use authorized under a consumptive water use permit or existing and exempt from permit requirements.

Finished water Water that completed a purification or treatment process; water that passed through all the processes in a water treatment plant and is ready to be delivered to consumers.

Fiscal Year (FY) The fiscal year for state agencies 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-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) An aquifer system composed of sequential layers of limestone and dolomite and is traditionally subdivided into the Upper and Lower Floridan aquifers which are separated by less productive horizons called the middle confining unit.

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.

Freeboard For lake or wetland MFLs it is expressed as the potential or allowable drawdown in the UFA, in feet. For spring MFLs constraints it is expressed as a flow rate or a percentage of the flow rate (in cubic feet per second or cfs).

Fresh water For water supply planning purposes, an aqueous solution with a total dissolved solids concentration less than or equal to 500 mg/L.

Gross irrigation demand or gross irrigation requirement (AFSIRS model) The amount of water that must be withdrawn from the source in order to be delivered to the plant's root zone. Gross irrigation demand includes both the net irrigation requirement and the losses incurred irrigating the plant's root zone.

Gross water demand (or raw water demand) is the amount of water withdrawn from the water resource to meet a particular need of a water user or customer. Gross demand is the amount of water allocated in a consumptive water use permit.

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.

Headwaters The waters at the highest upstream point of a natural system that are considered the major source waters of the system.

Hydrogeology The geology of groundwater, with particular emphasis on the chemistry and movement of water.

Hydrologic condition The state of an area pertaining to the amount and form of water present.

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 moved into a specific location.

Injection well A well constructed to inject water directly into the ground. Injection wells are generally drilled below freshwater levels, or into unused aquifers or aquifers that do not deliver drinking water.

Intermediate aquifer system This aquifer system consists of five zones of alternating confining and producing units. The producing zones include the Sandstone and Mid-Hawthorn aquifers.

Irrigation efficiency (1) A measure of the effectiveness of an irrigation system in delivering water to a plant for irrigation and freeze protection purposes. It is expressed as the ratio of the volume of water used for supplemental plant evapotranspiration to the volume pumped or delivered for use. (2) The average percent of total water pumped for use that is delivered to the root zone of a plant. (3) As a modeled factor, irrigation efficiency refers to the average percent of total delivered water applied to the plant's root zone.

Leak detection Systematic method to survey the distribution system and pinpoint the exact locations of hidden underground leaks.

Level of certainty A water supply planning goal to assure at least a 90 percent probability during any given year that all the needs of reasonable-beneficial water uses will be met, while sustaining water resources and related natural systems during a 1-in-10 year drought event.

Marsh A frequently or continually inundated unforested wetland characterized by emergent herbaceous vegetation adapted to saturated soil conditions.

Measuring sticks Environmental assessment review criteria developed to provide level of review to confidently address the potential for unacceptable environmental changes.

Micro irrigation The application of small quantities of water on or below the soil surface as drops or tiny streams of spray through emitters or applicators placed along a water delivery line. Micro irrigation includes a number of methods or concepts, such as bubbler, drip, trickle, mist or micro spray, and subsurface irrigation.

Million gallons per day (mgd) A rate of flow of water equal to 133,680.56 cubic feet per day, or 1.5472 cubic feet per second, or 3.0689 acre-feet per day. A flow of one million gallons per day for one year equals 1,120 acre-feet (365 million gallons).

Minimum Flows and Levels (MFL) The point at which additional withdrawals will result in significant harm to the water resources or the ecology of the area (Sections 373.042 and 373.0421, F.S.).

MFL recovery strategy Developed when the water body currently exceeds the MFLs criteria. The goal of a recovery strategy is to achieve the established MFLs as soon as practicable.

MFL prevention strategy Developed when the MFLs criteria are not currently violated, but are projected to be exceeded within the next 20 years. The goal of a prevention strategy is for the water body to continue to meet the established MFLs in the future.

Mitigation The action of lessening in severity or intensity.

Mobile irrigation laboratory 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.

MODFLOW A modular, three-dimensional, finite-difference groundwater modeling code created by the United States Geological Survey, which is used to simulate the flow of groundwater through aquifers.

Monitor well A well to monitor fluctuations in groundwater levels, quality of underground waters, or the concentration of contaminants in underground waters.

National Geodetic Vertical Datum of 1929 (NGVD) A geodetic datum derived from a network of information collected in the United States and Canada. It was formerly called the “Sea Level Datum of 1929” or “mean sea level.” Although the datum was derived from the average sea level over a period of many years at 26 tide stations along the Atlantic, Gulf of Mexico, and Pacific coasts, it does not necessarily represent local mean sea level at any particular place.

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

Net irrigation demand or net irrigation requirement The amount of water the plant needs in addition to anticipated rainfall. This is an estimate of the amount of water (expressed in inches per year) that should be delivered to the plant’s root zone.

Net water demand (or user/customer water demand) is the water demand of the end user after accounting for treatment and process losses, and inefficiencies. When discussing Public supply, the term “finished water demand” is commonly used to denote net demand.

Per capita use The average amount of water used per person per day.

Performance measure A scientifically measurable indicator or condition that can be used as a target for meeting water resource management goals. Performance measures quantify how well or how poorly an alternative meets a specific objective.

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

Planning Area The CFWI Planning Area is located in central Florida and consists of all of Orange, Osceola, Seminole, and Polk counties and southern Lake County. The St. Johns River Water Management District, (SJRWMD), South Florida Water Management District (SFWMD), and the Southwest Florida Water Management District (SWFWMD) each contain portions of the CFWI Planning Area.

Potable water Water that is safe for human consumption.

Potentiometric surface A surface that represents the hydraulic head in an aquifer and is defined by the level to which water will rise above a datum plane in wells that penetrate the aquifer.

Process water Water used for nonpotable industrial usage, e.g., mixing cement.

Rapid infiltration basin (RIB) A method by which treated wastewater is applied in deep and permeable deposits of highly porous soils for percolation through deep and highly porous soil.

Raw water Water that is direct from the source—groundwater or surface water—without any treatment.

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 into the ground to raise groundwater levels.

Recharge (hydrologic) The downward movement of water through soil to groundwater; the process by which water is added to the zone of saturation; or the introduction of surface water or groundwater to groundwater storage, such as an aquifer. Recharge or replenishment of groundwater supplies consists of three types: 1) natural recharge, which consists of precipitation or other natural surface flows making their way into groundwater supplies; 2) artificial or induced recharge, which includes actions specifically designed to increase supplies in groundwater reservoirs through various methods, such as water spreading (flooding), ditches, and pumping techniques; 3) incidental recharge, which consists of actions, such as irrigation and water diversion, which add to groundwater supplies, but are intended for other purposes. Recharge may also refer to the amount of water so added.

Reclaimed water Water that received at least secondary treatment and basic disinfection and is reused after flowing out of a domestic wastewater treatment facility (Rule 62-610.200, Florida Administrative Code)

Reference Condition Reference Condition was established and used to compare modeled results from a number of projected future withdrawal conditions. The CFWI RWSP Reference Condition is a combination of observed ecologic status of water bodies from 2005 to 2010 and the modeled hydrologic conditions of the 2005 withdrawal condition.

(Regional) Water supply plan Detailed water supply plan developed by the Water Management Districts under Section 373.709, Florida Statutes, providing an evaluation of available water supply and projected demands at the regional scale. The planning process projects future demand for 20 years and recommends projects to meet identified needs.

Retention The prevention of stormwater runoff from direct discharge into receiving waters; included as examples are systems that discharge through percolation, exfiltration, filtered bleed-down, and evaporation processes.

Retrofit (1) Indoor: the replacement of existing water fixtures, appliances, and devices with more efficient fixtures, appliances, and devices for the purpose of water conservation. (2) Outdoor: the replacement or changing out of an existing irrigation system with a different irrigation system, such as a conversion from an overhead sprinkler system to a micro irrigation system (Basis of Review, SFWMD 2012b).

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

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.

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.

Saltwater Intrusion Minimum Aquifer Level (SWIMAL) Adopted and proposed by the SWFWMD to support MFLs recovery strategy.

Seawater or salt water Seawater is defined by the SJRWMD and SFWMD as water with a chloride concentration at or above 19,000 mg/L and by the SWFWMD as water with a total dissolved solids concentration greater than or equal to 10,000 mg/L.

Sedimentation The action or process of forming or depositing sediment.

Seepage irrigation Irrigation that conveys water through open ditches. Water is either applied to the soil surface (possibly in furrows) and held for a period of time to allow infiltration, or is applied to the soil subsurface by raising the water table to wet the root zone.

Seepage irrigation system A means to artificially supply water for plant growth that relies primarily on gravity to move the water over and through the soil, and does not rely on emitters, sprinklers, or any other type of device to deliver water to the vicinity of expected plant use.

Semi-confined aquifer A completely saturated aquifer that is bounded above by a semi-pervious layer, which has a low, though measurable permeability, and below by a layer that is either impervious or semi-pervious.

Service area The geographical region in which a water supplier has the ability and the legal right to distribute water for use.

Solutions Strategies The CFWI 2035 Water Resources Protection and Water Supply Strategies document, was developed by the Solutions Planning Team and is Volume II and Volume IIA of the CFWI RWSP. The Solutions Strategies provides relevant project information to further develop specific water supply project options through partnerships with water users. The document includes project cost estimates, potential sources of water, feasibility and permitability analysis, and identification of governance structure options.

Southern Water Use Caution Area (SWUCA) Established by the SWFWMD in 1992 due to environmental concerns related to groundwater withdrawals in the southern and central regions of the SWFWMD. The primary areas of resource concern within the SWUCA include lake levels along the Lake Wales Ridge, flows in the upper Peace River, and saltwater intrusion into the UFA from the Gulf of Mexico.

Stormwater Water that does not infiltrate, but accumulates on land as a result of storm runoff, snowmelt runoff, irrigation runoff, or drainage from areas, such as roads and roofs.

Stormwater discharge Precipitation and snowmelt runoff from roadways, parking lots, and roof drains. A major source of nonpoint source pollution to water bodies and a challenge to sewage treatment plants in municipalities where the storm water is combined with the flow of domestic wastewater (sewage) before entering the wastewater treatment plant.

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) An unconfined aquifer consisting of varying amounts of limestone and sediments that extend from the land surface to the top of an intermediate confining unit.

Time series A statistical process analogous to the taking of data at intervals of time.

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

Turbidity The measure of water clarity caused by suspended material in a liquid.

Upconing Process by which saline water underlying fresh water in an aquifer rises upward into the freshwater zone as a result of pumping water from the freshwater zone.

Uplands An area with a hydrologic regime that is not sufficiently wet to support vegetation typically adapted to life in saturated soil conditions. Upland soils are nonhydric soils.

Utility Any legal entity responsible for supplying potable water for a defined service area.

Wastewater The combination of liquid and water carried pollutants from residences, commercial buildings, industrial plants, and institutions together with any groundwater, surface runoff, or leachate that may be present.

Water budget An accounting of total water use or projected water use for a given location or activity.

Water conservation Policies, strategies, and activities to manage water as a sustainable resource to protect the water environment and to meet current and future demand.

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

Water Protection and Sustainability Program (WPSP) Florida trust fund created by the legislature to provide Districts with state matching funds to support the development of alternative water supplies by local governments, water supply authorities, and other water users.

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 Water set aside for the protection of fish and wildlife or the public health and safety. Reserved water is not allocated to consumptive uses (Subsection 373.223(4), F.S.).

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, Florida Statutes).

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 South Florida Water Management District operations. Unlike drainage basins, which are defined by rule, watersheds are continuously evolving as the drainage network evolves.

Water shortage restrictions Limit water use when sufficient water is temporarily unavailable to meet user needs or when conditions require temporary reduction in use to prevent serious harm to water resources (Sections 373.175 and 373.246, F.S.).

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 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.

Wellfield One or more wells producing water from a subsurface source.

Wetland An area that is inundated or saturated by surface water or groundwater with vegetation adapted for life under those soil conditions (e.g., swamps, bogs, and marshes).

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.

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