Withlacoochee Regional Water Supply Authority

Regional Water Supply Plan Update

Ensuring Water Supplies for the Future of the Region

Final

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2014

Withlacoochee Regional Water Supply Authority

2014 Regional Water Supply Plan Update

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Shaping the Future

This Regional Water Supply Plan Update for 2014 was co-funded by the Southwest Florida Water Management District and was developed with assitance from the following collaborators:

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Executive Summary

This document is the Withlacoochee Regional Water Supply Authority's update to the 2005 Master Regional Water Supply Plan and 2010 Phase II Detailed Water Supply Feasibility Analysis. The Southwest Florida Water Management District (SWFWMD) co-funded the development of this document and intends to incorporate portions of it into the 2015 update of the Regional Water Supply Plan for the Northern Planning Region.

This Water Supply Plan is a 20-year assessment of water demands and potential sources of water available to meet these demands. The objective is to assist water supply utilities within the WRWSA's four-county region by developing implementable water supply options and strategies to meet future demands. The timing and feasibility of supply options may vary among the utilities based on their location, level of need, conservation and reuse potential, economic constraints, or the availability of traditional and alternative water supplies. A comprehensive analysis of options has been completed which includes environmental concerns according to location and potential yield; consideration of utilizing new sources; water quality and treatment requirements; and economic considerations for transmission, pumping, operation and maintenance costs. The following is a summary of the important information and conclusions in the Water Supply Plan Update.

1.0 Water Demand Projections

Water demand for public supply utilities in the WRWSA four-county region is projected to increase by approximately 40.9 mgd from 2010 through 2035. The table below shows the increases by county in five-year increments. Water demand for all use categories in the WRWSA region is projected to increase by approximately 96.7 mgd from 2010 through 2035.

Public Water Supply Utility Demand Projections for WRWSA Counties (2010-2035).

County	2010 Water Demand (mgd)	Projected Public Supply Demands (mgd)					Total Change in Demand	Percent Increase
		2015	2020	2025	2030	2035		
Citrus	14.7	15.2	16.6	17.8	18.9	20.0	5.3	36.0
Hernando	22.1	22.8	24.4	25.9	27.1	28.1	6.0	27.4
Mar. SWFWMD	11.2	12.3	14.7	16.9	19.6	22.2	11.0	98.2
Mar. SJRWMD	26.8	27.8	29.5	30.7	31.7	32.6	5.8	21.7
Sumter	20.1	24.6	28.5	29.8	31.3	32.9	12.8	53.7
TOTALS	**94.9**	**102.7**	**113.7**	**121.1**	**128.6**	**135.8**	**40.9**	**43.1**

2.0 Evaluation of Demand Management Potential and Potential Water Sources

The potential for demand management and the quantity of water that is potentially available from all sources of water within the WRWSA region to meet water supply demands through 2035 was quantified. Sources of water that were evaluated included reclaimed water, groundwater, surface water, and seawater desalination. A summary of this information is included below.

2.1 Public Supply Water Conservation Potential

A comprehensive assessment of public supply water conservation potential was conducted for the planning period by the University of Florida's Conserve Florida Water Clearinghouse (CFWC). The CFWC completed the analysis using the EZGuide Online water conservation tool, which is a web-based model designed to estimate conservation potential for public supply utilities. Three tiers of water conservation savings targets to achieve 5, 10, and 15 percent savings, were developed. To achieve these levels of conservation, a series of BMPs, retrofit programs, and other water savings measures were developed for each tier. The 5, 10, and 15 percent conservation targets have the potential to reduce public water supply demand in the WRWSA region by 6.3, 13.0, and 20.2 mgd, respectively, by 2035.

2.2 Reclaimed Water Availability

An analysis was performed to determine the quantities of reclaimed water that will be available in 2035 as the result of increasing population. The quantity of reclaimed water that is projected to be available in 2035 that is not yet allocated to projects that are planned, completed, or under development is 4.9 mgd.

2.3 Groundwater Availability

Developing an accurate estimate of the availability of groundwater for water supply is challenging due to the existence of major uncertainties that include the ongoing process to develop MFLs, which could significantly restrict groundwater availability, and lack of data to assess the availability of groundwater in the Lower Floridan aquifer. The SWFWMD used their Northern District Groundwater Flow Model to assess the potential of the Upper and Lower Floridan aquifers to supply groundwater to meet the 2035 projected demands for all use categories in the WRWSA region. The projected 2035 water demands used in the model were adjusted by the SWFWMD to account for water conservation and use of reclaimed water. The adjustments included demand reductions of 10 percent for public supply and agriculture. Recreation/aesthetic demand was reduced by 20 percent because of the likelihood that reclaimed water would both offset demand and provide recharge to the Upper Floridan aquifer.

In the SWFWMD portion of the WRWSA region, results of the modeling investigation using the adjusted demands, indicated that the 2035 demands can be met with groundwater with no exceedences to springs and rivers for which MFLs have been proposed or adopted. However, if the demands are not adjusted, it is likely there would be MFL exceedences for Homosassa and Chassahowitzka Springs. The implication of this result is that beyond 2035, the availability of additional groundwater quantities for water supply from the Upper Floridan in the SWFWMD portion of the WRWSA region may become limited in certain areas.

In the SJRWMD portion of the WRWSA region, MFLs for Silver Springs/Silver River are being developed by the SJRWMD and will likely impact resource availability. Based on current analyses, the current draft MFLs would not be met under 2035 projected demand. The SJRWMD is working on tools to assist in the development of a prevention/recovery strategy.

2.4 Surface Water Availability

Withlacoochee River - Available flows are based on the SWFWMD's proposed minimum flows for the river which were developed at the Croom, Wysong, and Holder gages. The Holder gage is furthest downstream so the available flow is greatest there; approximately 35.6 mgd on a median annual basis. Much larger quantities could be developed downstream at Lake Rouseau because of its location downstream of the very large inflow of the Rainbow River, fed by Rainbow Springs. The SWFWMD did not establish a minimum flow at this location so there is currently no estimate of flow potentially available for water supply.

Ocklawaha River - The SJRWMD's draft 2015 District Water Supply Plan states that preliminary estimates indicate that up to 30 mgd may be available from the river in the District's Planning Region 2 (which includes Marion County) depending on how much is withdrawn in the District's other planning regions. This estimate will be refined once MFLs are adopted for the river.

2.5 Seawater Desalination

The quantity of water that is potentially available from desalinated seawater, 15 mgd, was developed for the WRWSA's 2010 Water Supply Plan and was based on a long-range forecast of the demands for utilities that could potentially be served by the facility. Since the completion of the WRWSA's 2010 Water Supply Plan, Duke Energy has decided that all of their nuclear and coal generating units will be retired by 2020. This will eliminate the cooling water outflow that was to provide dilution of concentrate for a future seawater desalination facility. Although there are other options for disposal of waste concentrate, they are much more technically complex and expensive. Without the ability to dilute the waste concentrate with cooling water, locating a seawater desalination facility at the power station has become significantly more problematic.

An investigation was conducted to determine the potential for developing sites for additional seawater desalination facilities along the coasts of Citrus and Hernando Counties. The investigation concluded that developing a new site with all the necessary attributes including permitted intakes and discharges, an above sea level location near the gulf, and availability of power, water, and road access, would probably not be possible.

3.0 Potential of Demand Management and Water Supplies to Meet Future Demand

The total demand reduction potential through conservation measures and the quantity of water available from the sources discussed above through 2035 ranges from 175 to 195 mgd. This is considered a conservative estimate because of the potential for additional fresh and brackish groundwater from the Lower Floridan aquifer and much higher quantities available from the

Withlacoochee River if a water supply facility were constructed below the confluence of the Withlacoochee and Rainbow Rivers.

Comparing the projected increase in demand from 2010 through 2035 for all use categories in the WRWSA region, 96.7 mgd, to the demand reduction potential of the public supply water use category and the potential availability of water from all sources, conservatively estimated at between 175 and 195 mgd, indicates that demands for all use categories can be met at least through 2035 and probably well into the future beyond 2035.

4.0 Water Supply Project Options

Investigations were conducted to identify reasonable project options for water conservation and each of the sources discussed above. Planning level technical, cost, and environmental feasibility information were updated or developed. A summary of this information is included below.

4.1 Water Conservation

The EZGuide water conservation model was used to determine which best management practices and other water conservation measures could be used to accomplish 5, 10, and 15 percent water conservation savings targets. The EZ Guide model was then used to estimate the cost of implementation for each utility to meet these targets. On average, the costs to meet the conservation targets will range from $1.03, for a 15 percent reduction, to $0.81, for a 5 percent reduction, per thousand gallons.

4.2 Reclaimed Water

A list of 18 reclaimed water project options was developed with input from utilities and other interested parties. Capital costs ranged from $250,000 to $6.23 million and costs/1,000 gallons ranged from $0.13 to $1.56.

4.3 Fresh Groundwater

Four groundwater supply project options were identified. Capital costs and cost/1,000 gallons are as follows.

- Option 1 – Increasing production of the Charles A. Black wellfield in central Citrus County – no infrastructure changes needed.
- Option 2 - Lower Floridan aquifer in the City of Wildwood’s southern wellfield (4.1 mgd) - $6.7 million and $0.52/1,000 gallons.
- Option 3 - Upper Floridan aquifer in the Marion Oaks area of southwest-central Marion County (5.4 mgd) - $7.8 million and $0.36/1,000 gallons (the county is also interested in exploring the viability of Lower Floridan aquifer wells in the Marion Oaks area).
- Option 4 - Lower Floridan aquifer near Silver Springs in southeast-central Marion County (8.2 mgd) - $7.9 milllion and $0.40/1,000.

4.4 Brackish Groundwater Desalination

The water management districts should evaluate the potential of the Lower Floridan aquifer to produce mineralized or brackish groundwater for desalination at some point in the future when resources become available. The desalination of brackish groundwater for water supply is a common practice in the southern coastal portions of the SWFWMD and is becoming increasingly cost effective as the technology improves. It has the potential to become a major source of supply in certain areas of the WRWSA region when freshwater supplies from the Upper Floridan aquifer become limited.

4.5 Surface Water

Three surface water project options were developed for the Withlacoochee River. Capital costs and cost/1,000 gallons are as follows.

- North Sumter (10 mgd) - $103.1 million and $2.82/1,000 gallons.
- Holder with Reservoir (25 mgd) - $406.4 million and $3.74/1,000 gallons.
- Lake Rousseau (25 mgd) - $306.5 million and $3.12/1,000 gallons.

4.6 Seawater Desalination

Costs were developed for a seawater desalination project option at the Crystal River Power Station in northern Citrus County for a 15 mgd option using three different methods of waste concentrate disposal; deep well injection, zero liquid discharge, and ocean outfall. Capital cost and cost/1,000 gallons are as follows.

- Deep well injection – $221.8 million and $5.68/1,000 gallons.
- Zero Liquid Discharge - $339.5 million and $11.42/1,000 gallons.
- Ocean Outfall – $305.6 million and $6.53/1,000 gallons.

5.0 Regionalization of Water Supplies

5.1 Advantages of Regionalization

The advantages of joining with other local governments to address water supply issues is the opportunity to share common concerns and arrive at solutions that would not otherwise be possible for a single local government because of geographic, resource, or funding constraints. Education, information sharing, and focused research or data-gathering are other benefits of a collective, as opposed to an individual, approach to water supply issues. Having the opportunity to meet and discuss the concerns and positions of the various local governments is beneficial to all the parties. These discussions will lead to a better understanding between the members, thus making it easier to find mutually acceptable solutions to common problems and building trust between the members.

A major advantage to a regional approach to projects is the economy of scale. For example, it is unlikely that an individual local government in the four-county region could develop a water supply from the Withlacoochee River due to the high cost of such an option. However, the

WRWSA could develop the water supply and transmission system in cooperation with the SWFWMD and the water could be wholesaled to any local governments needing additional supply. This would reduce the costs that individual governments would otherwise incur.

Additional advantages of regionalization of water supply facilities include:

- ability to take advantage of conjunctive use, where both groundwater and alternative sources are available and can be managed to optimize water supply by taking advantage of natural hydrologic cycles;
- helping to ensure that adequate water supplies are available to meet growing demands for member governments and participating water supply utilities;
- spreading the cost of developing alternative water supplies, such as the Lower Floridan aquifer or surface water projects to achieve economies of scale;
- providing for a diversity of water sources so that availability and reliability during droughts are increased; and
- increasing reliability of water delivery by providing emergency interconnects between utility systems.

5.2 Evolution of a Regional Water Supply System

A possible sequence of steps to achieve regionalization of water supply systems and what the WRWSA's involvement could be during the near-term, mid-term, and long-term periods is outlined below.

Near-Term Period (2015-2025) - Although the Upper Floridan aquifer will continue to be relied on to meet the majority of demands through 2035 in the SWFWMD portion of the WRWSA region, the Lower Floridan aquifer will be increasingly developed, especially in Marion and Sumter counties where the aquifer is more likely to contain potable quality water. An early step in the process of regionalization would be to investigate opportunities to be involved in the development of the Upper and Lower Floridan aquifer groundwater project options listed above. The WRWSA's role could include owning and operating the facilities or owning the facilities with operation delegated to the local utility. Another important step would be to identify and support the development of small-scale interconnects between water supply systems.

The WRWSA's governance structure was recently revised and is considered to be sufficient to continue its support for water conservation and to assist in the development of the small-scale water supply projects and interconnects. However, the WRWSA is in the process of negotiating a new agreement with Citrus County for the operation of the Charles A. Black Wellfield. The original agreement, which was executed in the early 1990s, has become outdated due to the rapid rate of expansion of the quantity of water supplied by the wellfield and it is recommended that it be renegotiated. In addition, the agreement would need to be renegotiated prior to implementing the proposed project option to increase the permitted quantities of the wellfield by over 2 mgd.

The WRWSA is the preferred entity to foster the development of regional water sources, and local governments should work with the WRWSA when developing projects to meet their future water supply needs. Both the SJRWMD and SWFWMD give funding priority to multijurisdictional projects. This is in accordance with section 373.(8)(f)7, Florida Statutes, which provides that when the districts are selecting projects for financial assistance, “significant weight” is to be given to “whether the project will be implemented by a multijurisdictional water supply entity or regional water supply authority.

Mid-Term Period (2025-2035) - By the beginning of the mid-term period, it is probable that the water management districts will have increased their understanding of the water supply potential of the Lower Floridan aquifer. This will enhance their capability to determine to what degree and where in the region the aquifer will contribute to meeting projected water supply demands. It is anticipated that the Lower Floridan aquifer will be increasingly used to meet demand in Sumter and Marion counties where it is most likely to contain potable water. The WRWSA could have a role in facilitating the development of the aquifer in these areas and in distributing water between utilities.

The WRWSA’s governance structure would need to be evaluated during this period to determine its suitability to oversee and operate a regional system. Issues that would need to be considered include membership and voting structure, ownership and funding of facilities and operations, authorization to hire staff to operate and maintain facilities and provide administrative and technical support, water rate structures, and a dispute resolution process.

During the decade from 2000 to 2010, the SWFWMD provided hundreds of millions of dollars in cost share funding to Tampa Bay Water and the Peace River Authority to develop alternative water supply projects. This funding was provided for the purpose of mitigating some of the negative environmental impacts that had resulted from the over development of fresh groundwater from the Upper Floridan aquifer. Within the WRWSA’s four-county region, the water management districts have not yet found it necessary to adopt a prevention or recovery strategy for any of the currently adopted MFLs, unlike other parts of the state where such prevention and recovery strategies exist. The WRWSA members should request funding for regional water projects through the WRWSA to ensure continued compliance with established MFLs and that the environmental impacts that occurred in other parts of the state due to withdrawals will be avoided in the WRWSA area.

Long-Term Period (Beyond 2035) - During this period in the SWFWMD portion of the WRWSA region, new groundwater supplies from the Upper Floridan aquifer may become increasingly difficult to obtain in certain areas. This will result in increased emphasis on development of fresh and possibly brackish groundwater from the Lower Floridan aquifer and regional interconnections of water supply systems.

Because the freshwater producing zone of the Lower Floridan aquifer is located well to the east of Citrus and Hernando counties, these counties may not have the ability to develop the aquifer as a freshwater supply. This may present an opportunity for the WRWSA to begin the planning for development of Lower Floridan aquifer groundwater systems in Sumter and Marion counties that would be interconnected with water utilities in Hernando and Citrus counties. Interconnections of Lower Floridan aquifer systems in eastern Marion County may also be necessary due to resource constraints imposed by the Silver Springs MFLs.

The WRWSA could also lead or support an investigation to determine the potential of the Lower Floridan aquifer in Hernando and Citrus counties to supply small-scale brackish groundwater desalination facilities that could be owned and operated by the WRWSA.

As part of the planning for the interconnected systems discussed above, the systems would be designed with the objective of eventual incorporation into a larger regional transmission system that would be accessible to the large municipalities in the WRWSA region. Such a system would be supplied by a diversity of sources including fresh and brackish groundwater and eventually surface water from the Withlacoochee and possibly the Ocklawaha Rivers.

During this period, the regional system outlined above would be developed. The first phase could be the construction of interconnects between Lower Floridan aquifer groundwater systems in Sumter and Marion counties and water utilities in Hernando and Citrus counties. Brackish groundwater desalination facilities supplied by the Lower Floridan aquifer in Hernando and Citrus counties could also be interconnected into the system.

The next phase would be to begin the construction of a regional transmission system that would likely be constructed in phases over many years. It would be sized to meet the build-out demands of the utilities that would be its customers.

The final step would be the construction of systems to use surface water from the Withlacoochee and Ocklawaha Rivers and the ability to incorporate this supply into the regional system.

By the beginning of the long-term period, a governance structure should be in place that will allow for the regional sharing of water supplies from a diverse set of water supply facilities. This will become a reality as each phase of the regional transmission system is completed.

During this period, the WRWSA should request cost-share funding from the SWFWMD and SJRWMD at levels proportionate to what has been provided to Tampa Bay Water and the Peace River Authority during the past 15 years. This funding will be necessary to develop the phases of the regional transmission system and surface water projects on the Withlacoochee and Ocklawaha Rivers.

Chapter 1. Introduction

This document is the Withlacoochee Regional Water Supply Authority's (WRWSA) update to their 2010 Phase II Detailed Water Supply Feasibility Analysis (2010 Water Supply Plan). The Southwest Florida Water Management District (SWFWMD) co-funded the development of this document and intends to incorporate portions of it into the 2015 update of the Regional Water Supply Plan for the Northern Planning Region.

This Water Supply Plan is a 20-year assessment of water demands and potential sources of water available to meet these demands. The objective is to assist water supply utilities within the WRWSA region by developing implementable water supply options and strategies to meet future demands. The timing and feasibility of supply options may vary among the utilities based on their location, level of need, conservation and reuse potential, economic constraints, or the availability of traditional and alternative water supplies. A comprehensive analysis of options has been completed which includes environmental concerns according to location and potential yield; consideration of utilizing new sources; water quality and treatment requirements; and economic considerations for transmission, pumping, operation and maintenance costs.

Part A. The Withlacoochee Regional Water Supply Authority

The WRWSA is an independent special district of the state of Florida, created and existing pursuant to Section 373.713 and 163.01, Florida Statutes and is one of three water supply authorities in the SWFWMD. The WRWSA is comprised of Citrus, Hernando, Marion and Sumter counties and municipalities within the region. A portion of the WRWSA in Marion County is within the St. Johns River Water Management District (SJRWMD). Figure 1-1 shows the WRWSA four-county region and its member governments.

The WRWSA is charged with planning for and developing cost efficient, high quality water supplies for its member governments and promotes environmental stewardship through its water conservation programs. In the future, it is anticipated that the WRWSA will partner with its member governments to develop water sources to augment current supplies to meet the region's long-term needs. The WRWSA owns the Charles A. Black wellfield in Citrus County, with a permitted capacity of approximately 4.6 mgd. The system includes seven production wells, two water treatment facilities, two 4-mg and one 1-mg storage tanks and associated transmission system pipelines.

The WRWSA was founded in 1977 by Hernando, Citrus, Sumter, Marion and Levy counties. An amendment to the WRWSA's inter-local agreement in 1984 provided for municipal membership, which allowed cities within each county to become members. In 1982, Levy County formally withdrew and today, the current membership includes Citrus, Hernando, Marion, and Sumter counties and their associated municipalities. These include Belleview, Brooksville, Bushnell, Center Hill, Coleman, Crystal River, Dunnellon, Inverness, McIntosh, Ocala, Reddick, Webster, and Wildwood.

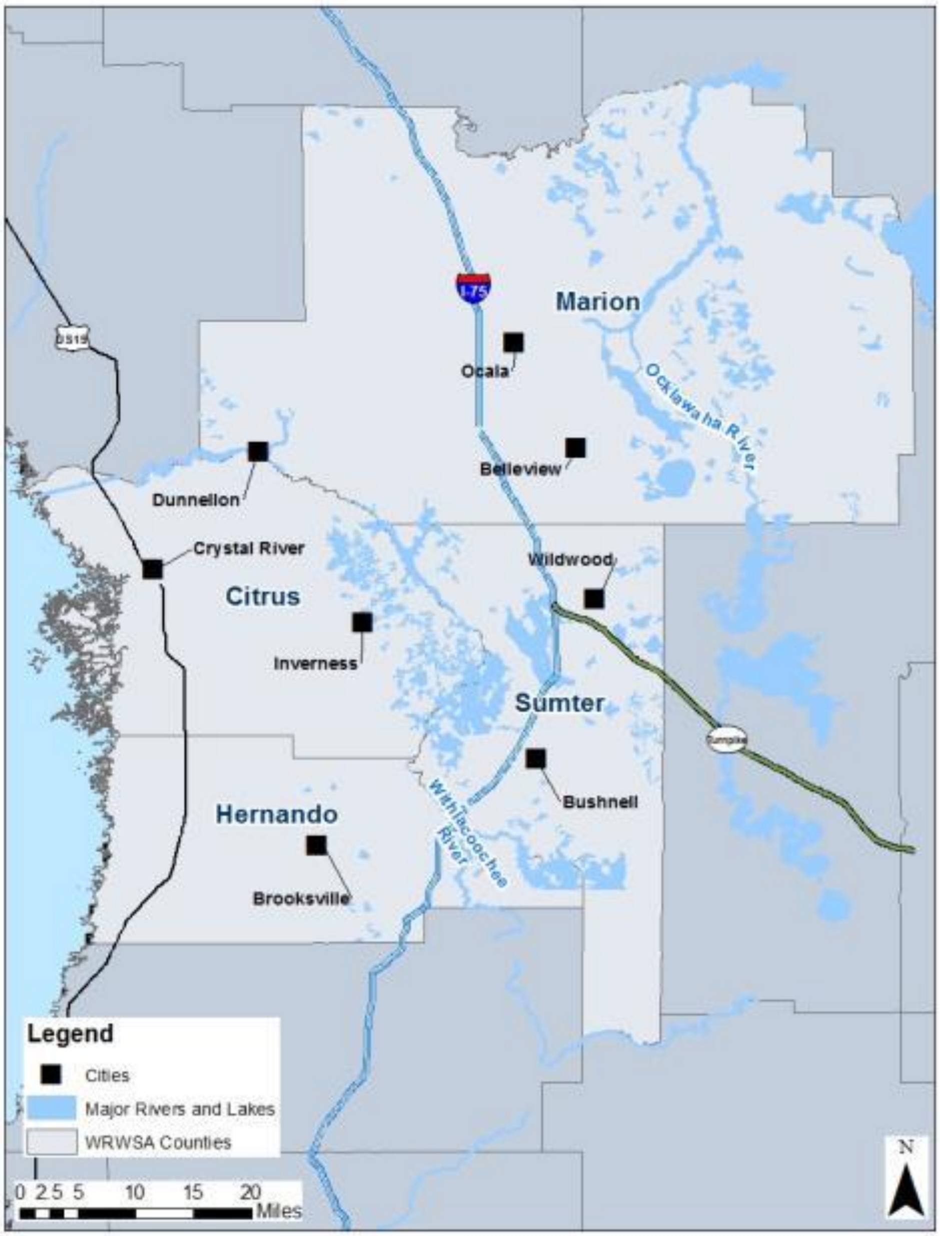

Figure 1-1. The WRWSA Four-County Region and its Member Governments.

In 2014, a revised and restated Inter-local Agreement which creates the WRWSA was approved by Citrus, Hernando, Marion and Sumter counties, the four counties which are parties to the Agreement. Pursuant to the new Agreement, the WRWSA Board is comprised of two county commissioners from Citrus, Hernando and Sumter counties, three commissioners from Marion County and one municipal representative from a municipality within each of these counties (currently Crystal River, Brooksville, Belleview and Bushnell).

Section 1. Water Supply Planning History

Since the WRWSA is authorized to develop and supply water, it has historically completed water supply planning studies, constructed a regional water supply facility in Citrus County, and developed a cooperative funding program to assist member local governments in developing adequate water supply facilities and water conservation (WRWSA Website).

The WRWSA's early water supply planning efforts began with the *Water Sources and Demand Study* (1982) and the *WRWSA Master Plan for Water Supply* (1987). These were followed in 1996 by the *Withlacoochee Regional Water Supply Authority Master Plan for Water Supply*. In 2007 the WRWSA, in cooperation with the SWFWMD, completed the *Withlacoochee Regional Water Supply Authority Regional Water Supply Plan Update - 2005*.

In 2005 the WRWSA established the WRWSA Master Water Supply Plan and Implementation Program, which is a comprehensive process to plan for the region's water supply future. It was a multi-year, multi-phase program that contained phases for water supply planning, identification and prioritization of water supply projects, the design of selected projects and implementation of the projects and initiatives.

The WRWSA Detailed Water Supply Feasibility Study was initiated in 2007 and completed in 2010 and was considered Phase II of the WRWSA Master Water Supply Plan and Implementation Program. Its purpose was to update regional population and water demands and determine potential water supply projects to supply these needs. As the study progressed, Marion County decided to rejoin the WRWSA. The inclusion of Marion County into the WRWSA added challenges and opportunities with respect to regionally sustainable water supply development. The WRWSA's geographic area increased by approximately 86 percent from 1,892 square miles to 3,516 square miles and its population increased by approximately 68 percent from 494,931 to 732,681 (2005 estimate).

Part B.The WRWSA 2014 Regional Water Supply Plan Update

The purpose of the 2014 Water Supply Plan Update is to update regional water supply planning over the recent past as part of the WRWSA's Regional Water Supply Planning and Implementation Program. The Water Supply Plan update presents the current population and water demand estimates for utilities in the WRWSA region based on the water management districts' demographic data and other current studies. Potential water use offsets from conservation and reuse strategies for the larger utilities were analyzed and strategies were identified that could reduce estimated demands. Utilities with projected deficits of permitted quantities were identified. Water supply project options were identified and an analysis was conducted to assess their technical, economic, regulatory and environmental feasibility. The Water Supply Plan update also contains a discussion of a number of issues that will need to be considered by the WRWSA and its member governments as the Authority moves toward regional sharing of water supplies.

The Water Supply Plan update has been structured to follow the format of the Florida Department of Environmental Protection's (FDEP) Regional Water Supply Plan guidelines to the greatest extent possible. The SWFWMD has also followed these guidelines in structuring their Regional Water Supply Plans.

The following describes the content of the Water Supply Plan update: Chapter 1 is an introduction to the Plan, which contains information on the planning process and a description of the land use, population, physical characteristics, hydrology and geology/hydrogeology of the four-county region. Chapter 2, Resource Protection Criteria, addresses the resource protection strategies that the SWFWMD and SJRWMD have implemented or are considering implementing, including water use caution areas (WUCAs) and minimum flows and levels (MFLs) programs. Chapter 3, Demand Estimates and Projections, is a quantification of existing and reasonably projected water supply demand through the year 2035, focusing on public supply but also including agricultural, industrial/commercial, mining/dewatering, power generation and recreational/aesthetic water use categories. Chapter 4, Evaluation of Water Sources, is an evaluation of the potential for water conservation to reduce future demand and the water supply potential of traditional and alternative sources. Chapter 5 is the Water Supply Options component, which presents a list of water supply project options including water conservation, reclaimed water, groundwater, surface water, and seawater desalination. For each option, the estimated amount of water that could be produced and the estimated cost of developing the option are provided. Chapter 6 is an overview of the WRWSA's Regional Supply Framework. This section presents a number of issues that will need to be considered by the WRWSA and its member governments as the Authority moves toward regional sharing of water supplies. Chapter 7 contains the conclusions and recommendations of the Water Supply Plan.

Part C.Description of the Planning Region

Section 1. Land Use & Population

The WRWSA four-county region is characterized by a diversity of land use types (Table 1-1). The area encompasses extensive tracts of federal, state, and water-management district-owned conservation lands. These protected public lands are used and maintained for timber management, ecological restoration, public recreation, and conservation of hardwood swamps, fresh and saltwater marshes, river frontage, sandhill-dwelling plants, public recreation, and prime black bear habitat. Limestone mining activities occur primarily in Hernando and Sumter counties and numerous inactive mines are scattered throughout the region. Significant agricultural activities are carried out in the region. Forestry and pasture dominate agricultural use in terms of acres and Marion County is known for its thoroughbred horse breeding industry. Ornamental production is growing particularly in Sumter County. Watermelons have been a primary crop while other crops such as sweet peppers, squash, cucumbers, cantaloupes and sweet corn are farmed at a much smaller scale.

The population of the region is projected to grow from approximately 738,732 in 2010 to 1,150,000 in 2035. This is an increase of approximately 411,268 new residents; a 56 percent increase during the planning period. Marion and Sumter counties include sections of The Villages retirement communities, the largest residential development in central Florida. A future expansion of the Suncoast Parkway may result in an increase in commercial and industrial land uses and bring new residents to Citrus County. Residential and commercial development has also been concentrated along U.S. 19 in Hernando and Citrus counties and along SR 200 southwest of Ocala in Marion County.

Table 1-1. Land Use/Land Cover in the WRWSA Region.

Land Use/Land Cover Types (2007)	Percent	Acres
Urban & Built-up	18	387,836
Agriculture	16	343,360
Rangeland	3	71,627
Upland Forest	36	760,582
Water	3	54,082
Wetlands	17	356,889
Barren Land	5	108,040
Transportation, Communication & Utilities	1	23,715
Industrial and Mining	1	26,532
Total	**100**	**2,132,663**

Source: SWFWMD 2007 LULC GIS layer (SWFWMD, 2007). Percentages and acreages are rounded.

Section 2. Physical Characteristics

The WRWSA Region is divided along the Brooksville Ridge physiographic region into three distinct watersheds; the Springs Coast, Withlacoochee River, and Ocklawaha watersheds. The Springs Coast watershed is comprised of the Coastal Swamp in eastern Hernando and Citrus counties along the Gulf of Mexico. It also encompasses the Gulf Coastal Lowlands between the Coastal Swamp and the Brooksville Ridge, which consists of relatively flat plains to rolling sandhills. The Withlacoochee River watershed encompasses parts of Marion, Levy, Citrus, Hernando, all of Sumter County, and portions of Pasco and Polk counties. The Ocklawaha River watershed encompasses nearly 2,800 square miles in parts of Marion, Levy, Alachua, Putnam, Polk, Lake, Orange, and Sumter counties.

The Brooksville Ridge trends northwest-southeast across the region through the central portions of Citrus and Hernando counties. Elevations along the Ridge range from 70 to 275 feet above sea level. The Ridge has an irregular surface due to the prevalence of karst features and is mantled with clay-rich soils. The Tsala Apopka Chain of Lakes lies between the Brooksville Ridge and the Withlacoochee River within the recharge area of the coastal springs. It has a large number of interconnected lakes that are divided by peninsulas and islands. Elevations range from 35 to 75 feet above sea level.

Section 3. Hydrology

Figure 1-2 depicts the major hydrologic features of the WRWSA Region including rivers, lakes, and springs.

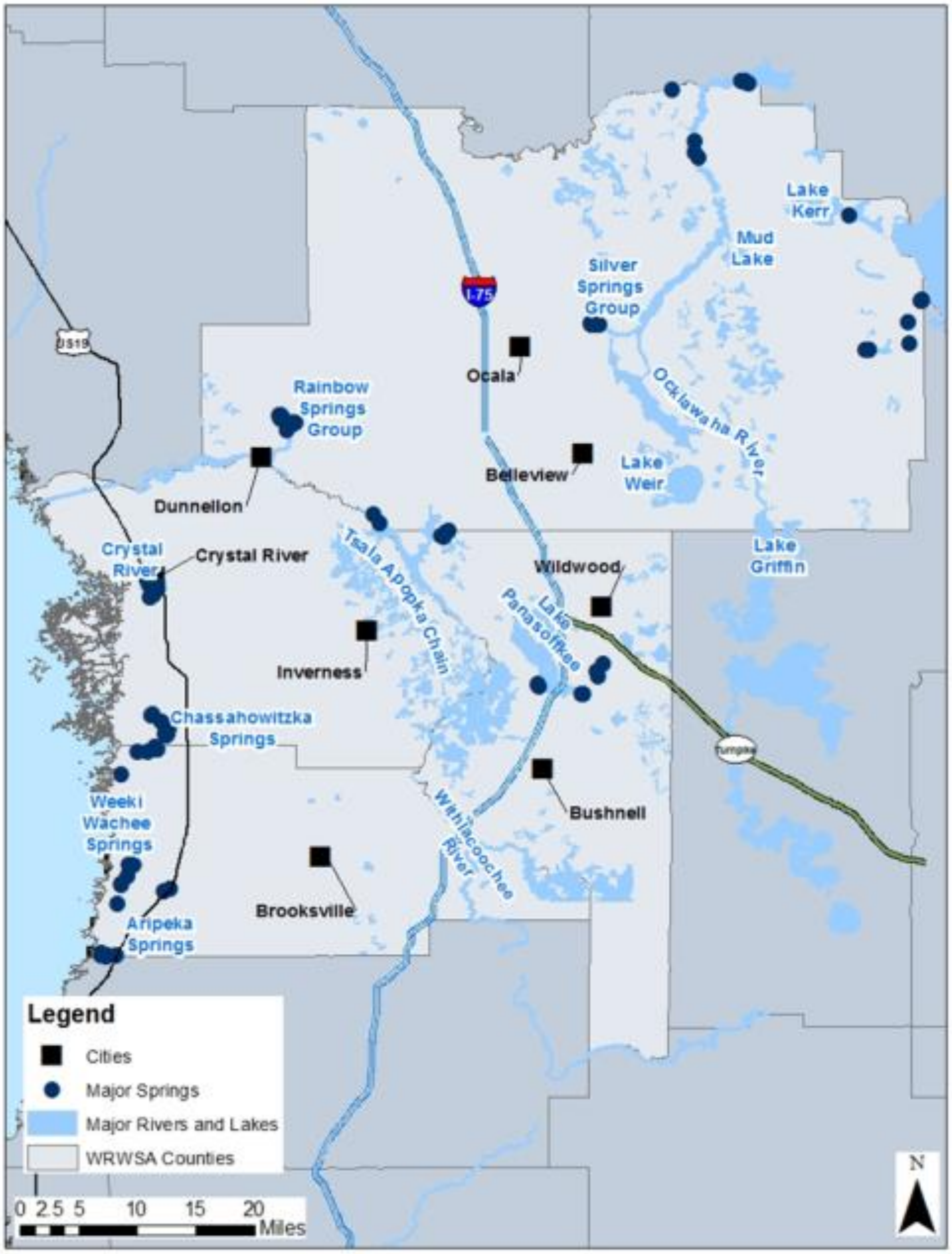

Figure 1-2. Major Hydrologic Features in the WRWSA Region.

1.0 Rivers

Rivers in the Springs Coast Watershed include the Weeki Wachee and Mud Rivers in Hernando County and the Chassahowitzka, Homosassa, Halls, and Crystal Rivers in Citrus County. The rivers are relatively short (less than 10 miles in length) and their flow is derived primarily from spring discharge. The Withlacoochee River's tributaries include the Rainbow River in Marion County, the Little Withlacoochee River in northeast Hernando County and Sumter County, and

Jumper Creek and the Panasoffkee Outlet River in Sumter County. From its headwaters in the Green Swamp, the Withlacoochee River traverses eight counties before discharging into the Gulf of Mexico. The Green Swamp is also the source of the Hillsborough, Peace, and Ocklawaha Rivers. The Ocklawaha River, which originates in the Green Swamp and is fed by Lake Griffin and the Harris chain of lakes in Central Florida, flows nearly 75 miles in a northerly direction from its headwaters to the confluence with the St. Johns River. Significant inputs to the river's flow include contributions from the spring-fed Silver River and Orange Creek.

2.0 Lakes

Lakes include Lake Panasoffkee in Sumter County (4,460 acres), Bonable Lake in Marion County (211 acres), Lake Rousseau in Levy County (3,657 acres), and the Tsala Apopka Chain of Lakes in Citrus County (23,300 acres). The Tsala Apopka chain consists of interconnected ponds, marshes and the open water portions of primary pools at Floral City (9,100 acres), Inverness (8,000 acres) and Hernando (6,200 acres). In the SJRWMD portion of the WRWSA region, in Marion County, major lakes include Lake Kerr (2,924 acres), Lake Weir (5,617 acres), and a portion of Lake George (43,402 acres). Figure 1-2 depicts the locations of lakes in the WRWSA region greater than 20 acres in size.

3.0 Springs

Several first magnitude springs (discharge exceeds 100 cubic feet per second (cfs)) are located in the WRWSA region. These include the Rainbow and Silver Springs Groups and Silver Glen Springs in Marion County, the Crystal River Group, Chassahowitzka and Homosassa Springs Groups in Citrus County, and the Weeki Wachee Springs Group in Hernando County. The Rainbow Springs Group consists of multiple springs which are the source of the Rainbow River, which flows for approximately 5.9 miles before merging with the Withlacoochee River upstream of Lake Rousseau. Combined discharge of the Rainbow Springs Group averages 680 cfs (439 mgd), (SWFWMD, 2011) which makes it the fourth largest among Florida's 33 first magnitude springs. The King's Bay, Chassahowitzka, and Homosassa Springs Groups are located on Citrus County's gulf coast. The King's Bay Springs are part of a complex network of more than 30 springs that discharge into the tidally influenced Kings Bay at an average rate of 400 cfs (259 mgd) (SWFWMD, 2011). Because the springs are located within the saltwater interface, the boundary between fresh and saltwater in the Upper Floridan aquifer, most of the springs discharge water that is brackish to varying degrees. The Homosassa Springs Group discharges approximately 270 cfs (175 mgd) (SWFWMD, 2011) and together with springs on the Halls River, provides the majority of flow for the Homosassa River. The quality of water discharging from the main spring at the head of the Homosassa River is brackish. Chassahowitzka Springs is comprised of a group of springs with a combined average discharge of 130 cfs (84 mgd) (SWFWMD, 2011). The springs are the primary source of water for the Chassahowitzka River. The quality of water discharging from the largest spring at the head of the river is also brackish. The Weeki Wachee Main Spring is located at the head of the Weeki Wachee River and discharges at an average rate of 180 cfs (116 mgd) (SWFWMD, 2011). Because the spring is located considerably further inland than the springs discussed above, water discharging from the spring is always fresh. Several smaller springs discharge brackish water into the Weeki Wachee River downstream of the main spring (Jones et al., 1997).

Numerous smaller springs that are second magnitude or less (discharge between 10 cfs and 100 cfs), are located in the region. Fenny Springs, a second magnitude spring located in Sumter County, flows to Lake Panasoffkee and the Withlacoochee River. Gum Slough, a four-mile long spring run that flows into the Withlacoochee River, is fed by several springs located at the head of the slough in northwestern Sumter County. The Aripeka Springs group includes Hammock Creek and is composed of numerous small springs clustered in a one-square mile area of southwestern Hernando County.

The Silver Springs Group in Marion County consists of three major springs and multiple smaller springs with a combined average daily discharge of 740 cfs (478 mgd) (SWFWMD, 2011). The Silver Springs Group forms the headwaters of the Silver River, which flows approximately five miles eastward to the confluence with the Ocklawaha River. The Silver Springs Group is one of the largest spring groups in Florida. Silver Glen Springs in eastern Marion County is a first magnitude spring with an average flow of 102 cfs. The spring discharge flows approximately 0.75 mile east via a broad spring run to the St. Johns River. Fern Hammock, Juniper, and Salt Springs, also in eastern Marion County, are second magnitude springs that discharge into spring runs that ultimately reach the St. Johns River.

4.0 Wetlands

Wetlands in the region can be grouped into saltwater and freshwater types. Saltwater wetlands are found bordering estuaries which are coastal wetlands influenced by the mixing of freshwater and seawater. Salt grasses and mangroves are common estuarine plants. Significant coastal wetlands are located along the western portions of Hernando and Citrus counties.

Freshwater wetlands are common in inland areas. Hardwood-cypress swamps and marshes are two major freshwater wetland systems. Both systems are found either bordering lakes and rivers or standing alone as isolated wetlands. The hardwood-cypress swamps are forested systems with water at or above land surface for a considerable portion of the year. Marshes are typically shallower systems vegetated by herbaceous plants rather than trees. Wet prairies, also present in inland areas, are vegetated with a range of mesic herbaceous species and hardwood shrubs, and are inundated during the wettest times of the year. Extensive hardwood swamps and wet prairies occur throughout the Withlacoochee River watershed. The Green Swamp covers the entire southern end of Sumter County with isolated wetlands typically vegetated by herbaceous plants. The hardwood-cypress swamps in the Halpata Tastanaki Tract are a major freshwater system in southwestern Marion County.

Section 4. Geology/Hydrogeology

1.0 Upper Floridan Aquifer

The Upper Floridan aquifer system is the principal storage and water conveying aquifer in the region. Figure 1-3 is a generalized northeast-trending cross section from the coast in Citrus County to the southeastern border of Marion County. The cross section shows the Upper and Lower Floridan aquifers and the confining units that separate the aquifers.

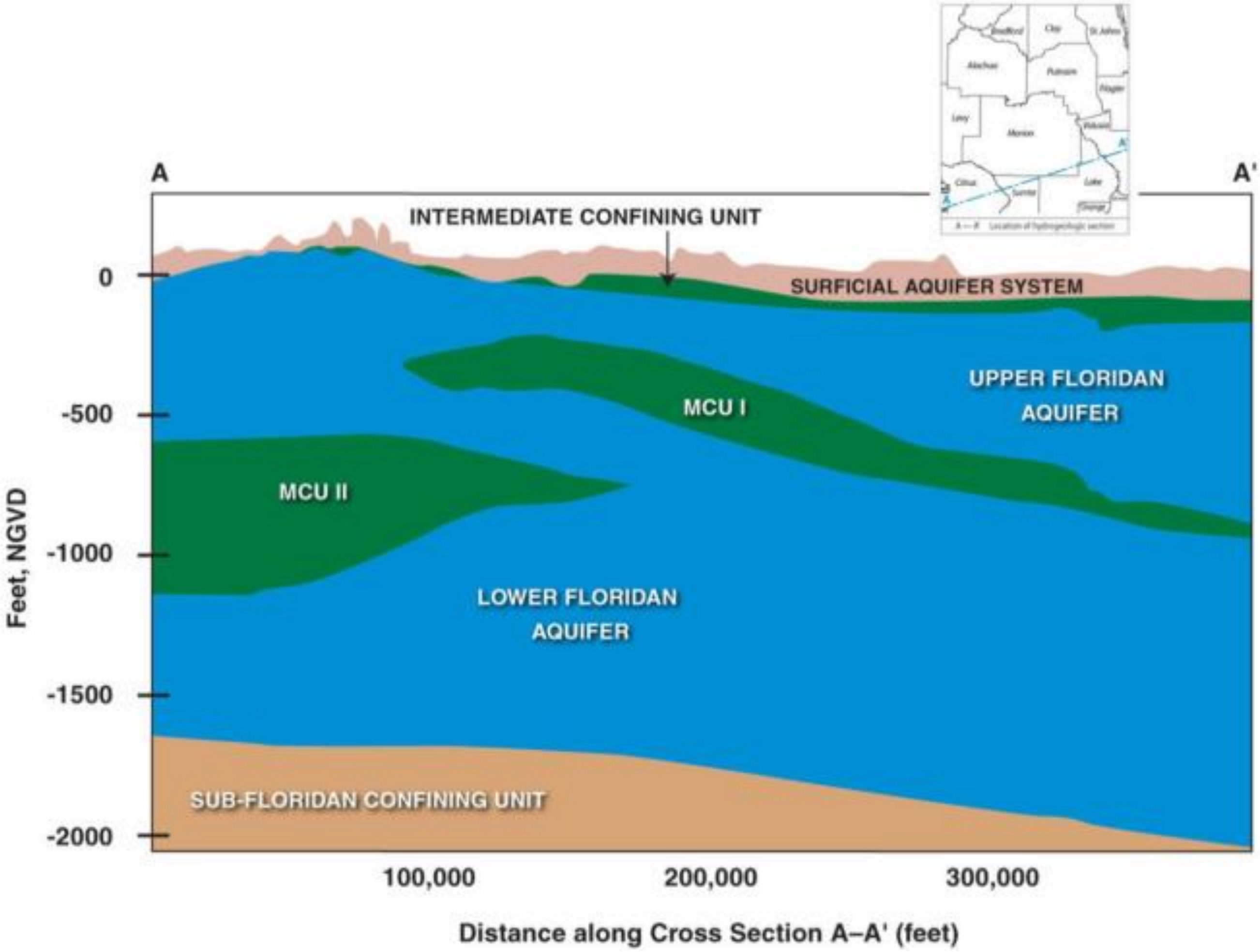

Figure 1-3. Generalized Northeast-Trending Cross Section Showing the Relationship between the Upper and Lower Floridan Aquifers and their Associated Confining Units (Modified from North-Central Florida Active Water Table Regional Groundwater Flow Model, SJRWMD, 2004)

The Upper Floridan aquifer is comprised of a thick sequence of marine carbonate deposits and is the main source for water supply for the region. The aquifer is largely unconfined, with a relatively thin sequence of sands, silts, and clays that overlies the carbonate deposits. The upper several hundred feet of limestone and dolomite comprise the most productive and utilized portion of the aquifer. Stratigraphic units of the Upper Floridan aquifer (in order of increasing geologic age and depth) include the Suwannee Limestone, the Ocala Limestone, and the Avon Park Formation.

The Suwannee Limestone is approximately 300 feet thick and is present at or near land surface in Hernando County (Yon and Hendry, 1972). It contains many solution channels and forms part of the upper flow zone for the Upper Floridan aquifer, which is the source for most of the spring discharge observed in the region (SWFWMD, 1987). The Ocala Limestone averages 300 feet in thickness and outcrops in southern Sumter County within the Green Swamp area. Extensive karst features can be observed in the surface outcrops and karst plains associated with both of the Suwannee and Ocala Limestones.

The Avon Park Formation averages about 600 feet in thickness and is composed of interbedded limestones and dolostones with locally-present gypsum beds. The formation underlies the entire region and outcrops in several areas of limited extent, mainly within Citrus County. The Avon Park Formation is the deepest potable water-bearing formation in the region and forms the lower flow zone for the Upper Floridan aquifer.

2.0 Lower Floridan Aquifer

The Lower Floridan aquifer underlies the Upper Floridan aquifer throughout the region. One or more “middle confining units” in the Middle Avon Park Formation affect the connectivity of the Upper Floridan and Lower Floridan aquifers. However, little is known regarding the degree and spacial extent throughout the region.

The Lower Floridan aquifer consists chiefly of portions of the lower Avon Park Formation and the Oldsmar Formation. Dominant lithologies of the aquifer include chalky, fossiliferous limestone and porous, crystalline dolomite, with some intergranular gypsum present (USGS, 1986). Some intervals within the aquifer are capable of yielding large quantities of groundwater and some municipalities in central Florida currently obtain municipal water supplies from the Lower Floridan aquifer.

The water quality in the Lower Floridan aquifer ranges from fresh to highly mineralized, depending on depth, confinement and other factors. Because of the spatial variability in water quality, and the high cost of drilling deep Lower Floridan aquifer wells (the top of the aquifer generally ranges from 800 to 1,200 ft below land surface), the aquifer has not been extensively developed for water supply purposes in the region. However, the Lower Floridan aquifer in the carbonates beneath MCU1 has been identified as a potential future water supply source by a number of utilities, particularly in Marion and Sumter counties.

Due to a general lack of information concerning the spacial characteristics of the Lower Floridan aquifer, site specific testing at any proposed Lower Floridan aquifer well location will be necessary to confirm water quality assumptions and quantify the degree of confinement between the Upper and Lower Floridan aquifers.

3.0 Karst Hydrogeology

Intensive karst development characterizes much of the region including the Coastal Swamps Lowlands, the Brooksville Ridge and the Tsala Apopka Plain. Numerous sinkholes, lack of surface drainage, and undulating topography play a dominant role in moving groundwater through the Upper Floridan aquifer. In karst areas, the dissolution of limestone has created and enlarged cavities along fractures in the limestone which eventually collapse and form sinkholes. Sinkholes capture surface water drainage and funnel it underground, which promotes further dissolution of limestone. This leads to progressive integration of voids beneath the surface and allows larger and larger amounts of water to be funneled into the underground drainage system. Many of these paths or conduits lie below the present water table and greatly facilitate groundwater flow. Because the altitude of the water table has shifted in response to historic changes in sea level, many vertical and lateral paths have developed in the underlying carbonate strata in the area (Carroll, 1970 and Jones et al., 1997).

Chapter 2. Water Resource Protection Strategies

This Chapter addresses the regulatory and minimum flows and levels (MFL) strategies that are being implemented by the water management districts in the WRWSA four-county region to protect water resources.

Part A. Water Management District Water Resource Protection Strategies

Section 1. SWFWMD Regulations Pertaining to the Northern District

In response to rapidly increasing development pressure in their Northern Planning Region, in 2007 the SWFWMD began developing a series of strategies to address water supply in this area, as well as in other areas of the District. These strategies included expansion of the Southern Water Use Caution Area (SWUCA) per capita requirements throughout the remainder of the District; potential designation of a WUCA in portions of Marion and Sumter counties; potential designation of a WUCA in all or part of Citrus and Hernando counties; and enhancing public supply water conservation requirements throughout the District.

Expansion of the SWUCA per capita requirements into the rest of the District, including the WRWSA region, occurred in 2008. These new requirements included a per capita water use standard of 150 gallons per day (gpd). Previously, 150 gpd per capita had been stated as a goal but not a requirement in the northern portion of the District. The 150 gpd standard must be achieved over a 10 year period with a minimum of 50 percent of the progress to achieving the standard being made in the first five years after the effective date of the rule (August, 2008). This phase-in is to allow permittees and their customers 10 years over which to depreciate the value of previous investments in less efficient irrigation equipment and landscapes. This phase-in also allows further time to develop alternative sources of water for irrigation such as reclaimed water. Other aspects of the per capita rulemaking included:

- refined service area delineation requirements and reporting necessary for enhanced use of GIS technology and accurate population estimation and projection;
- refined and additional significant use deductions in the per capita formula for large or regional commercial, industrial and institutional uses and a consistent service area population methodology where a permanent and seasonal functional population estimation is required, and optional tourist and net commuter population estimates with prescribed methodology;
- annual residential water use reporting;
- annual reclaimed/stormwater reporting;
- allowing golf course irrigation within a permittee's service area where the irrigation quantities to be included in the permitted quantities for the service area and reported as withdrawals;
- allowing stormwater use inside a permittee's service area, used other than for golf course irrigation, to be included in the permitted quantities for the service area and are reported as withdrawals;

- allowing deduction of 50 percent of the reclaimed water provided outside the permittee's service area or 25,000 gpd or more annual average provided to a single-site within the permittee's service area, except not if used for residential or common area irrigation, and
- allowing a persons-per-household (pph) of 2.01 to be substituted for the actual service area pph in the calculation of the functional population when compliance with the 150 gallons per capita per day (gpcd) cannot be achieved by all allowable deductions and credits and the actual pph is less than 2.01. This allowance addressed the concerns of utilities that have a high per capita water use, in part due to a low service area pph.

The Enhanced Conservation Rulemaking effort was geared at addressing increasing water use efficiency in the northern portion of the District that was not in a Water Use Caution Area, enhancing water conservation requirements District-wide for all five major use types, establishing water conservation requirements for all applications for water use permits, and expanding feasibility studies and required use of reclaimed water in lieu of ground or surface water as a water source. These rules apply predominantly to permits of 100,000 gpd and greater. The major changes affecting public supply use include:

- setting a maximum water loss standard at 10 percent of the output from treatment plants;
- requiring wholesale WUPs for all wholesale public supply utilities that receive a combined total of 100,000 gpd or more from other permittees on an annual average basis;
- requiring a water-conserving rate structure to be adopted by all public supply permittees by January 1, 2012;
- requiring standardized billing and information inclusions to enable customers to understand the financial impact of their water use;
- making the annual reporting of reclaimed water compatible with the reporting requirements of the FDEP and for cooperatively funded projects;
- standardizing water conservation requirements for the other four use types and requiring them upon application for a new, renewal or modification of a WUP;
- use of Florida-friendly landscape principles and components required for permittees that have permitted quantities to irrigate lawn and landscape; and
- defining “common areas” and requiring the use of alternative water supply sources where available.

These rules became effective in April, 2010.

Recently, there was a statewide effort to develop a level of consistency between the water management districts’ consumptive use permitting processes, known as CUPCON, led by the FDEP. Phase 1 of the effort has been completed and it does not appear that any of the proposed rules will significantly impact the WRWSA.

In the 2007-2010 timeframe, the SWFWMD conducted a public outreach campaign to engage stakeholders, decision-makers, residents, and regulated communities in their northern planning region. These efforts included a conservation summit for local governments and utilities, individual meetings with local government staff, and joint coordination meetings with the WRWSA, the Withlacoochee Regional Planning Council, editorial boards, and other agencies.

Consideration of the establishment of a Water Use Caution Area in the northern District has been intermittently discussed, but at this time there are no plans to initiate one. SJRWMD Strategies

In the draft SJRWMD District Water Supply Plan, which has yet to be approved by the Governing Board, the SJRWMD declared that each of the water supply planning regions analyzed within the plan shall be considered a Water Resource Caution Area (WRCA - previously "Priority" Water Resource Caution Area, or PWRCA). This includes the eastern portion of Marion County in the WRWSA region. This designation is based on a comparison of water resource constraints to the results of assessments of hydrologic impacts due to 2035 projected water use. WRCAs are areas where existing and reasonably anticipated sources of water and conservation efforts may not be adequate to supply water for all existing legal uses and reasonably anticipated future needs and to sustain the water resources and related natural systems. The SJRWMD identified WRCAs based on the water resource constraints and the results of water use, groundwater, and surface water assessments.

Part B. Minimum Flows and Levels

Section 1. Statutory and Regulatory Framework

An MFL is the level or flow below which significant harm occurs to the water resources or ecology of the area resulting from permitted water withdrawals. The Florida Water Resources Act (Chapter 373, F.S.) and the Water Resource Implementation Rule (Chapter 62-40, F.A.C.) provide the basis for establishing MFLs and explicitly include provisions for setting them. The Water Resources Act requires the water management districts to establish minimum levels for both ground and surface waters and minimum flows for surface-watercourses below which significant harm to the area's water resources or ecology would result. Chapter 373 requires the water management districts to annually update and submit for approval by the FDEP a priority list and schedule for the establishment of MFLs throughout their respective jurisdictions.

In accordance with the requirements of Section 373.042, F.S., the water management districts have established and annually update a list of priority ground and surface waters for which MFLs will be set. As part of determining the priority list and schedule, the factors listed below are considered:

- the importance of the water bodies to the state or region;
- the existence of or potential for significant harm to the water resources or ecology of the state or region to occur;
- the required inclusion of all first magnitude springs and all second magnitude springs within state or federally owned lands purchased for conservation purposes;
- the availability of historic hydrologic records (flows and/or levels) sufficient to allow statistical analysis and calibration of computer models when selecting particular water resources in areas with many water resources;
- the proximity of MFLs already established for nearby water resources;
- the possibility that the water resource may be developed as a potential water supply in the foreseeable future; and
- the value of developing an MFL for regulatory purposes or permit evaluation.

Section 2. SWFWMD MFLs Program

1.0 Background

Since the early 1970's, the SWFWMD has been engaged in an effort to develop MFLs for water resources. The SWFWMD implements established MFLs primarily through its water resource evaluation and water use permitting programs, and by funding water resource and water supply development projects that are part of a recovery or prevention strategy. Beginning with legislative changes to the MFL statute in 1996, this District has accelerated its program for the development of MFLs.

2.0 Technical Approach to MFL Establishment

The SWFWMD's approach to establishing MFLs assumes that hydrologic regimes that differ from historic conditions exist, but those regimes will protect the structure and function of aquifers and other water resources from significant harm. For example, consider a historic condition for an unaltered river or lake system with no local ground or surface water withdrawal impacts. A new hydrologic regime for the system would be associated with each increase in water use, from very small withdrawals that have no measurable effect on the historic regime to very large withdrawals that could markedly alter the long-term hydrologic regime. A threshold hydrologic regime may exist that is lower than the historic regime, but which protects the water resources and ecology of the system from significant harm. The threshold regime, resulting primarily from water withdrawals, would essentially preserve the natural flow regime, but with changes to the amplitude in flows that reflect a general lowering across the entire flow range. The purpose of establishing MFLs is to define the threshold hydrologic regime that would allow for water withdrawals while protecting the water resources and ecology from significant harm. Thus, MFLs represent minimum acceptable rather than historic or optimal hydrologic conditions.

3.0 Prevention Strategy

Although not formalized as such, the SWFWMD utilizes a three-point strategy to address MFLs: 1) monitoring water levels and flows for water resources/sites with established MFLs to evaluate the need for prevention strategies; 2) assessment of potential water supply/resource problems as part of the regional water supply planning process; and 3) implementation of the water use permitting program, which ensures that water withdrawals do not cause violation of established MFLs. In addition to the development of a RWSP for the Northern Planning Region, the District and other entities in the region are involved in additional water resource assessments and planning efforts. The goal is to insure that future water supply demands will be met without adversely impacting proposed or established MFLs.

4.0 Status of MFL Establishment in the WRWSA Four-County Region

Table 2-1 lists the MFL Priority Waterbodies for which MFLs have been established in the SWFWMD portion of the WRWSA four-county region and Table 2-2 lists the MFL Priority Waterbodies for which MFLs have not yet been established and their anticipated dates of establishment.

Table 2-1. MFLs Established for Priority Waterbodies in the SWFWMD Portion of the WRWSA Four-County Region.

Waterbody	County	Adoption Date	Effective Date
Springs			
Weeki Wachee River and Spring	Hernando	4/20/2009	5/10/2009
Homosassa River System	Citrus	2/28/2013	3/20/2013
Chassahowitzka River System and Springs	Citrus	2/28/2013	3/20/2013
Lakes			
Hunters Lake	Hernando	5/12/2005	6/5/2005
Lake Lindsey	Hernando	5/12/2005	6/5/2005
Mountain Lake	Hernando	5/12/2005	6/5/2005
Neff Lake	Hernando	5/12/2005	6/5/2005
Spring Lake	Hernando	5/12/2005	6/5/2005
Weeki Wachee Prairie Lake	Hernando	5/12/2005	6/5/2005
Tooke Lake	Hernando	2/1/2013	2/21/2013
Whitehurst Lake	Hernando	2/1/2013	2/21/2013
Lake Fort Cooper	Citrus	1/23/2007	2/12/2007
Tsala Apopka Chain	Citrus	1/23/2007	2/12/2007
Deaton Lake	Sumter	1/23/2007	2/12/2007
Big Gant Lake	Sumter	1/23/2007	2/12/2007
Lake Panasoffkee	Sumter	1/23/2007	2/12/2007
Lake Miona and Black Lake	Sumter	1/23/2007	2/12/2007
Okahumpka Lake	Sumter	1/23/2007	2/12/2007
Lake Bonable	Marion	2/1/2013	2/21/2013
Little Lake Bonable	Marion	2/1/2013	2/21/2013
Tiger Lake	Marion	2/1/2013	2/21/2013

Table 2-2. MFL Establishment Schedule for Priority Waterbodies in the SWFWMD Portion of the WRWSA Four-County Region.

Waterbody	Schedule	County
Springs		
King's Bay	2016	Citrus
Gum Springs Group	2014	Sumter
Rainbow River and Springs	2016	Marion
Lakes		
Whitehurst	2014	Hernando
Rivers		
Crystal River System	2016	Citrus
Upper Withlacoochee River	2016	Hernando
Middle Withlacoochee River	2016	Sumter
Lower Withlacoochee River	2016	Citrus
Chassahowitzka River and Springs (re-evaluation)	2019	Citrus
Homosassa River and Springs (re-evaluation)	2019	Citrus

In 2012, the SWFWMD's Governing Board approved minimum flows for the Homosassa and Chassahowitzka Spring groups that were considerably more restrictive than what was recommended by the District's technical staff. The adopted minimum flows only allow for a 3 percent decline in flow for each spring group from pre-pumping conditions. The recent groundwater availability investigation for the northern District conducted by the SWFWMD using the Northern District Groundwater Flow Model (Chapter 4), predicted that reductions in flow for Homosassa and Chassahowitzka Spring groups resulting from projected 2035 groundwater withdrawals would be 2.9 percent and 1.9 percent, respectively. This indicates that the ability to utilize groundwater from the Upper Foridan aquifer to meet demands beyond 2035 could be limited in certain areas.

For Weeki Wachee Springs in Hernando County, actual flows were previously thought to be on the cusp of the 10 percent flow reduction allowed by the minimum flow However, with the pumpage reductions from Tampa Bay Water's Cross Bar Ranch Wellfield in recent years and reductions in western Hernando County (Spring Hill), actual impacts are now down in the range of 7 percent.

Section 3. SJRWMD MFLs Program

1.0 Background

The SJRWMD initiated their MFLs program in response to Section 373.415[3], Florida Statutes [1988]. This legislation directed the SJRWMD to establish MFLs for the Wekiva River System & minimum water levels for the aquifer underlying the Wekiva Basin, no later than March 1, 1991. MFLs were adopted in 1992 for the Wekiva River at SR46, and Black Water Creek at

SR44. The underlying aquifer was addressed by setting MFLs for Messant, Miami, Palm, Rock, Sanlando, Seminole, Starbuck, and Wekiwa Springs. These were the first MFLs adopted by SJRWMD. In the early-to-mid 1990's, the SJRWMD progressed to lakes and springs in the fern-growing area of Putnam and Volusia counties. MFLs have currently been set by the SJRWMD for 101 lakes, 7 wetlands, 9 springs, and 6 river reaches.

2.0 Technical Approach to MFL Establishment

The SJRWMD has developed a MFLs method that has been applied to rivers, lakes, wetlands, and springs. The method is primarily focused on ecological protection to ensure systems meet minimum eco-hydrologic requirements. Information from elevation transects is typically used to determine multiple MFLs which define a minimum hydrologic regime to ensure that high, intermediate, and low hydrologic conditions are protected. MFLs are often expressed as statistics of long-term hydrology incorporating magnitude (flow and/or level), duration (days), and return interval (years) to define how often and for how long the high, intermediate and low water flows and/or levels should occur to prevent significant harm. Two to five MFLs are typically defined for each system and include the minimum infrequent high, minimum frequent high, minimum average, minimum frequent low and minimum infrequent low (Figure 2-1). Figure 2-2 represents two example hydrographs depicting the fluctuation of high and low water levels or flow in a typical stream or lake over a long time period. The upper line represents the existing hydrologic conditions and the lower line represents the hydrologic conditions defined by the MFLs. The hydrologic conditions defined by the MFLs are similar to, but are usually lower than, the existing hydrologic conditions.

These hydrographs can be summarized as the percentage of time each water level or flow is equaled or exceeded; this is called a water level or flow duration curve (Figure 2-3). The area below the MFLs curve (salmon-colored shaded area) represents the water reserved for protection of fish and wildlife or public health and safety. When use of water resources shifts the water levels below that defined by the MFLs, significant ecological harm is expected to occur. The distance between the two curves (light blue shaded area) represents the water available for use that will not result in significant harm to the water resources.

3.0 Prevention/Recovery Strategy

The goal of a SJRWMD Prevention/Recovery Strategy is to develop a suite of projects and measures that would meet both projected future water demands and applicable MFLs. The SJRWMD approach to Prevention/Recovery strategies consists of the following types of actions:

- water conservation;
- development of alternative water supplies (reclaimed water, surface water, and brackish groundwater);
- aquifer recharge;
- use of the existing consumptive use permitting program to implement projects and adjust allocations to ensure that water withdrawals do not cause violation of established MFLs;
- water level and flow monitoring; and
- adaptive management.

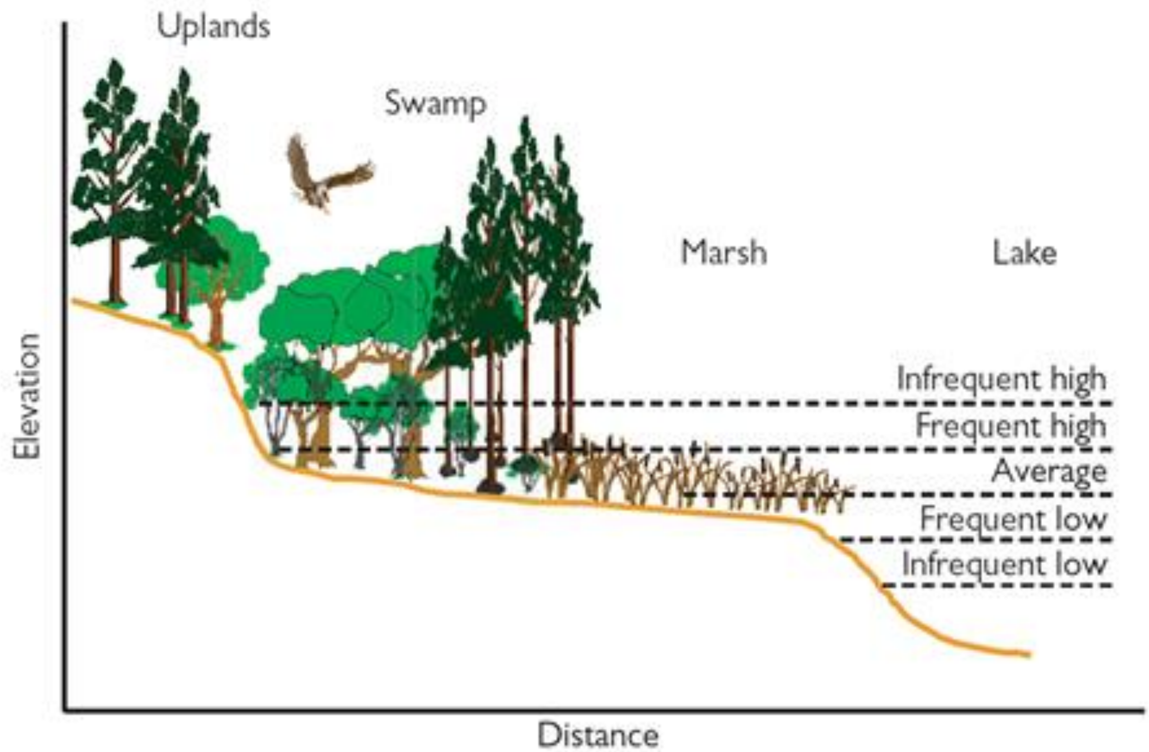

Figure 2-1. Illustration of the Range of Hydrologic Conditions Protected by the SJRWMD MFLs.

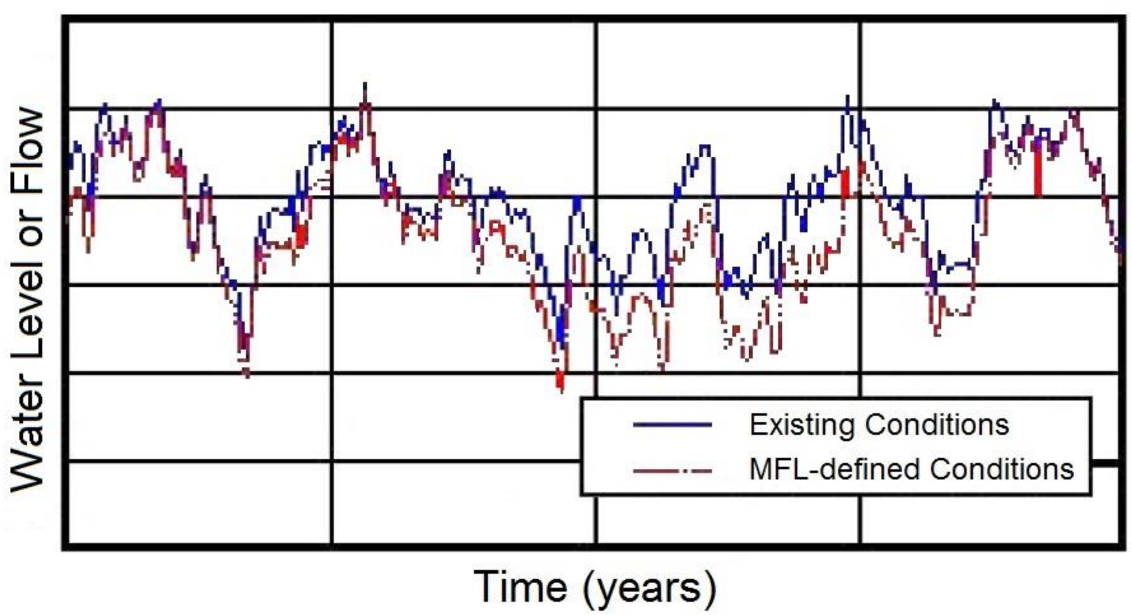

Figure 2-2. Hydrograph Showing a Typical Relationship between the Existing Hydrologic Conditions in a Stream or Lake and the MFLs Condition.

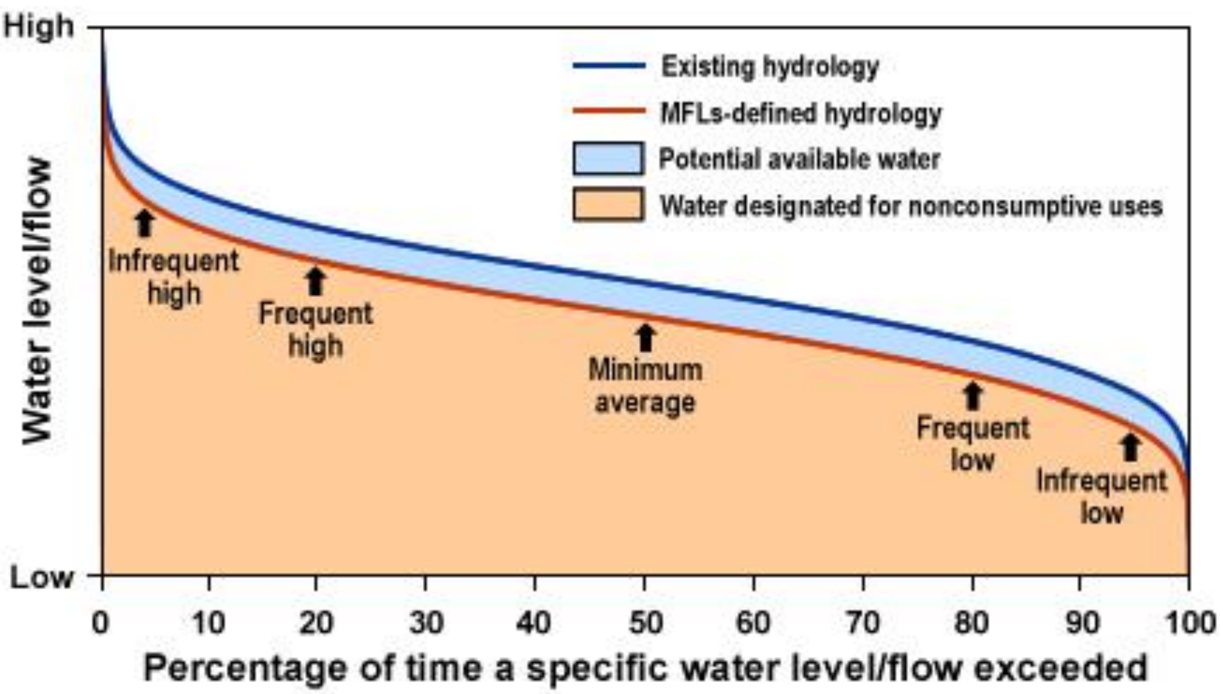

Figure 2-3 Example of a Flow Duration Curve.

4.0 Status of MFL Establishment in the WRWSA Four-County Region

Tables 2-3 and 2-4 list the MFL Priority Waterbodies for which MFLs have been established in the SJRWMD portion of the WRWSA region and the MFL Priority Waterbodies for which MFLs have not yet been established and their anticipated dates of establishment, respectively.

Table 2-3. MFLs Established for Priority Waterbodies in the SJRWMD Portion of the WRWSA's Four-County Region.

Waterbody	County
Bowers Lake	Marion
Charles Lake	Marion
Halfmoon Lake	Marion
Hopkins Prairie	Marion
Lake Kerr (re-evaluate in 2014)	Marion
Nicotoon Lake	Marion
Smith Lake	Marion
Lake Weir	Marion

Table 2-4. MFL Establishment Schedule for Priority Waterbodies in the SJRWMD Portion of the WRWSA's Four-County Region.

Waterbody	Schedule	County
Springs		
Silver Springs	2013[1]	Marion
Silver Glen Springs	2015-2020	Marion
Rivers		
Ocklawaha River (Lower)	2013[1]	Marion

[1]Notice of rule development was published in 2013 for Silver Springs/Silver River and Lower Ocklawaha River.

MFLs for Silver Springs/Silver River are currently being developed by the SJRWMD and will likely impact resource availability. An analysis by SJRWMD staff indicates that the current draft MFLs would not be met under 2035 projected demands. Therefore, the SJRWMD is currently working on tools to assist in the development of a prevention/recovery strategy.

Part C. Inter-district Coordination

Due to trans-boundary water resource issues between the two districts in the Sumter/Marion/Lake county area, a formalized construct for inter-district coordination known as the North Central Florida Coordination Area was established in 2006. Numerous meetings were held for the purpose of better coordinating water resource investigations and planning activities within this region. For various reasons, this formal initiative ceased in 2009; however, the technical staffs of the districts continue to coordinate regarding water supply planning, resource assessment, model development, and MFL activities in the region. Most recently, the two districts collaborated to merge the SWFWMD's Northern District Model with the SJRWMD's North Central Florida Model into a single groundwater model that encompasses, among other areas, the area from the gulf coast to the St. Johns River east of Marion County. This effort was funded by both districts, Marion County and the WRWSA. Utilization of this model should ensure consistent results between the two districts pertaining to the Sumter and Marion County areas, in particular.

Chapter 3. Water Demand Projections

This Chapter is a comprehensive analysis of the demand for water for the public supply water-use category in the WRWSA four-county region for the planning period. It also includes projections for the domestic self-supply, agricultural, industrial/commercial, and recreational water-use categories. The projected demand represents the total amount of water required to meet reasonable and beneficial water needs from the 2010 base year through 2035 and does not account for reductions that could be achieved by demand management measures. Water conservation is accounted for separately in Chapter 4 as a means by which demand can be reduced. Demands were developed for average precipitation conditions (5-in-10) and drought conditions (1-in-10) and are presented in five-year increments.

Part A. Demand Projection Methodology

The following is a brief summary of the methods used to project water demand for each water-use category. Table 3-1 contains a brief description of each category.

Table 3-1. Description of Water Uses that Comprise Each Use Category.

Water Use Category	Abbreviation[1]	Description of Uses
Agricultural	AG	Irrigation of crops, livestock watering, and aquaculture
Industrial, Commercial, Institutional	I/C	Businesses, manufacturing facilities, schools, hospitals, hotels, processing facilities, industrial fire protection, mining, and thermoelectric power generation
Domestic Self Supply	DSS	Self-served potable and household uses for individual (or multi-family) residences
Public Water Supply	PS	Mainly potable and household uses; some commercial, institutional, and industrial users are also connected to public water supply systems
Recreational	REC	Golf course and landscape irrigation

[1]*Water Use Abbreviations are used in other tables in this chapter.*

Section 1. Data Sources

Data used to develop the water demand projections for all use categories were obtained from the SWFWMD and SJRWMD. The projections were developed by both districts in support of their regional water supply planning processes. Table 3-2 provides an overview of the data sources used in the preparation of the projections.

Section 2. Methodology

The SWFWMD and SJRWMD use a variety of methods in the development of their population and water demand projections. Table 3-3 provides a brief overview of the methods used in the development of the projections presented in this document. A detailed overview of the projection methods and input data sources used by the SWFWMD and SJRWMD is contained in the following documents:

Table 3-2. Water Demand and Population Projection Data Sources by Year and County.

<table>
<tr><th rowspan="2">County</th><th colspan="6">Water Use and Population Projection Data Source(s)</th></tr>
<tr><th>2010 (Base Year)</th><th>2015</th><th>2020</th><th>2025</th><th>2030</th><th>2035</th></tr>
<tr><td>Citrus</td><td colspan="5" rowspan="3">AG, I/C, and Rec water demand projections were obtained from spreadsheets used in the SWFWMD's 2010 Northern Planning Region RWSP. For the DSS and PS categories, population and water demand projections were obtained from SWFWMD's Public Supply Demand Projections Technical Memorandum, March 5, 2013. The 2010 SWFWMD Northern Planning Region RWSP and the Public Supply Demand Projections Technical Memorandum provide an overview of the methods used in developing the projections.</td><td rowspan="3">For the AG, I/C, and Rec categories, linear projections were developed based on the trends from 2010-2030. For the DSS and PS categories, population and water demand projections were obtained from SWFWMD's Public Supply Demand Projections Technical Memorandum.</td></tr>
<tr><td>Hernando</td></tr>
<tr><td>Marion - SWFWMD Portion</td></tr>
<tr><td>Marion - SJRWMD Portion</td><td colspan="6">AG, DSS, I/C, PS, and Rec water use projections, in addition to population projections, were provided by SJRWMD staff in spreadsheet format, dated February 27, 2013. The spreadsheets were developed to support the draft SJRWMD DWSP.</td></tr>
<tr><td>Sumter</td><td colspan="5">AG, I/C, and Rec water demand projections (5-in-10 and 1-in-10) were obtained from spreadsheets used in SWFWMD's 2010 Northern Planning Region RWSP. For the DSS and PWS water use sectors, population and water demand projections were obtained from SWFWMD's Public Supply Demand Projections Technical Memorandum, dated March 5, 2013. The 2010 SWFWMD Northern Planning Region RWSP and the Public Supply Demand Projections Technical Memorandum provide an overview of the methods used in developing the projections.</td><td>For the AG, I/C, and Rec categories, linear projections were developed based on the trends from 2010-2030. For the DSS and PS water use sectors, population and water demand projections were obtained from SWFWMD's Public Supply Demand Projections Technical Memorandum.</td></tr>
</table>

- 2010 SWFWMD Northern District Regional Water Supply Plan;
- SWFWMD Public Supply Demand Projections Technical Memorandum (March 5, 2013 and May 3, 2013 versions);
- 2005 SJRWMD Districtwide Water Supply Assessment and associated addenda;
- supporting data associated with the draft SJRWMD DWSP; and
- the Water Demand Projection and Distribution Methodology of the SJRWMD for the 2008 District Water Supply Assessment and the 2010 District Water Supply Plan (GIS Associates, Inc. for SJRWMD in 2009).

It is important to understand the inherent difficulty and potential uncertainties in projecting population and water use over a twenty-year period. Many factors which are not foreseeable can potentially affect future population growth, economic activities, and water demand. For example, the development of a thermoelectric power generation facility, or a large scale biofuel farm during the planning period could substantially change the total water demands in the WRWSA region. While uncertainties are present in the projections, they are an integral part of the planning process and drive the decision-making behind many components presented in this Water Supply Plan. It is important that water supply planning actions be undertaken and updated periodically so that current trends are reflected in the planning process and that an adaptive water management approach can be taken to insure the continued provision of water resources to meet beneficial uses while protecting environmental values.

Table 3-3. Water Demand Projection Methods used in the Regional Water Supply Plan.

<table>
<tr><th rowspan="2">Water Management District</th><th rowspan="2">Water Use Category</th><th colspan="2">Methods Used to Project Water Demands</th></tr>
<tr><th>2010 (Base Year) - 2030</th><th>2035</th></tr>
<tr><td rowspan="5">SWFWMD</td><td>Agricultural[1]</td><td>Acreage trends for each crop type were determined using water use permit data (1998-2008). These trends were extrapolated through 2030. Then, irrigation application rates for each crop type were multiplied by projected crop acreage. Ag demands = projected crop acreage multiplied by irrigation application rate.</td><td>Extrapolated from linear trend of existing Ag projections (2010-2030).</td></tr>
<tr><td>Domestic Self Supply[2]</td><td colspan="2">DSS demands = average per capita residential water use (for the years 2007-2011) multiplied by the projected population for areas outside of a utility service area (derived from the SWFWMD GIS-based Population Projection model).</td></tr>
<tr><td>Industrial/ Commercial[3]</td><td>I/C demands = 2010 permitted I/C quantities (from the district's Water Use Permit database) multiplied by the average percentage of total permitted quantities used by permittees (2001-2006). A growth trend was then applied to the 2010 base year I/C demand to derive projections.</td><td>Extrapolated from linear trend of existing I/C projections (2010-2030).</td></tr>
<tr><td>Public Water Supply[2]</td><td colspan="2">PS demands = average per capita residential water use (for the years 2007-2011) was multiplied by the projected population for each utility service area (derived from the SWFWMD GIS-based Small Area Population Projection Model).</td></tr>
<tr><td>Recreational[4]</td><td>Golf course irrigation demands = average golf course irrigation water use (2003-2007) per hole multiplied by a linear trend equation reflecting the number of golf course holes likely to be built through the year 2030. Landscape demands = average per capita landscape irrigation water use (2003-2007) multiplied by projected county population (2010 - 2030). Rec demands = golf course irrigation demand + landscape irrigation demand.</td><td>Extrapolated from linear trend of existing Rec projections (2010-2030).</td></tr>
<tr><td rowspan="5">SJRWMD</td><td>Agricultural[5]</td><td colspan="2">Ag demands = projected agricultural acreage (determined based on trends between 1995 and 2005) multiplied by 2005 irrigation water application rate.</td></tr>
<tr><td>Domestic Self Supply[5]</td><td colspan="2">DSS demands = average per capita residential water use (for the years 2006-2010) multiplied by the projected population for areas outside of a utility service Area (derived from the GIS-based Population Projection Model)</td></tr>
<tr><td>Industrial / Commercial[5]</td><td colspan="2">I/C demands = average I/C water use (for the years 1995-2005) multiplied by the population growth rate (2005-2030).</td></tr>
<tr><td>Public Supply[5]</td><td colspan="2">PS demands = average gross per capita water use (for the years 2006-2010) multiplied by the projected population for each utility service area (derived from the GIS-based Population Projection Model).</td></tr>
<tr><td>Recreational[5]</td><td colspan="2">REC demands = average golf course and aesthetic irrigation rates (per acre, 1995-2005) multiplied by the population growth rate (2005-2030).</td></tr>
</table>

[1]*Refer to Appendix 3-1 to the 2010 SWFWMD Northern Planning Region RWSP for additional details on the methods used.*

[2]*Refer to the SWFWMD Public Supply Demand Projections Technical Memorandum (March 5, 2013) for additional details on the methods used.*

[3]*Refer to Appendix 3-2 to the 2010 SWFWMD Northern Planning Region RWSP for additional details on the methods used.*

[4]*Refer to Appendix 3-4 to the 2010 SWFWMD Northern Planning Region RWSP for additional details on the methods used.*

[5]*Refer to SJRWMD Special Publication SJ2010-SP1 and Draft Tables 1-12 of the SJRWMD DWSP for additional details on the methods used.*

Part B. Demand Projections by County

Section 1. Citrus County

1.0 Public Supply

The population of the public supply utility service areas in Citrus County (Figure 3-1) is expected to increase by approximately 34 percent or 32,000 people from 2010 through 2035 (Table 3-4). Utilities in the county will need to develop an additional 5.3 mgd of water to meet public water supply demands within their service areas during this period (Table 3-5).

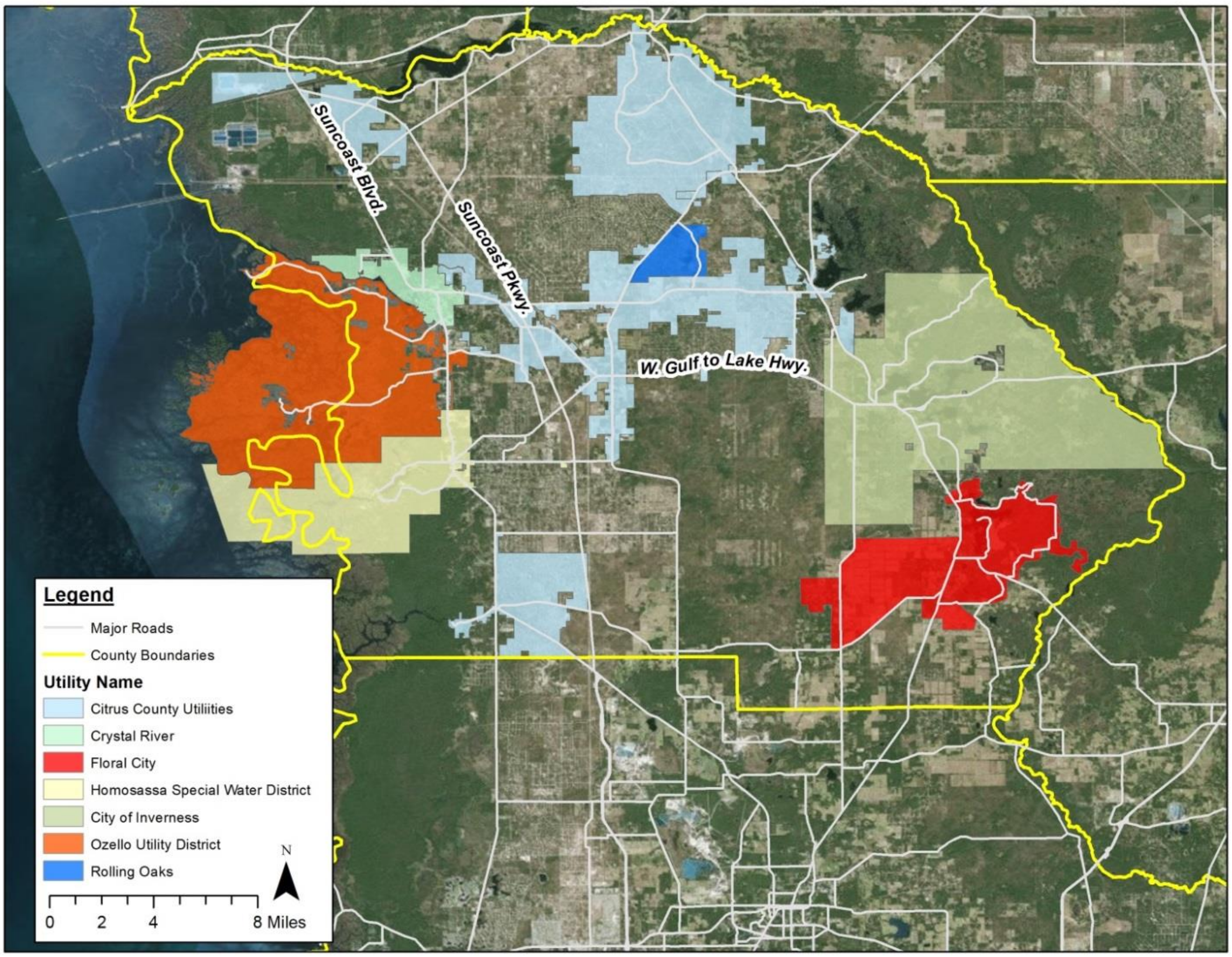

Figure 3-1. Major Public Supply Utility Service Area Boundaries in Citrus County.

2.0 Projections for all Water Use Categories

Projections developed for all water use categories in Citrus County indicate that water demand will increase by approximately 33 percent between 2010 and 2035 (Table 3-6 and Figure 3-2). The largest increases will occur in the public supply, domestic self-supply, and recreational categories. In total, approximately 10.6 mgd of additional water supplies will need to be developed to meet water needs for all use categories in Citrus County through the year 2035.

Table 3-4. Citrus County Public Supply Service Area Population Projections (2010-2035).

Utility Name	2010 Population	Projected Public Supply Population				
		2015	2020	2025	2030	2035
Small Utilities[1]	3,688	3,554	3,694	3,698	3,701	3,704
City Of Crystal River	4,580	5,465	5,544	5,619	5,688	5,752
City Of Inverness	8,973	9,194	9,480	9,742	9,975	10,181
Floral City Water Assoc.	7,527	7,384	7,397	7,411	7,425	7,439
Citrus County CS/PR	15,904	16,018	21,088	25,935	30,462	34,763
Rolling Oaks Utilities, Inc.	9,767	9,940	10,043	10,142	10,233	10,318
Homosassa Special Water District	5,400	5,714	6,169	6,599	6,994	7,356
Gulf Highway Land Corporation	600	562	564	565	567	568
Citrus County & WRWSA CAB	22,851	24,496	25,960	27,337	28,597	29,760
Citrus County SMW	9,677	9,646	9,821	9,997	10,170	10,341
GCP Walden Woods 1 and 2	403	413	413	413	413	413
Ozello Water Association	4,174	4,530	4,661	4,784	4,896	4,999
TOTALS	**93,546**	**96,917**	**104,835**	**112,241**	**119,121**	**125,595**

[1]Small Utilities includes utilities which were permitted to use 100,000 gallons or less per day in the year 2010.

Table 3-5. Citrus County Public Supply Demand Projections (2010-2035).

Utility Name	2010 Water Demand (mgd)	Average Per Capita, gpcd (2007-2011)	Projected Public Supply Demands (mgd)				
			2015	2020	2025	2030	2035
Small Utilities[1]	0.57	153	0.55	0.57	0.57	0.57	0.57
City Of Crystal River	0.55	119	0.65	0.66	0.67	0.68	0.69
City Of Inverness	1.28	143	1.31	1.36	1.39	1.43	1.46
Floral City Water Assoc.	0.43	57	0.42	0.42	0.43	0.43	0.43
Citrus County CS/PR	2.61	164	2.62	3.45	4.25	4.99	5.69
Rolling Oaks Utilities, Inc.	1.40	143	1.42	1.44	1.45	1.47	1.48
Homosassa Special Water District	0.74	137	0.79	0.85	0.91	0.96	1.01
Gulf Highway Land Corporation	0.11	183	0.10	0.10	0.10	0.10	0.10
Citrus County & WRWSA CAB	3.73	163	4.00	4.24	4.46	4.67	4.86
Citrus Coounty SMW	2.11	218	2.10	2.14	2.18	2.21	2.25
GCP Walden Woods 1 and 2	0.08	205	0.08	0.08	0.08	0.08	0.08
Ozello Water Association, Inc.	0.49	117	0.53	0.55	0.56	0.57	0.58
Additional Irrigation Demand[2]	0.63	-	0.65	0.70	0.74	0.78	0.82
TOTALS	**14.70**	-	**15.20**	**16.56**	**17.79**	**18.95**	**20.00**

[1]Small Utilities includes utilities which were permitted to use 100,000 gallons or less per day in the year 2010.
[2]Additional Irrigation Demand includes groundwater supplied via private wells for use in lawn irrigation within a utility service area. Homeowners obtain potable water via a connection with a utility, but meet irrigation needs using their own well.

Table 3-6. Citrus County Water Demand Projections for all Use Sectors (2010-2035).

Water Use Type	2010 Base Demand (mgd)		Citrus County Incremental Change in Water Demand (mgd)												2035 Total Demand (mgd)	
			2015		2020		2025		2030		2035		Total Increase			
	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10
Agricultural	0.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.5
Domestic Self Supply	7.6	8.0	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	1.8	1.8	9.4	9.8
Industrial Commercial	2.8	2.8	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4	0.4	3.3	3.3
Public. Supply	14.7	15.6	0.5	0.5	1.4	1.4	1.2	1.3	1.2	1.2	1.0	1.1	5.3	5.6	20.0	21.2
Recreational	6.3	8.1	0.6	0.8	0.6	0.8	0.6	0.8	0.6	0.8	0.7	0.8	3.1	3.9	9.3	12.0
Total	**32.1**	**35.1**	**1.4**	**1.6**	**2.5**	**2.7**	**2.3**	**2.6**	**2.3**	**2.5**	**2.2**	**2.4**	**10.6**	**11.7**	**42.4**	**46.8**

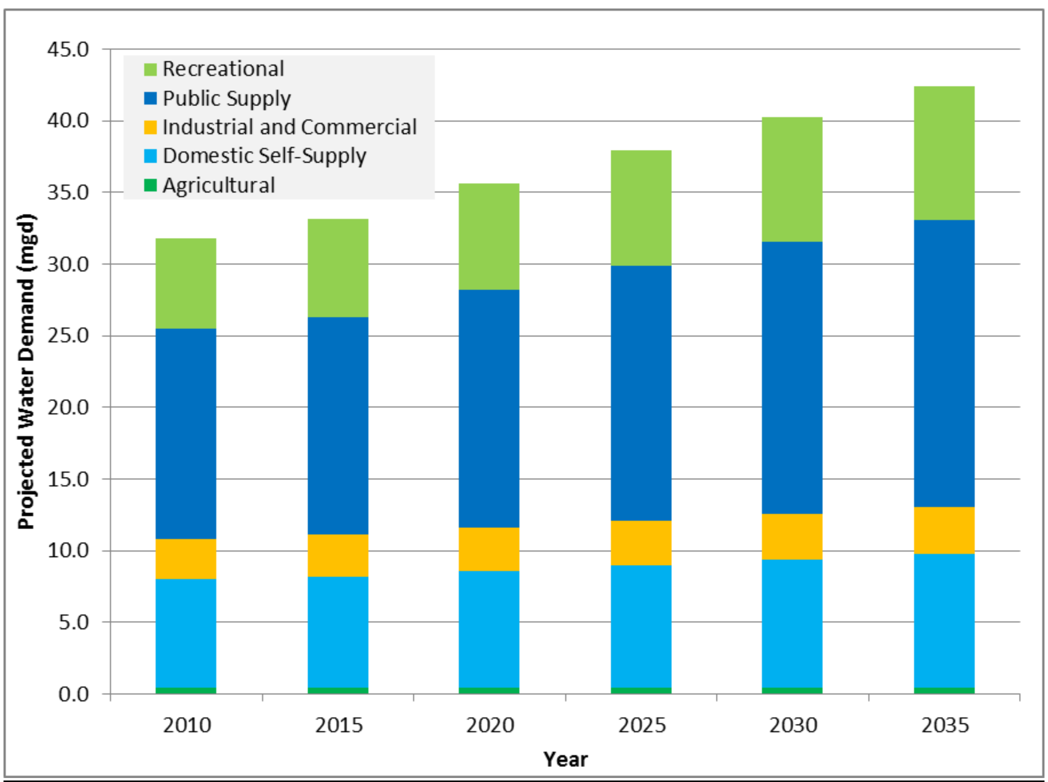

Figure 3-2. Citrus County Water Demand Projections for all Use Categories (2010-2035).

Section 2. Hernando County

1.0 Public Supply

The population of the public supply utility service areas in Hernando County (Figure 3-3) is expected to increase by approximately 27 percent or 38,000 people between 2010 and 2035

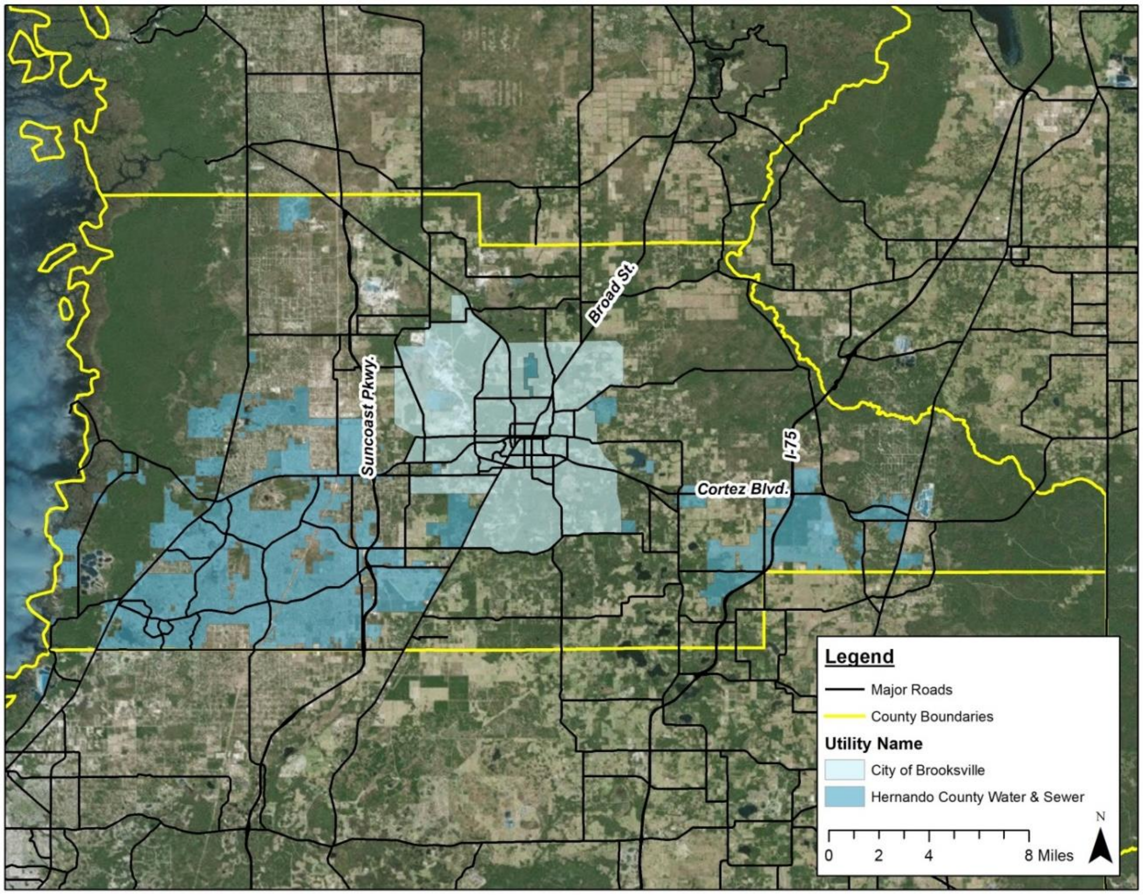

Figure 3-3. Major Public Supply Utility Service Area Boundaries within Hernando County.

(Table 3-7). Utilities in the county will need to develop an additional 6.0 mgd of water to meet public water supply demands within their service areas during this period (Table 3-8).

Table 3-7. Hernando County Public Supply Service Area Population Projections (2010-2035).

Utility Name	2010 Population	Projected Public Supply Population				
		2015	2020	2025	2030	2035
Small Utilities	849	758	759	760	761	775
Hernando Co Utilities Dept.	758	710	715	720	754	795
Hernando Co Utilities Dept.	117,456	121,471	129,540	136,099	140,693	144,076
Hernando Co Utilities Dept.	7,308	7,029	7,695	8,485	9,058	9,699
City Of Brooksville	16,417	16,911	18,538	20,471	22,955	25,805
Hernando Co Utilities Dept.	56	68	97	128	158	190
TOTALS	**142,844**	**146,948**	**157,344**	**166,663**	**174,380**	**181,341**

[1]*Small Utilities include utilities that were permitted to use 100,000 gallons or less per day in the year 2010.*

Table 3-8. Hernando County Public Supply Service Area Demand Projections (2010-2035).

Utility Name	2010 Water Demand (mgd)	Average Per Capita, gpcd (2007-2011)	Projected Public Supply Demands (mgd)				
			2015	2020	2025	2030	2035
Small Utilities	0.11	133	0.10	0.10	0.10	0.10	0.10
Hernando Co Utilities Dept.	0.11	142	0.10	0.10	0.10	0.11	0.11
Hernando Co Utilities Dept.	17.75	151	18.36	19.58	20.57	21.26	21.77
Hernando Co Utilities Dept.	0.93	127	0.89	0.98	1.08	1.15	1.23
City Of Brooksville	1.53	93	1.58	1.73	1.91	2.14	2.41
Hernando Co Utilities Dept.	0.01	153	0.01	0.01	0.02	0.02	0.03
Additional Irrigation Demand	1.63	-	1.75	1.94	2.12	2.29	2.46
TOTALS	**22.07**	-	**22.79**	**24.44**	**25.90**	**27.08**	**28.11**

[1]*Small Utilities includes utilities that were permitted to use 100,000 gallons or less per day in the year 2010.*
[2]*Additional Irrigation Demand includes groundwater supplied via private wells for use in lawn irrigation within a utility service area. The well owners obtain potable water via a connection with a utility, but meet irrigation needs using their own well.*

2.0 Projections for all Water-Use Categories

Water demand for all water-use categories in Hernando County is projected to increase by 37 percent from 2010 through 2035 (Table 3-9 and Figure 3-4). The largest increase in demand will be in the public supply and domestic self-supply categories, which will account for a combined, projected increase of more than 11.8 mgd by the year 2035. A significant increase in recreational water demands (3.4 mgd) is also projected through the year 2035. In total, approximately 17.2 mgd of additional water supply will need to be developed by 2035 to meet demands for all categories in the county.

Table 3-9. Hernando County Water Demand Projections for all Water-Use Categories (2010-2035).

Water Use Type	2010 Base Demand (mgd)		Hernando County Incremental Change in Water Demand (mgd)												2035 Total Demand (mgd)	
			2015		2020		2025		2030		2035		Total Increase			
	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10
Agricultural	2.8	2.8	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.3	3.1	3.1
Domestic Self-Supply	4.0	4.2	0.9	1.0	1.2	1.2	1.2	1.3	1.3	1.3	1.2	1.3	5.8	6.1	9.8	10.3
Industrial and Commercial	10.9	10.9	0.3	0.3	0.3	0.3	0.3	0 .3	0.4	0.4	0.3	0.3	1.7	1.7	12.6	12.6
Public Supply	22.1	23.4	0.7	0.8	1.7	1.8	1.5	1.5	1.2	1.3	1.0	1.1	6.0	6.4	28.1	29.8
Recreational	6.5	8.4	0.7	0.9	0.7	0.9	0.7	0.9	0.7	0.9	0.6	0.9	3.4	4.4	9.9	12.8
Total	**46.2**	**49.7**	**2.8**	**3.0**	**4.0**	**4.3**	**3.7**	**4.1**	**3.5**	**3.9**	**3.3**	**3.7**	**17.2**	**19.0**	**63.4**	**68.7**

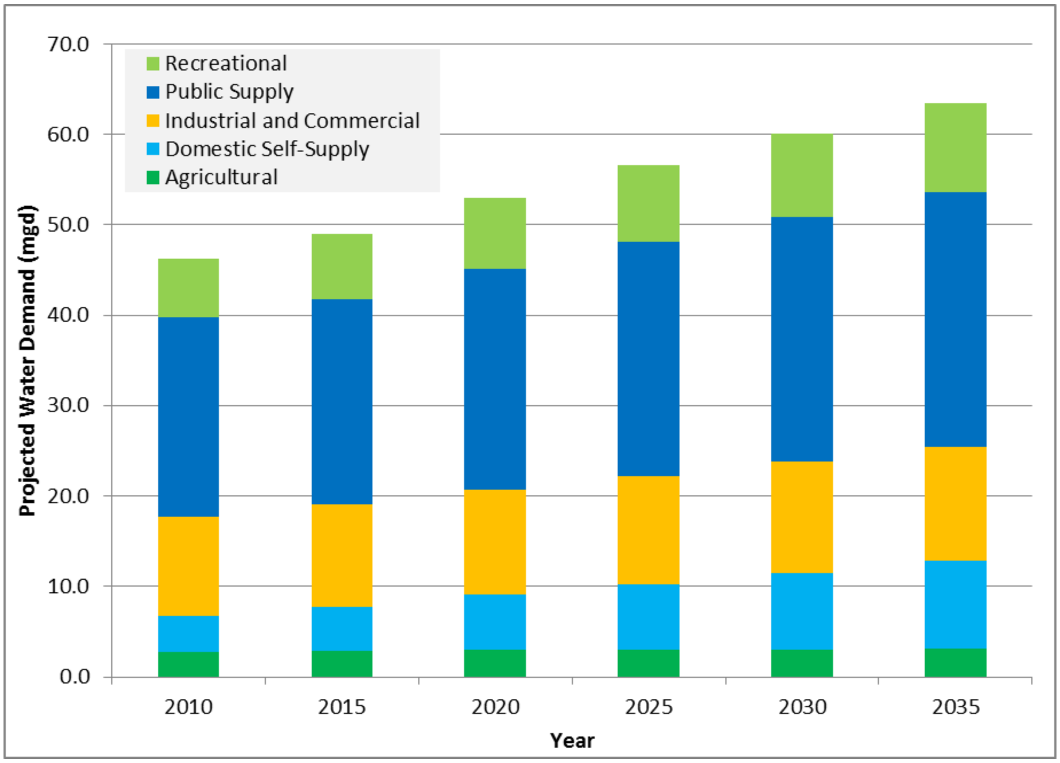

Figure 3-4. Hernando County Water Demand Projections for all Use Categories (2010-2035).

Section 3. Marion County

1.0 Public Supply Projections

1.1 Marion County, SWFWMD

The population of the public supply utility service areas (Figure 3-5) in the portion of Marion County in the SWFWMD is projected to increase by approximately 95 percent or 54,602 people between 2010 and 2035 (Table 3-10). Much of this increase is projected to occur in the Marion County Utilities service areas. Utilities in the SWFWMD portion of the county will need to develop an additional 11.0 mgd of water to meet public water supply demand within their service areas during this period (Table 3-11).

1.2 Marion County, SJRWMD

The population of the public supply utility service areas (Figure 3-6) in the portion of Marion County in the SJRWMD is projected to increase by approximately 26 percent or 36,564 people between 2010 and 2035 (Table 3-12). Much of this increase is projected to occur in the Marion County Utilities, City of Ocala, and City of Bellview service areas. Utilities in the SJRWMD portion of the county will need to develop an additional 5.8 mgd of water to meet public water supply demand in their service areas during this period (Table 3-13).

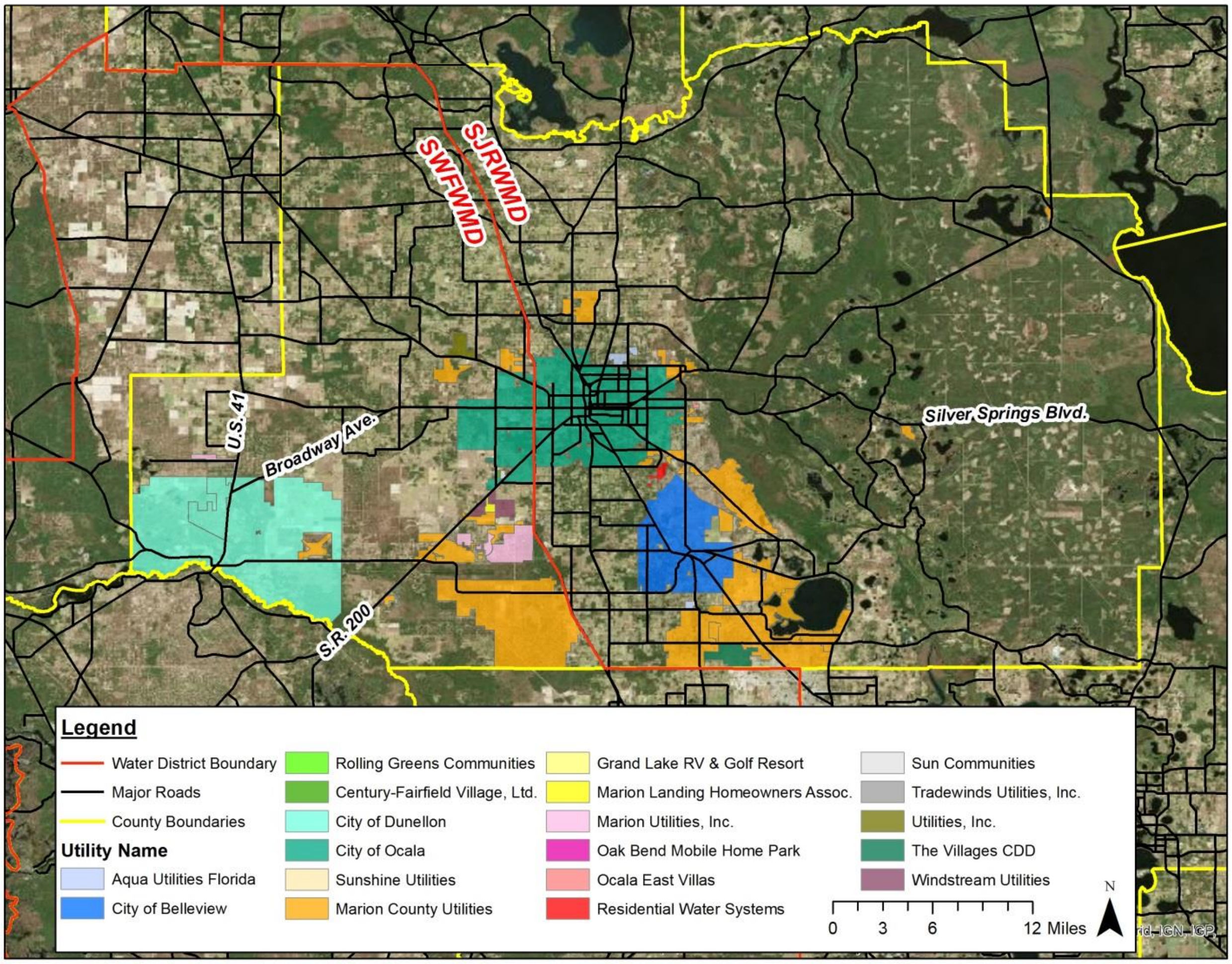

Figure 3-5. Major Public Supply Utility Service Area Boundaries in Marion County.

Table 3-10. Marion County (SWFWMD) Public Supply Service Area Population Projections (2010-2035).

Utility Name	2010 Population	Projected Public Supply Population				
		2015	2020	2025	2030	2035
Small Utilities	1,113	1,344	1,392	1,408	1,424	1,440
Bay Laurel Community Devl. Dist.	7,844	9,074	11,756	14,080	16,392	18,696
Marion Utilities, Inc.	959	997	1,006	1,016	1,025	1,035
Utilities Inc. of Florida	975	1,007	1,087	1,169	1,337	1,509
Marion Co Utilities Dept.	29,108	31,263	38,095	44,740	54,628	64,424
Sun Communities Operating LP	808	750	750	750	750	750
Marion Utilities, Inc.	721	798	1,004	1,005	1,005	1,005
Century Fairfield Village, Ltd.	605	606	606	606	606	606
Assoc of Marion Landing Owners	1,244	1,310	1,310	1,310	1,310	1,310
City Of Dunnellon	6,191	6,587	6,912	7,236	7,556	7,868
Marion Utilities/ Spruce Creek	5,408	6,093	7,202	8,109	8,542	8,984
Windstream Utilities Company	2,403	2,669	3,092	3,502	3,936	4,354
SWFWMD TOTALS	**57,379**	**62,497**	**74,213**	**84,932**	**98,511**	**111,982**

[1]*Small Utilities includes utilities which were permitted to use 100,000 gallons or less per day in the year 2010.*

Table 3-11. Marion County (SWFWMD) Public Supply Demand Projections (2010-2035).

Utility Name	2010 Water Demand (mgd)	Average Per Capita, gpcd (2007-2011)	Projected Public Supply Demands (mgd)				
			2015	2020	2025	2030	2035
Small Utilities	0.22	200	0.27	0.28	0.28	0.29	0.29
Bay Laurel Community Devl. Dist.	2.12	270	2.45	3.18	3.80	4.43	5.05
Marion Utilities, Inc.	0.13	140	0.14	0.14	0.14	0.14	0.14
Utilities Inc. of Florida	0.13	135	0.14	0.15	0.16	0.18	0.20
Marion Co Utilities Dept.	5.21	179	5.59	6.81	8.00	9.77	11.52
Sun Communities Operating LP	0.12	154	0.12	0.12	0.12	0.12	0.12
Marion Utilities, Inc.	0.12	164	0.13	0.16	0.16	0.16	0.16
Century Fairfield Village, Ltd.	0.07	120	0.07	0.07	0.07	0.07	0.07
Assoc. of Marion Landing Owners	0.18	146	0.19	0.19	0.19	0.19	0.19
City Of Dunnellon	1.10	175	1.15	1.20	1.26	1.32	1.38
Marion Utilities Inc. & Spruce Creek Development Company	1.00	184	1.12	1.33	1.49	1.57	1.65
Windstream Utilities Company	0.60	251	0.67	0.78	0.88	0.99	1.09
Additional Irrigation Demand	0.22	-	0.23	0.27	0.30	0.34	0.38
SWFWMD TOTALS	**11.22**	-	**12.27**	**14.68**	**16.85**	**19.57**	**22.24**

[1]*Small Utilities includes utilities which were permitted to use 100,000 gallons or less per day in the year 2010.*
[2]*Additional Irrigation Demand includes groundwater supplied via private wells for use in lawn irrigation within a utility service area. The well owners obtain potable water via a connection with a utility, but meet irrigation needs using their own well.*

Table 3-12. Marion County (SJRWMD) Public Supply Service Area Population Projections (2010-2035).

Utility Name	2010 Population	Projected Public Supply Population				
		2015	2020	2025	2030	2035
Marion County Utilities / Salt Springs	213	213	213	213	213	213
Sunshine Utilities / South Marion Regional System	2,549	2,729	2,907	3,079	3,198	3,305
Tradewinds Utilities, Inc.	1,157	1,196	1,229	1,243	1,247	1,252
Residential Water Systems / High Pointe	1,758	1,768	1,781	1,789	1,792	1,792
Ocala East Villas	455	456	457	457	458	459
Sunshine Utilities / Ocala Heights	1,020	1,037	1,059	1,084	1,111	1,140
Rolling Greens Communities	2,013	2,013	2,013	2,013	2,013	2,013
Aqua Utilities of Florida, Inc. / Ocala Oaks	1,509	1,566	1,648	1,756	1,864	1,917
Marion County Utilities / Silver Springs Shores, Deerpath, South Oak Subdivision	12,553	13,489	14,517	15,295	15,783	16,193
Oak Bend Mobile Home Park	674	674	674	674	674	674
Marion County Utilities / Silver Springs Woods and Villages	726	775	815	839	856	872
Marion Utilities, Inc. / Fore Acres	1,095	1,097	1,099	1,102	1,105	1,109
Marion Utilities, Inc. / Green Fields - Indian Pines	761	762	763	763	763	763
Sunshine Utilities / Sun Ray Estates	1,709	1,724	1,734	1,735	1,736	1,738
City of Belleview	14,513	16,280	18,662	20,890	22,542	23,862
Marion County Utilities / Silver Springs Regional Water and Sewer	1,773	1,808	1,859	1,932	2,034	2,150
Grand Lake RV & Golf Resort	150	150	150	150	150	150
City of Ocala	58,375	60,621	63,356	65,215	67,218	69,234
Marion County Utilities / South Lake Weir	623	666	723	787	842	900
Marion County Utilities / Stonecrest, Spruce Creek South	15,460	17,496	18,831	19,775	20,568	21,293
Marion County Utilities / Spruce Creek Golf and Country Club	8,633	10,056	10,954	11,361	11,609	11,816
Marion County Utilities / Irish Acres, Ocala Meadows	64	99	168	261	371	499
Marion County Utilities / Utopia	2	2	2	2	2	2
Small Utilities	11,699	12,084	12,465	12,592	12,646	12,702
SJRWMD TOTALS	**139,484**	**148,761**	**158,079**	**165,007**	**170,795**	**176,048**

[1] *Small Utilities includes utilities which were permitted to use 100,000 gallons or less per day in the year 2010.*

Table 3-13. Marion County (SJRWMD) Public Supply Demand Projections (2010-2035).

Utility Name	2010 Water Demand (mgd)	Average Per Capita, gpcd (2007-2011)	Projected Public Supply Demands (mgd)				
			2015	2020	2025	2030	2035
Marion County Utilities / Salt Springs	0.04	180	0.04	0.04	0.04	0.04	0.04
Sunshine Utilities / South Marion Regional System	0.51	199	0.54	0.58	0.61	0.64	0.66
Tradewinds Utilities Inc	0.12	102	0.12	0.13	0.13	0.13	0.13
Residential Water Systems / High Pointe	0.26	146	0.26	0.26	0.26	0.26	0.26
Ocala East Villas	0.08	174	0.08	0.08	0.08	0.08	0.08
Sunshine Utilities / Ocala Heights	0.12	120	0.12	0.13	0.13	0.13	0.14
Rolling Greens Communities	0.36	181	0.36	0.36	0.36	0.36	0.36
Aqua Utilities of Florida, Inc. / Ocala Oaks	0.17	112	0.18	0.19	0.20	0.21	0.22
Marion County Utilities / Silver Springs Shores, Deerpath, South Oak Subdivision	1.68	134	1.81	1.94	2.05	2.11	2.17
Oak Bend Mobile Home Park	0.08	119	0.08	0.08	0.08	0.08	0.08
Marion County Utilities / Silver Springs Woods and Villages	0.06	81	0.06	0.07	0.07	0.07	0.07
Marion Utilities, Inc. / Fore Acres	0.12	110	0.12	0.12	0.12	0.12	0.12
Marion Utilities, Inc. / Green Fields - Indian Pines	0.12	163	0.12	0.12	0.12	0.12	0.12
Sunshine Utilities / Sun Ray Estates	0.22	127	0.22	0.22	0.22	0.22	0.22
City of Belleview	1.47	102	1.65	1.89	2.12	2.29	2.42
Marion County Utilities / Silver Springs Regional Water and Sewer	0.35	196	0.35	0.36	0.38	0.40	0.42
Grand Lake RV & Golf Resort	0.11	727	0.11	0.11	0.11	0.11	0.11
City of Ocala	13.09	224	13.59	14.21	14.63	15.07	15.53
Marion County Utilities / South Lake Weir	0.02	40	0.03	0.03	0.03	0.03	0.04
Marion County Utilities / Stonecrest, Spruce Creek South	4.24	274	4.79	5.16	5.42	5.64	5.83
Marion County Utilities / Spruce Creek Golf and Country Club	2.14	247	2.49	2.71	2.81	2.87	2.92
Marion County Utilities / Irish Acres, Ocala Meadows	0.01	100	0.01	0.02	0.03	0.04	0.05
Marion County Utilities / Utopia	0.00	181	0.00	0.00	0.00	0.00	0.00
Small Utilities	1.46	115	0.62	0.64	0.65	0.65	0.65
SJRWMD TOTALS	**26.8**	-	**27.75**	**29.45**	**30.65**	**31.67**	**32.64**

[1] *Small Utilities includes utilities which were permitted to use 100,000 gallons or less per day in the year 2010.*

2.0 Projections for all Use Categories

2.1 Marion County, SWFWMD

Projections for all water-use categories in the SWFWMD portion of Marion County indicate that demand will increase by approximately 69 percent between 2010 and 2035 (Table 3-14). The largest increase will occur in the public supply category (11.1 mgd). In total, approximately 18.1 mgd of water will need to be developed by 2035 to meet demands for all use categories.

Table 3-14. Marion County (SWFWMD) Water Demand Projections for all Use Categories (2010-2035)

Water Use Type	2010 Base Demand (mgd)		Marion County (SWFWMD) Incremental Change in Water Demand (mgd)												2035 Total Demand (mgd)	
			2015		2020		2025		2030		2035		Total Increase			
	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10
Agricultural	3.0	5.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4	0.6	3.4	5.6
Domestic Self-Supply	7.5	8.0	0.5	0.5	0.8	0.9	0.8	0.8	0.9	0.9	0.8	0.9	3.8	4.0	11.3	12.0
Industrial and Commercial	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2
Public Supply	11.3	12.0	1.0	1.1	2.4	2.5	2.2	2.3	2.7	2.9	2.8	3.0	11.1	11.8	22.2	23.8
Recreational	4.3	5.6	0.6	0.7	0.6	0.7	0.6	0.7	0.6	0.7	0.6	0.7	2.8	3.6	7.2	9.2
Total	**26.2**	**30.8**	**2.1**	**2.5**	**3.9**	**4.2**	**3.6**	**4.0**	**4.2**	**4.6**	**4.3**	**4.7**	**18.1**	**20.0**	**44.1**	**50.8**

2.2 Marion County, SJRWMD

Projections for all water-use categories in the SJRWMD portion of Marion County indicate that demand will increase by approximately 44 percent between 2010 and 2035 (Table 3-15). Demands are projected to increase for each category with the exception of agriculture, which is projected to undergo a slight decline. The largest increase will occur in the public supply category (5.8 mgd) and domestic self-supply category (9.9 mgd). In total, approximately 20.7 mgd of water will need to be developed by 2035 to meet demands.

Marion County as a whole is projected to experience significant increases in total water demand during the planning period (Table 3-16 and Figure 3-17). More than 38.7 mgd of water will need to be developed by 2035, an increase of more than 52 percent over 2010 water use. The largest increases will occur in the public supply (16.9 mgd) and domestic self-supply (13.7 mgd) categories. Agriculture is projected to experience the smallest increase (0.1 mgd).

Table 3-15. Marion County (SJRWMD) Water Demand Projections for all Use Categories (2010-2035)

Water Use Type	2010 Base Demand (mgd)		Marion County (SJRWMD) Incremental Change in Water Demand (mgd)												2035 Total Demand (mgd)	
			2015		2020		2025		2030		2035		Total Increase			
	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10
Agricultural	3.6	4.1	-0.1	-0.1	0.0	-0.1	0.0	-0.1	-0.1	-0.1	0.0	0.0	-0.2	-0.3	3.3	3.9
Domestic Self-Supply	11.2	11.9	1.6	1.7	1.9	2.0	2.2	2.3	2.2	2.3	2.0	2.1	9.9	10.5	21.1	22.3
Industrial and Commercial	3.2	3.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	1.1	1.1	2.6	2.6	5.7	5.7
Public Supply	26.8	28.4	0.9	1.0	1.7	1.8	1.2	1.3	1.0	1.1	1.0	1.0	5.8	6.2	32.6	34.6
Recreational	2.7	2.7	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	1.1	1.1	2.6	2.7	5.3	5.4
Total	**47.5**	**50.3**	**3.2**	**3.6**	**4.4**	**4.5**	**4.0**	**4.2**	**3.9**	**4.1**	**5.2**	**5.4**	**20.7**	**21.7**	**68.0**	**71.9**

Table 3-16. Marion County Total Water Demand Projections for all Use Categories (2010-2035)

Water Use Type	2010 Base Demand (mgd)		Marion County Total Incremental Change in Water Demand (mgd)												2035 Total Demand (mgd)	
			2015		2020		2025		2030		2035		Total Increase			
	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10
Agricultural	6.6	9.2	-0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.1	0.1	0.3	6.7	9.5
Domestic Self-Supply	18.7	19.8	2.1	2.2	2.7	2.9	2.9	3.1	3.0	3.2	2.9	3.0	13.7	14.5	32.4	34.3
Industrial and Commercial	3.3	3.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	1.1	1.1	2.6	2.6	5.9	5.9
Public Supply	38.1	40.4	1.9	2.1	4.1	4.1	3.4	3.4	3.7	3.7	3.8	4.0	16.9	18.0	54.8	58.4
Recreational	7.0	8.3	1.0	1.1	0.9	1.1	0.9	1.1	0.9	1.1	1.7	1.8	5.4	6.3	12.4	14.6
Total	**73.7**	**81.0**	**5.7**	**5.9**	**8.2**	**8.5**	**7.7**	**8.0**	**8.0**	**8.5**	**9.5**	**10.0**	**38.7**	**41.7**	**112.2**	**122.7**

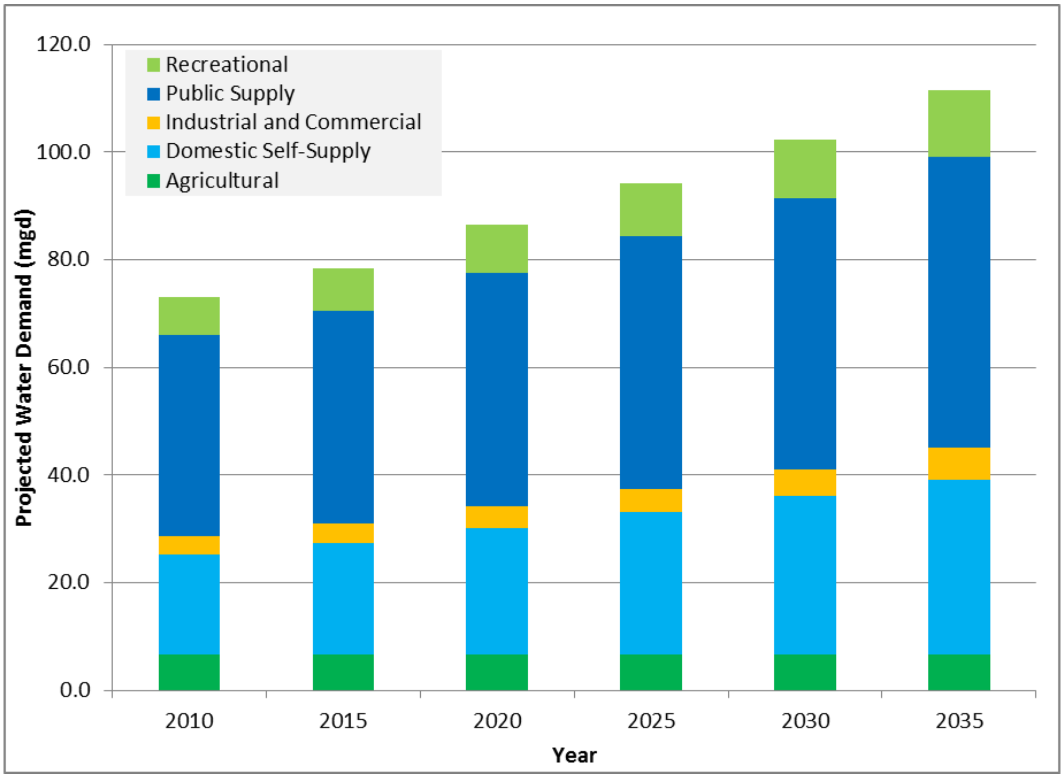

Figure 3-6. Marion County Water Demand Projections for all Use Categories (2010-2035).

Section 4. Sumter County

1.0 Public Supply Projections

The population of the public supply utility service areas in Sumter County (Figure 3-7) is projected to increase by approximately 73 percent or 70,761 people from 2010 through 2035 (Table 3-17). Large increases in population will occur in the City of Wildwood (40,000 additional residents) and in The Villages (26,000 additional residents) during the planning period. Utilities in the county will need to develop an additional 12.8 mgd of water to meet public water supply demands within their service areas during this period (Table 3-18).

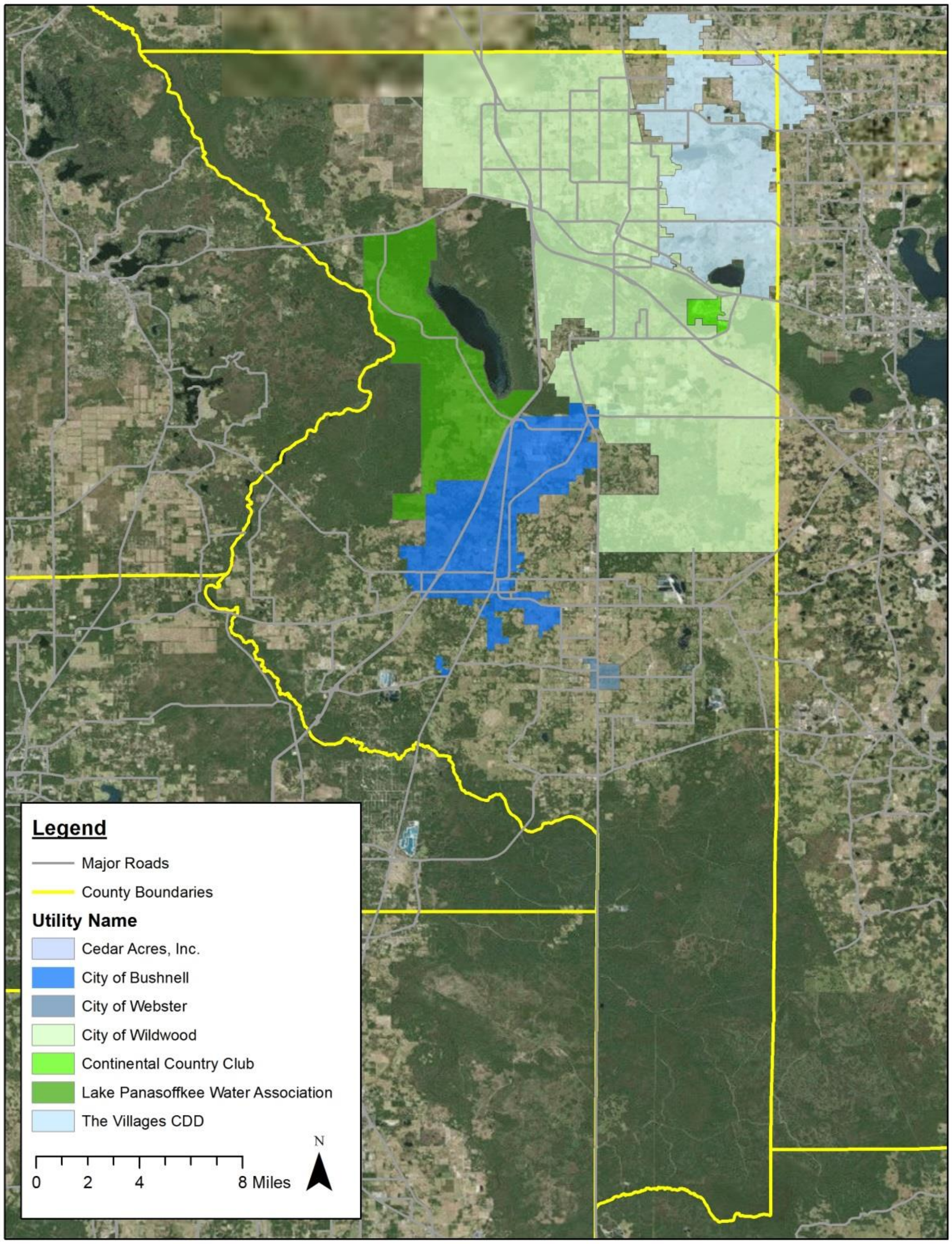

Figure 3-7. Major Public Supply Utility Service Area Boundaries in Sumter County.

Table 3-17. Sumter County Public Water Supply Service Area Population Projections (2010-2035).

Utility Name	2010 Population	Projected Public Supply Population				
		2015	2020	2025	2030	2035
Small Utilities	1,539	1,519	1,575	2,042	2,619	3,216
Lake Panasoffkee Water Assoc., Inc.	3,733	3,817	3,927	4,043	4,146	4,242
Continental Country Club Rd., Inc.	1,382	1,395	1,417	1,444	1,472	1,503
City Of Bushnell	3,793	3,853	3,977	4,106	4,223	4,333
City Of Webster	757	803	884	983	1,085	1,196
Cedar Acres, Inc.	546	628	629	630	631	631
City Of Wildwood	19,252	25,486	33,531	41,733	50,220	59,910
The Villages in Sumter and Marion counties	65,420	80,727	92,152	92,152	92,152	92,152
TOTALS	**96,422**	**118,228**	**138,092**	**147,133**	**156,548**	**167,183**

[1]*Small Utilities includes utilities which were permitted to use 100,000 gallons or less per day in the year 2010.*

Table 3-18. Sumter County Public Water Supply Demand Projections (2010-2035).

Utility Name	2010 Water Demand (mgd)	Average Per Capita, gpcd (2007-2011)	Projected Public Supply Demands (mgd)				
			2015	2020	2025	2030	2035
Small Utilities	0.23	150	0.23	0.24	0.31	0.39	0.48
Lake Panasoffkee Water Assoc., Inc.	0.24	64	0.24	0.25	0.26	0.27	0.27
Continental Country Club Rd., Inc.	0.27	195	0.27	0.28	0.28	0.29	0.29
City Of Bushnell	0.57	150	0.58	0.60	0.62	0.63	0.65
City Of Webster	0.10	126	0.10	0.11	0.12	0.14	0.15
Cedar Acres, Inc.	0.04	80	0.05	0.05	0.05	0.05	0.05
City Of Wildwood	2.91	151	3.85	5.07	6.31	7.59	9.06
The Villages in Sumter and Marion counties	15.66	158[3]	19.15	21.72	21.72	21.72	21.72
Additional Irrigation Demand	0.10	-	0.12	0.14	0.16	0.18	0.21
TOTALS	**20.12**	-	**24.59**	**28.46**	**29.84**	**31.26**	**32.88**

[1]*Small Utilities includes utilities that were permitted to use 100,000 gallons or less per day in the year 2010.*
[2]*Additional Irrigation Demand includes groundwater supplied via private wells for use in lawn irrigation within a utility service area. The well owners obtain potable water via a connection with a utility, but meet irrigation needs using their own well.*
[3]*The average compliance per capita is shown for The Villages to reflect the impact of their current use of alternative water supplies and to acknowledge the low persons per home for a retirement community.*

2.0 Projections for all Water-Use Categories

Projections for all water use categories in Sumter County indicate that water demand will increase by approximately 89 percent between 2010 and 2035 (Table 3-19 and Figure 3-7). The largest increases will occur in the public supply category (12.8 mgd) and in the domestic self-supply category (13.1 mgd). In total, approximately 30.3 mgd of additional water supplies will need to be developed by 2035 to meet demands for all use categories in the county.

Table 3-19. Sumter County Water Demand Projections for all Use Categories (2010-2035).

Water Use Type	2010 Base Demand (mgd)		Sumter County Incremental Change in Water Demand (mgd)														2035 Total Demand (mgd)	
			2015		2020		2025		2030		2035		Total Increase					
	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10			5-in-10	1-in-10
Agricultural	7.2	7.6	0.7	0.7	0.6	0.7	0.7	0.7	0.0	1.0	0.8	0.7	2.8	3.9			10.0	11.5
Domestic Self-Supply	0.7	0.7	4.0	4.2	2.2	2.4	2.3	2.5	2.3	2.5	2.3	2.5	13.1	13.9			13.7	14.6
Industrial and Commercial	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1			0.8	0.8
Public Supply	20.1	21.3	4.5	4.7	3.9	4.1	1.4	1.5	1.4	1.5	1.6	1.7	12.8	13.5			32.9	34.8
Recreational	5.4	6.9	0.3	0.4	0.4	0.5	0.2	0.3	0.3	0.4	0.4	0.4	1.5	1.9			6.9	8.8
Total	**34.0**	**37.2**	**9.5**	**10.1**	**7.1**	**7.7**	**4.6**	**5.0**	**4.0**	**5.4**	**5.1**	**5.3**	**30.3**	**33.3**			**64.3**	**70.5**

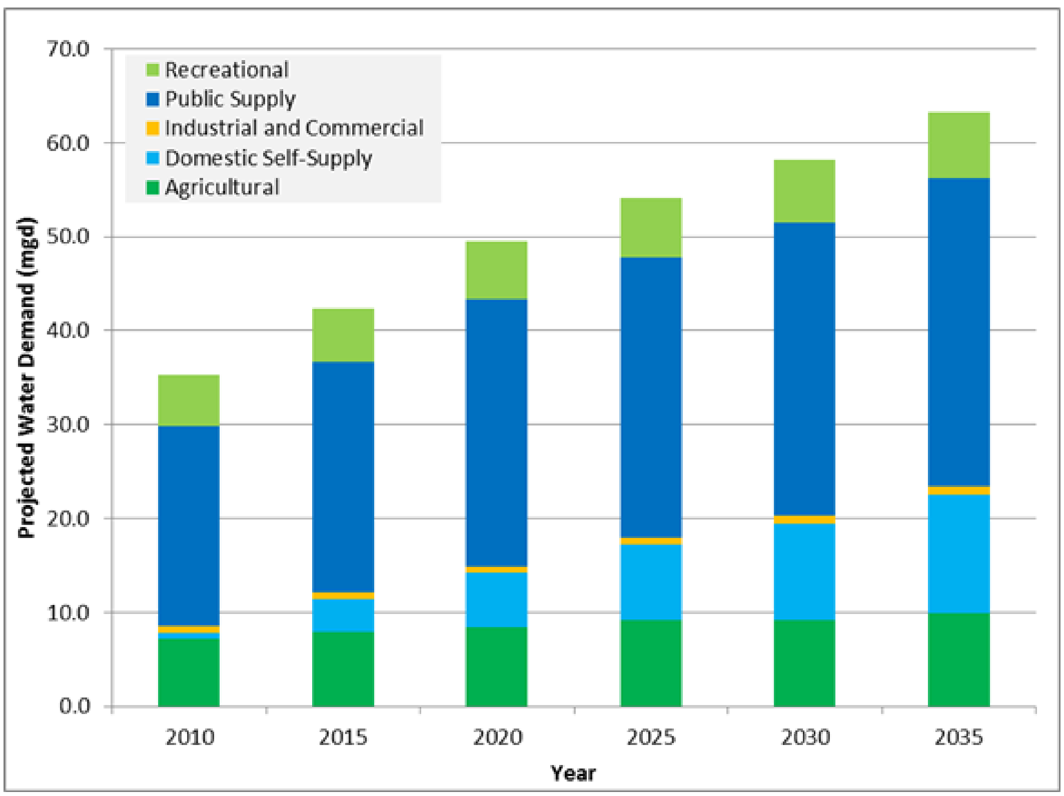

Figure 3-8. Sumter County Water Demand Projections for all Use Categories (2010-2035).

Section 5. Regional Summary

The following section is a summary of the information presented in this chapter.

1.0 Public Supply Projections

1.1 Citrus County

The public water supply utility service area population is projected to increase by more than 32,000 (34 percent) between 2010 and 2035 (Table 3-20). Utilities will need to develop 5.3 mgd of water to meet 2035 public water supply demands (Table 3-21).

1.2 Hernando County

The public water supply utility service area population is projected to increase by 38,000 (27 percent) between 2010 and 2035 (Table 3-20). Utilities will need to develop 6.0 mgd of water to meet 2035 public water supply demands (Table 3-21).

1.3 Marion County

The public water supply utility service area population is projected to increase by more than 90,000 people between 2010 and 2035 (Table 3-20). In the SJRWMD and SWFWMD portions of Marion County, population will increase by more than 26 percent and 95 percent, respectively. Utilities will need to develop 16.7 mgd of water to meet 2035 public water supply demands (Table 3-21).

1.4 Sumter County

The public water supply utility service area population is projected to increase by more than 70,000 people (73 percent) between 2010 and 2035 (Table 3-20). Utilities will need to develop 12.8 mgd of water to meet 2035 public water supply demands (Table 3-21).

1.5 WRWSA Four-County Region

For the WRWSA four-county region as a whole, population and public water supply demands will continue to increase substantially throughout the planning period. Public water supply utility service area population is expected to increase by more than 232,000 from 2010 through 2035 (Table 3-20). This is a 44 percent increase in the number of public supply customers, with the largest increase occurring in Sumter County and the SWFWMD portion of Marion County. As a result of the projected increasing customer base, approximately 40.9 mgd of new public water supplies will need to be developed through 2035 (Table 3-21 and Figure 3-9).

Total functional population, which includes resident and transient populations, is projected to increase by 417,871 people (54 percent) between 2010 and 2035 (Table 3-22 and Figure 3-10). Total functional population is used by the SWFWMD to project water demands for all water use categories. As a result of the increasing population and associated economic activities, water demands are projected to increase in each water use category through 2035 (refer to the following section). Residential-related use sectors including public supply, domestic self-supply, and recreation, will experience the largest increases in demand during the planning period. This suggests that continued population migration will occur during the planning period, as the projected rates of population growth are greater than the natural birth rate. In total, 96.7 mgd of water (above 2010 use rates) will be needed to meet demands by 2035.

Table 3-20. Public Water Supply Utility Service Area Population Projections for the WRWSA Four-County Region (2010-2035).

County	2010 Population	Projected Public Supply Population					Total Change in Population	Percent Increase
		2015	2020	2025	2030	2035		
Citrus	93,546	96,917	104,835	112,241	119,121	125,595	232,474	43.9
Hernando	142,844	146,948	157,344	166,663	174,380	181,341	38,497	27.0
Mar. SWFWMD	57,379	62,497	74,213	84,932	98,511	111,982	54,602	95.2
Mar. SJRWMD	139,484	148,761	158,079	165,007	170,795	176,048	36,563	26.2
Sumter	96,422	118,228	138,092	147,133	156,548	167,183	70,761	73.4
TOTALS	**529,675**	**573,351**	**632,563**	**675,976**	**719,355**	**762,149**	**232,474**	**43.9**

Table 3-21. Public Water Supply Utility Demand Projections for the WRWSA Four-County Region (2010-2035).

County	2010 Water Demand (mgd)	Projected Public Supply Demands (mgd)					Total Change in Demand	Percent Increase
		2015	2020	2025	2030	2035		
Citrus	14.7	15.2	16.6	17.8	18.9	20.0	5.3	36.0
Hernando	22.1	22.8	24.4	25.9	27.1	28.1	6.0	27.4
Mar. SWFWMD	11.2	12.3	14.7	16.9	19.6	22.2	11.0	98.2
Mar. SJRWMD	26.8	27.8	29.5	30.7	31.7	32.6	5.8	21.7
Sumter	20.1	24.6	28.5	29.8	31.3	32.9	12.8	53.7
TOTALS	**94.9**	**102.7**	**113.7**	**121.1**	**128.6**	**135.8**	**40.9**	**43.1**

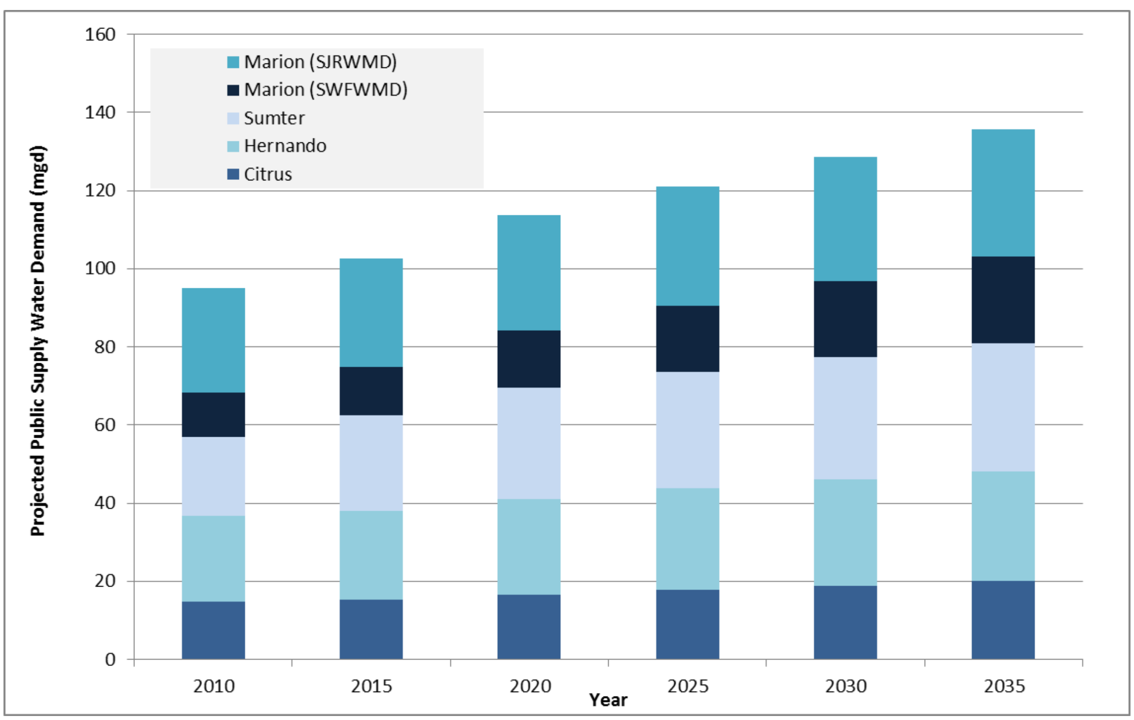

Figure 3-9. Public Water Supply Demand Projections for WRWSA Counties (2010-2035).

Table 3-22. Total Functional Population Projections for WRWSA Counties (2010-2035).

County	2010 Population	Projected Total Functional County Population					Total Change in Population	Percent Change
		2015	2020	2025	2030	2035		
Citrus	154,956	159,834	171,205	182,147	192,447	202,101	47,145	30.4
Hernando	178,062	190,389	211,237	231,139	250,045	267,964	89,902	50.5
Marion SW	107,234	115,745	132,859	148,709	168,042	187,138	79,904	74.5
Marion SJ	233,713	251,475	271,920	291,873	308,170	321,045	87,332	37.4
Sumter	100,219	125,033	147,925	170,211	192,327	213,807	113,588	113.3
Total	**774,184**	**842,476**	**935,146**	**1,024,079**	**1,111,031**	**1,192,055**	**417,871**	**54.0**

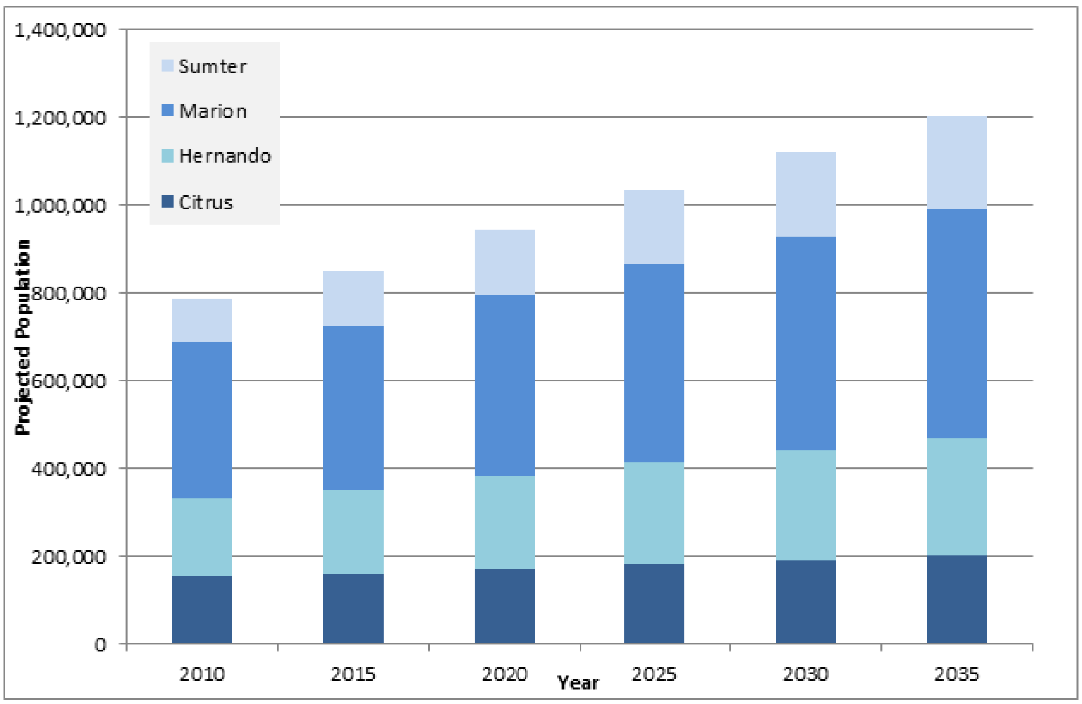

Figure 3-10. Total Functional Population Projections for the WRWSA Counties (2010-2035).

2.0 Projections for all Use Categories

2.1 Citrus County

Projections for all use categories in Citrus County indicate that water demand will increase by approximately 33 percent between 2010 and 2035 (Table 3-6 and Figure 3-2). The largest increases in demand will occur in the public supply category (5.3 mgd) and recreational category (3.1 mgd). In total, approximately 10.6 mgd of additional water supply will need to be developed by 2035 to meet demands for all use categories.

2.2 Hernando County

Projections for all categories in Hernando County indicate that water demand will increase by approximately 37 percent between 2010 and 2035 (Table 3-9 and Figure 3-4). The largest increase in demand will occur in the public supply category (6.0 mgd) and domestic self-supply category (5.8 mgd). A significant increase in recreational water demands (more than 3.4 mgd) is also projected through the year 2035. In total, approximately 17.2 mgd of additional water supply will need to be developed by 2035 to meet demands for all use categories.

2.3 Marion County

Projections for all water use categories in Marion County indicate that water demand will increase by approximately 52 percent between 2010 and 2035 (Table 3-16 and Figure 3-6). The largest increases will occur in the public supply category (16.9 mgd) and domestic self-supply category (13.7 mgd). In total, approximately 38.7 mgd of additional water supply will need to be developed by 2035 to meet demands for all use categories.

2.4 Sumter County

Projections for all categories in Sumter County indicate that water demand will increase by approximately 89 percent between 2010 and 2035 (Table 3-19 and Figure 3-7). The largest increases will occur in the public supply category (12.8 mgd) and domestic self- supply category (13.1 mgd). In total, approximately 30.3 mgd of water will need to be developed by 2035 to meet demands for all use categories.

Section 6. Water Demand Projection Comparison

This section is a comparison of the public water supply demand projections prepared for this Water Supply Plan with those prepared for the WRWSA's 2010 Water Supply Plan. The projections in the 2010 Plan are slightly higher for each five-year increment than the projections in this Plan (Table 3-24 and Figure 3-12). The projections differ because different input data were used. The base projection year for the 2010 Plan was 2005 while the base projection year for this Plan was 2010. In addition, differences in population growth rates occurred between 2005 and 2010 due to the recession and the associated drop in economic activity.

Table 3-23. Water Demand Projections for all Use Categories in WRWSA Counties (2010-2035).

Water Use Type	2010 Base Demand (mgd)		WRWSA Total Incremental Change in Water Demand (mgd)												2035 Total Demand (mgd)	
			2015		2020		2025		2030		2035		Total Increase			
	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10
Agricultural	17.0	20.2	0.7	0.9	0.8	0.8	0.8	0.8	0.0	1.1	0.9	0.8	3.2	4.4	20.2	24.6
Domestic Self-Supply	31.0	32.8	7.2	7.7	6.5	7.0	6.8	7.3	7.0	7.5	6.8	7.2	34.3	36.7	65.3	69.5
Industrial and Commercial	17.7	17.7	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	1.5	1.6	4.8	4.8	22.5	22.6
Public Supply	94.9	100.5	7.8	8.3	11.0	11.7	7.4	7.8	7.5	8.0	7.2	7.6	40.9	43.3	135.8	143.8
Recreational	25.2	31.7	2.6	3.2	2.6	3.3	2.4	3.0	2.5	3.2	3.4	3.9	13.5	16.5	38.7	48.2
Total	**185.8**	**202.9**	**19.1**	**20.9**	**21.7**	**23.6**	**18.2**	**19.7**	**17.9**	**20.6**	**19.8**	**21.1**	**96.7**	**105.7**	**282.5**	**308.7**

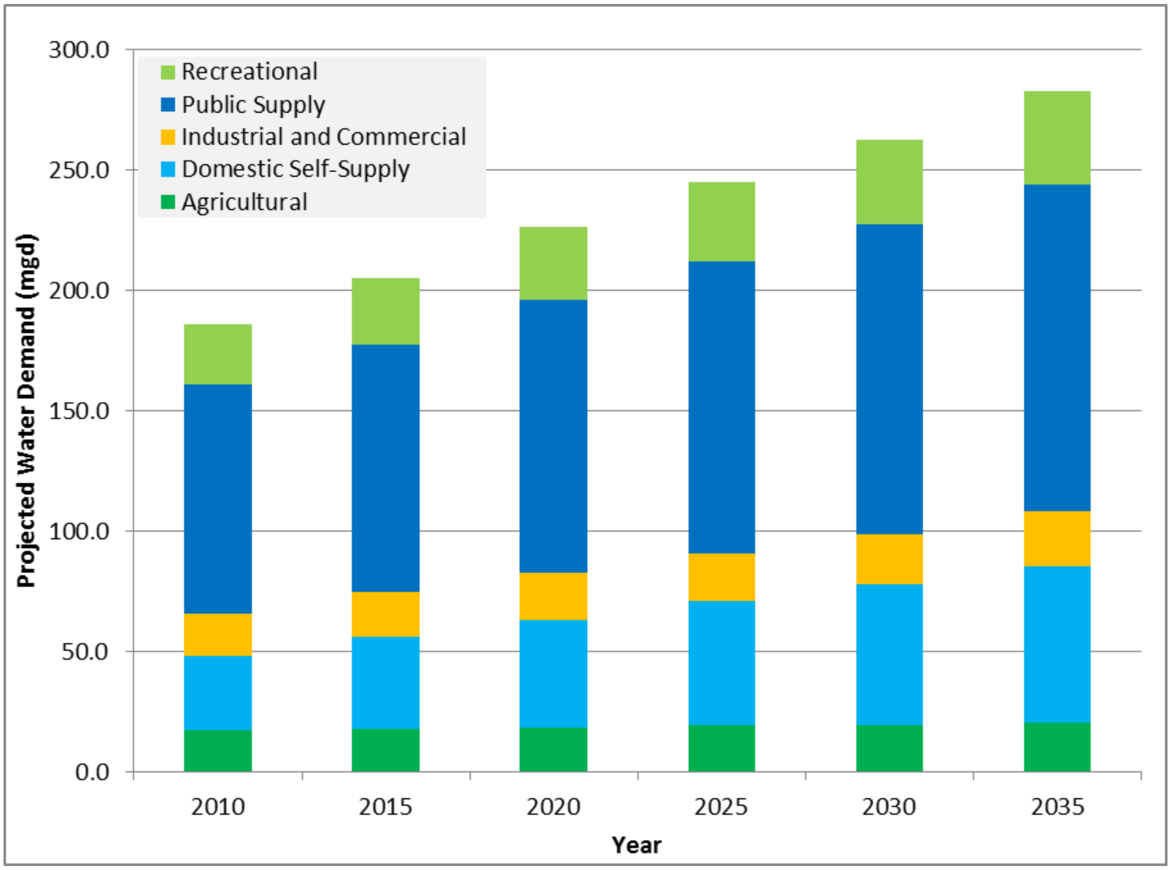

Figure 3-11. Water Demand Projections for all Use Categories in WRWSA Counties (2010-2035).

Table 3-24. Comparison of the Demand Projections for all Use Categories Prepared for the 2010 and 2014 Water Supply Plan Updates.

Year	Total Water Demands for WRWSA Region (mgd)		Percent Deviation
	2010 Plan	2014 Plan	
2010	199.8	185.8[1]	7.3
2015	219.1	204.9	6.7
2020	239.6	226.6	5.6
2025	253.8	244.8	3.6
2030	269.1	262.7	2.4

[1]*This value reflects actual 2010 Water Use*

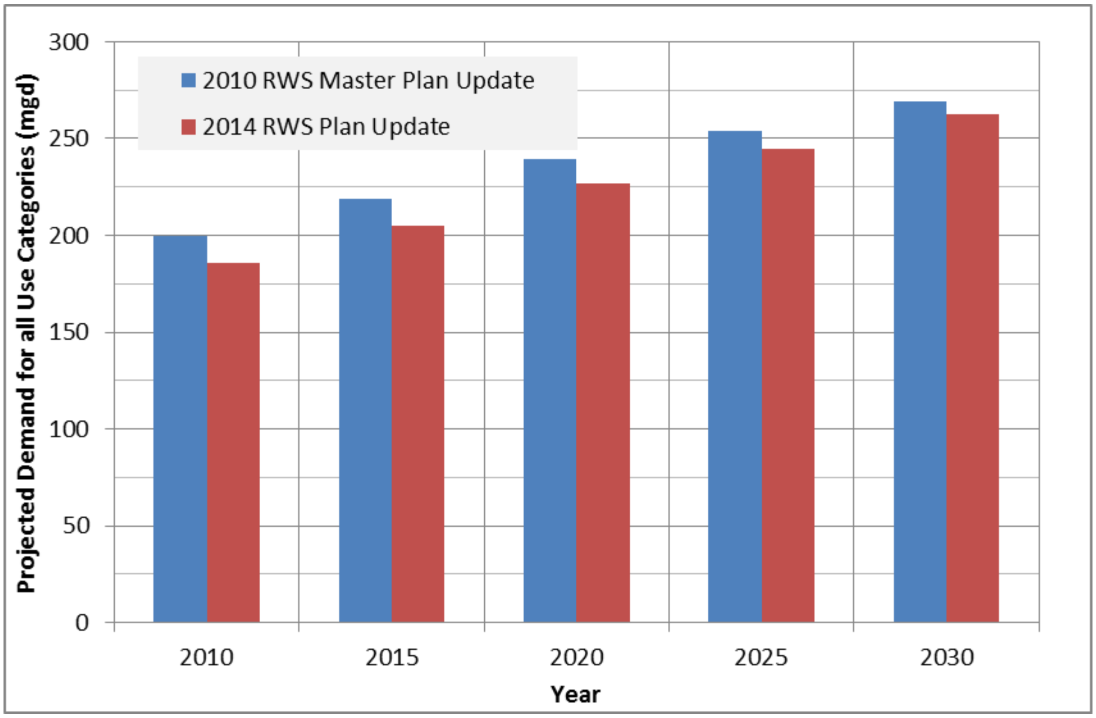

Figure 3-12. Comparison of the Demand Projections for all Use Categories Prepared for the WRWSA's 2010 and 2014 Water Supply Plan Updates.

Chapter 4. Evaluation of Water Sources

This chapter presents the results of investigations to quantify the amount of water that is potentially available from all sources of water within the WRWSA's four-county region to meet water supply demands through 2035. Sources of water that were evaluated include water conservation, reclaimed water, groundwater, surface water, and seawater desalination. The amount of water that is potentially available from these sources is compared to the water supply demand projections for the four-county region presented in Chapter 3 and a determination is made as to the sufficiency of the sources to meet demand through 2035.

Groundwater from the Upper and Lower Floridan aquifers currently is by far the principle source of supply for all use categories in the region and it is likely to supply the majority of projected demands through 2035. However, impacts resulting from groundwater withdrawals and establishment of MFLs for springs, rivers, and lakes will limit future availability of groundwater in certain areas.

To ensure that low-cost groundwater supplies are available as far into the future as possible, the water management districts are encouraging water users to implement conservation measures and develop reclaimed water systems through the water use permitting process and by providing financial incentives. These measures will enable public water supply systems to support more users with the same quantity of water and hydrologic stress.

Although it will be beyond the 2035 planning period for most areas in the region, continued growth will eventually require the development of alternative sources to meet public supply demand such as brackish groundwater, surface water, and seawater. The following discussion summarizes the evaluation of the availability of water sources to be used to produce new supplies for the region.

Part A. Evaluation of Water Sources

Section 1. Water Conservation

A comprehensive assessment of public supply water conservation potential in the WRWSA four-county region was conducted for the planning period by the University of Florida's Conserve Florida Water Clearinghouse (CFWC). The CFWC completed the analysis using the EZGuide Online water conservation tool, which is a web-based model designed to estimate conservation potential for public supply utilities.

1.0 Assessment Methodology

The EZGuide water conservation model uses a variety of inputs to determine water savings, costs, and per capita use rates that could be achieved as a result of implementing water conservation best management practices (BMPs) and other measures at the utility-level. The model produces a customized output that is specific to the customer profile of the utility. Additional details on the EZGuide Online tool, including a full description of the input data used in the model are available at the Conserve Florida website (www.conservefloridawater.org), and are also described in Appendix 4-1, *Water Conservation Analysis for Withlacoochee Regional Water Supply Authority*.

Input parameters for twelve of the larger public utilities (benchmark utilities) in the WRWSA region were entered into the EZGuide model to perform a detailed assessment of their water conservation potential. The group of benchmark utilities included the cities of Belleview, Brooksville, Bushnell, Crystal River, Dunnellon, Inverness, Ocala, and Wildwood, Citrus, Hernando, and Marion county utilities, and The Villages. The benchmark utilities represented approximately 82 percent of the total public supply population within the WRWSA region in the year 2010. The model results for these twelve utilities were extrapolated to the remaining 33 utilities within the WRWSA region that used in excess of 0.1 mgd. The extrapolation was accomplished by matching the water-use profiles of customers of the benchmark utilities to the group of 33 utilities with similar customer bases. Each utility has a different water use profile with a slightly different breakout of single family residential, commercial, multi-family residential, and other water uses.

2.0 Results

Three tiers of water conservation savings targets to achieve 5, 10, and 15 percent savings, were developed as part of this effort. To achieve these levels of conservation, a series of BMPs, retrofit programs, and other water savings measures was developed for each tier. Conservation measures to address each facet of residential and commercial water use were included in each of the three tiers of conservation targets. For example, in the single family residential category, measures were included to address outdoor water use, showers, sinks, clothes washers, and toilets. For each tier of conservation savings, the cost associated with each individual BMP or conservation measure generally increased commensurate with the water savings target.

If the proposed measures associated with each of the three tiers of water conservation savings were implemented, significant reductions in public water supply per capita water use would be realized in the WRWSA region. The collective per capita use reductions would result in the overall reduction in the 2035 projected water demands in the WRWSA region shown in Table 4-1 and Figure 4-1. If the 5, 10, and 15 percent conservation targets were achieved by the year 2035, approximately 6.3, 13.0, and 20.2 mgd (respectively) of water could be saved in the public supply category. Achieving this level of conservation will entail large-scale deployment of the specific water conservation measures identified by the EZGuide model associated with each tier of conservation targets. Cost information is provided in Chapter 5.

3.0 Current Water Conservation Measures

Many of the utilities in the WRWSA region have implemented water conservation programs and policies in their water service areas. Most of these existing and planned programs were not quantified in the EZGuide conservation assessment because the modeling approach analyzed water conservation potential through a standard set of practices and targets. Programs implemented by utilities are diverse in scope and level of customer participation and have had varying levels of success. Citrus County, Hernando County, and Marion County utilities, the City of Ocala, and The Villages, which collectively account for approximately 75 percent of all public supply water use in the WRWSA region, each have established water conservation programs, some of which include conservation-oriented rate structures, public education campaigns, irrigation audits, irrigation and other retrofits, and fixture rebates (Table 4-2).

Table 4-1. Public Water Supply Conservation-Adjusted Demand Projections (2010-2035).

County	2010 Water Demand (mgd)	2035 Projected Public Supply Water Demand (mgd)[1]						
		No Additional Conservation	Tier 1 (5% Demand Reduction)[2]	Tier 1 Savings (mgd)	Tier 2 (10% Demand Reduction)[2]	Tier 2 Savings	Tier 3 (15% Demand Reduction)[2]	Tier 3 Savings
Citrus	16.9	22.4	20.7	1.7	19.6	2.8	18.6	3.8
Hernando	22.1	28.1	24.4	3.7	23.2	4.9	21.7	6.4
Marion	38.0	54.8	54.6	0.2	51.8	3.0	48.9	5.9
Sumter	20.1	32.9	32.2	0.7	30.6	2.3	28.8	4.1
TOTALS	**97.1**	**138.4**	**131.9**	**6.3**	**125.2**	**13.0**	**118.0**	**20.2**

[1]*Projected values developed based on 2014 CFWC report, "Water Conservation Analysis for WRWSA".*
[2]*Actual conservation potential not exactly percentage listed; value was a target, and projected % reduction varies slightly from this.*

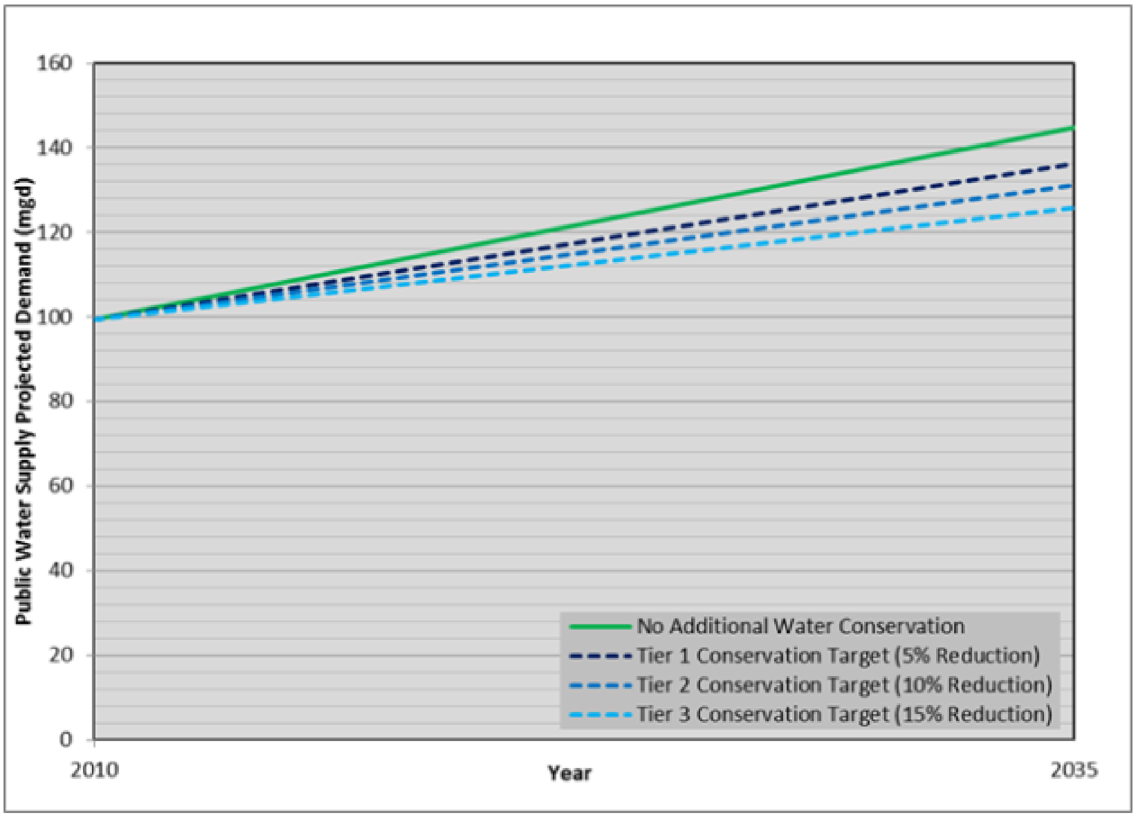

Figure 4-1. Water Conservation Potential for Public Supply Water-Use in the WRWSA Four-County Region (2010-2035).

Table 4-2. Selected Water Conservation Practices for the Five Largest Utilities in the WRWSA Region.

Utility	Selected Current Conservation BMPs, Practices, and Programs[1]
The Villages in Sumter and Marion Counties	• Implementation of Florida-friendly and drought-resistant landscaping • Irrigation fixture retrofits • Computerized irrigation management system • Landscape Audits • Leak detection program • Conservation-oriented water rate structure • Water-efficient fixtures are used in all new construction • Production of an annual water conservation report to track conservation efforts. • Outreach efforts, including presentations to new homeowners, participation in public events, billing inserts, etc.
Marion County Utilities	• Toilet Rebates • Irrigation Systems Evaluations • Irrigation / Landscape Retrofits • Indoor Retrofit Kits • Workshops and Micro-Irrigation kit distribution • Outreach efforts including high water user postcards, billing inserts, and participation at public events
Hernando County Utilities	• Low-flow toilet rebates • Rain sensor rebates • County lawn watering restrictions • Water efficiency focus group • Outreach efforts including a water conservation website, billing inserts, televised information on a local access channel, and participation at public events
Citrus County Utilities	• Leak detection program • Conservation-oriented water rate structure • Low-flow Toilet, showerhead, and faucet fixture rebates • Production of an annual water conservation report to track conservation efforts. • Rain sensor rebates • Clothes washer rebates • Rain barrel program • Water efficiency County ordinances • Water efficiency focus group • Outreach efforts including billing inserts, information on County website, HOA presentations, and participation at public events
City of Ocala	• Water auditing program (commercial and residential) • Efficient irrigation and xeriscaping demonstration projects on City properties • Outreach efforts at schools • Outreach efforts include posting of materials regarding Florida-friendly landscaping and water conservation available on utility website, billing inserts, televised information on a local access channel, public presentations, and participation in public events

[1]*Not a complete list of conservation measures*

4.0 Additional Considerations

Additional opportunities for public supply water conservation, beyond those estimated by the CFWC EZ Guide Model discussed in the preceding section, exist within the WRWSA region. The most significant conservation opportunity is in the single family residential outdoor water use sector, which currently accounts for an average of 33 percent of total public supply water use (approximately 33 mgd in the year 2010) in the WRWSA region. According to estimates developed by the CFWC, in some of the larger utility service areas in the WRWSA region, between 35 percent and 60 percent of water use is for lawn and landscape irrigation. The CFWC estimates that the average irrigable square footage of a single-family residential parcel in the WRWSA region is approximately 10,000 square feet, or slightly less than ¼ acre. Converting to drought tolerant landscaping, practicing onsite rainwater harvesting, and partially or fully replacing highly maintained lawns with more natural landscapes, could greatly reduce or eliminate the need for irrigation at single family residences, potentially saving a significant percentage of the 33 mgd of potable water used for outdoor purposes in the WRWSA region.

4.1 Effectiveness of Mandatory Landscape Irrigation Restrictions

The SJRWMD conducted a study of the effectiveness of District irrigation restrictions during the period from 2001 through 2004 (SJRWMD, 2008). The objective was to evaluate water use over time to quantify the water savings from the restrictions. During the study period, the SJRWMD used irrigation restrictions to reduce water use during a period of drought, when the compounding circumstance of decreasing water supplies and increasing irrigation-water demands existed. However, restrictions also can be applied during non-shortages to encourage efficient irrigation practices.

Understanding the efficacy of irrigation restrictions can assist the districts in policy decisions related to the future use of irrigation restrictions in managing scarce water supplies. The SJRWMD is currently using irrigation restrictions as a relatively long-term mechanism to promote efficient landscape irrigation, not just as a tool to cope through a short-term water shortage. Landscape experts agree that getting customers to irrigate less frequently can improve both water efficiency and the health of landscapes, especially lawns.

The history of reducing water use via irrigation restrictions in the U.S. is mixed. In some cases, irrigation restrictions can cause water use reductions of over 50 percent. In others, irrigation restrictions actually might increase total water usage because some customers irrigate on allowed days, even if weather conditions do not warrant it. They may also over-irrigate, as they know they will be restricted on future days. Hence, the efficacy of irrigation restrictions depends on local circumstances. Below, is a list of observations gleaned from reviewing the literature.

Enforcement - Water savings increase with enforcement and voluntary irrigation restrictions prove less effective than mandatory restrictions. Enforcements through written warnings, financial penalties, and termination of water service improve restriction compliance. Effective communication and education can improve compliance and make enforcement easier.

Restriction Severity - Water savings increase with more severe irrigation restrictions. Going from three to two to one day-per-week irrigation leads to greater water savings. The utilities reviewed limited irrigation to the morning and evening hours, when evapotranspiration is lower.

Magnitude of Irrigation - Water savings are higher for utilities that have a relatively high portion of their total potable water use associated with irrigation. Utilities with large commercial and industrial customer bases are less impacted. Utilities with customers that irrigate from alternative sources, such as reclaimed water, shallow irrigation wells, or surface water, experience less impact on their potable water use.

Goodwill - Water savings from restrictions are higher for customers who understand the need of restrictions to assist their water suppliers through times of water shortages.

Water System Peaking - Water managers must carefully anticipate and adjust restrictions to limit water use peaks exacerbated by day-of-week and time-of-day irrigation restrictions. Forcing all irrigation to occur in limited windows of time can stress the water system, leading to loss in water pressure and compromising fire-suppression abilities.

Evaluation of Water Savings - All studies that evaluated the water savings associated with irrigation restrictions controlled for weather. Ignoring weather can severely bias the results. When relevant, researchers also must control for customer growth and for the increasing use of alternative water-supply sources in isolating the impact from restrictions.

The irrigation restrictions put into effect in 2001 through a water shortage order by the SJRWMD for its East-Central region included three key constraints:

- landscape irrigation is restricted to a maximum of two days per week - properties with odd-number addresses are allowed to irrigate on Wednesday and Saturday and those with even-number addresses on Thursday and Sunday;
- landscape irrigation is prohibited between 10 a.m. and 4 p.m; and
- irrigation can only occur when actually needed because of lack of rainfall and must be limited to the application of no more than ¾-inch of water in the irrigated area.

This study conducted an empirical analysis of water use data over the period from 1997 through 2004 for the Cities of Apopka, DeLand, Ocoee, Port Orange, Sanford, and Winter Park and Orange and Seminole county utilities; all of which were subject to District irrigation restrictions. The analysis used statistical methods to control for weather, seasonal water use patterns, customer growth, and other factors that affect water use.

Results showed that water savings from irrigation restrictions vary significantly with utility circumstances. The irrigation-restriction water savings associated with the City of Ocoee and Seminole County are convincing. Both of these utilities have relatively high levels of outdoor water use. Savings for the City of Ocoee ranged from 11.6 to 12.8 percent and savings for Seminole County Utilities ranged from 16.9 percent to 18.5 percent.

The water shortage order for the SJRWMD's East-Central region remained in effect until March 1, 2006, when the District amended and expanded the landscape irrigation restrictions to cover the entire District. In 2009, SJRWMD further amended the rule to limit landscape irrigation to a maximum of one day per week during Eastern Standard Time when supplemental irrigation demand decreases in response to the cooler weather. The two day per week restrictions remain in effect throughout the SJRWMD during daylight saving time.

5.0 Summary of Potential Demand Reductions from Water Conservation

Three tiers of water conservation savings targets to achieve 5, 10, and 15 percent savings, were developed. To achieve these levels of conservation, a series of BMPs, retrofit programs, and other water savings measures was developed for each tier. If the 5, 10, and 15 percent conservation targets were achieved by the year 2035, demand reductions of 6.3, 13.0, and 20.2 mgd, respectively, could be achieved in the public supply category. It was decided to utilize the

10 percent savings level that will be achieved by 2035 in the public supply sector for purposes of this Plan. This will result in a demand reduction by 2035 of 13.0 mgd.

Section 2. Reclaimed Water

Reclaimed water is defined by the Florida Department of Environmental Protection (FDEP) as water that is beneficially reused after being treated to at least secondary wastewater treatment standards by a wastewater treatment facility. Reclaimed water can be used in a number of ways including decreasing reliance on potable water supplies, increasing groundwater recharge, and restoring natural systems. The SWFWMD and SJRWMD have been proactively promoting the use of reclaimed water by partnering with local governments and private utilities to cooperatively fund the development of reclaimed water projects.

1.0 Reclaimed Water Projects Completed or Under Development

1.1 SWFWMD

Table 4-3 contains information on the benefits and costs of all reclaimed water projects that have been completed or are under development in the SWFWMD portion of the WRWSA region. The SWFWMD is co-funding these projects with the cooperator listed in the table, with the exception of the three projects completed by The Villages at the end of the table. The table shows that the potable water offset of these projects will total approximately 11.3 mgd when all of the projects are completed in 2016.

1.2 SJRWMD

Table 4-4 contains information on reclaimed water projects that have been completed or are under development in the SJRWMD portion of the WRWSA region.

2.0 Assessment of Reclaimed Water Availability

An analysis of projected reclaimed water availability for the WRWSA four-county region was performed to determine the quantities of reclaimed water that are currently available that have not yet been allocated to planned and funded projects and quantities that will become available by 2035 as the result of increasing population.

2.1 Methods

SWFWMD – The service area populations for each wastewater treatment facility (WWTF) were determined and reclaimed water flows available in 2035 were calculated using projected population in 2035, a wastewater flow of 84 gallons per person per day, and a six percent indoor conservation rate. Plant capacities were independently calculated based on population projections regardless of future planned expansions. It was assumed that the level of treatment of all WWTFs would meet advanced secondary standards by 2035.

SJRWMD – Projections of reclaimed water availability in the SJRWMD portion of Marion County were calculated by multiplying the projected 2035 population by 84 gallons per person per day of wastewater flow for each WWTF. Planned and funded reclaimed water projects were incorporated into the analysis to represent allocated quantities. Only projected 2035 flows above 0.01 mgd were considered.

Table 4-3. Reclaimed Projects Completed/Under Development in the WRWSA Region (SWFWMD).

Entity, County, and Year Initiated	Project Name	Type and Primary Customer	Build-out Supply (mgd)	Build-out Benefit (mgd)	Total Capital Cost ($M)	Total SWFWMD Funding $M	Year On-line
Citrus County							
Citrus Co., 1998	SW Feasibility	Study	-	-	0.12	0.03	2001
Citrus Co., 1999	Homosassa	WW Sys Expan.	-	-	14.51	3	2009
Citrus Co., 2002	Black Diamond #1	Sys Expan, GC	0.25	0.19	0.68	0.31	2005
Inverness, Citrus, 2006	Inverness GC	Sys Expan, GC	0.41	0.31	2.0	1.14	2011
Citrus Co., 2002	Black Diamond, #2	Sys Expan, GC	0.52	0.39	0.30	0.15	2013
Crystal River, Citrus, 2012	Duke Energy	Sys Expan, IND	0.75	0.75	6.23	3.7	2016
Citrus Co.	Sugarmill Woods	Sys Expan	2.00	1.50	5.89	TBD	TBD
Hernando County							
Southern States, Hernando, 1995	Timber Pines	Sys Expan, GC	1.3	0.97	3.5	0.32	1996
Southern States, Hernando, 1996	Timber Pines Storage	Storage	-	-	0.44	0.22	1996
Brooksville, Hernando, 2004	Southern Hills	Sys Expan, GC	0.64	0.38	5.1	2.54	2013
Levitt & Sons, Hernando, 2007	Hickory Hills	Sys Expan, TBD	0.5	0.28	0.61	0.3	TBD
Hernando Co, 2008	Feasibility Study	Study	-	-	0.1	0.05	2009
Hernando Co, 2014	US 19	Sys Expan, GC	0.4	0.3	2.6	1.3	2015
Marion County							
Ocala, Marion, 1996	Airport, Sports Complex	Sys Expan, IND	0.22	0.18	0.37	0.18	1997
Marion Co, 2009	Oak Run GC	Sys Expan, GC	0.50	0.38	3.12	1.56	2013
On Top of the World, Marion, 2007	Bay Laurel GC	Sys Expan, GC	0.79	0.59	2.20	1.18	2012
Marion Co, 2011	Spruce Creek GC	Sys Expan, GC	0.35	0.26	1.62	0.81	2014
Sumter County							
Wildwood, Sumter, 1993	City Reuse Sys	Sys Expan GC	0.69	0.52	3.65	0.31	1995
Sumter Correctional, Sumter, 1997	National Cemetery	Sys Expan, OPAA	0.12	0.09	0.69	0.22	1998
Wildwood, Sumter, 2003	The Villages	Sys Expan, GC, OPAA	1.2	0.9	0.62	0.23	2006
Continental CC, Sumter, 2009	Feasibility Study	Study	-	-	0.02	0.01	2010
Bethel-Bushnell, Sumter, 2013	Bethel Farms	Sys Expan, AG	0.22	0.2	0.4	0.2	2016
VCCDD-LSSA, Sumter	The Villages	WW Sys Expan, GC	2.50	1.88	N/A	$0.00	1998
NSCUDD – NSU, Sumter	The Villages	WW Sys Expan, GC	2.59	1.94	N/A	$0.00	2004
Central Sumter Util Company, Sumter	The Villages	WW Sys Expan, GC	1.03	0.77	N/A	$0.00	2012
Total (24 Projects)			**16.98**	**11.28**	**$54.7**	**$17.8**	

Table 4-4. Reclaimed Projects Under Development in the WRWSA Region (SJRWMD).

Entity, County, and Year Initiated	Project Name	Type and Primary Customer	Build-out Supply (mgd)	Total Capital Cost $M	Total SJRWMD Funding $M	Year On-line
Silver Springs Shores , Marion	Silver Springs Shores to Spruce Creek GC	Sys. Upgrade & Expan, GC	0.55	8.22	3.19	2015

For both the SWFWMD and SJRWMD portions of the WRWSA region, the quantity of reclaimed water that has been allocated to projects that are completed or under development in the four-county region was subtracted from the total quantity projected to be available in 2035. This is the quantity that is available for future projects.

3.0 Summary of the Water Supply Potential of Reclaimed Water

The quantity of reclaimed water that is projected to be available in 2035 that is not yet allocated to projects that are planned, completed, or under development is 4.9 mgd (Table 4-5).

Table 4-5 Quantities of Reclaimed Water Available in 2035 not Currently Allocated to Projects that are Planned, Under Development, or Completed.

County	Unallocated Reclaimed Water Available in 2035 (mgd)
Citrus County	
Citrus County - Brentwood Regional	1.30
Walden Woods MHP	0.03
Total	**1.33**
Hernando County	
Hernando County - Brookridge	0.63
Hernando County - Ridge Manor	0.58
Total	**1.21**
Marion County	
On Top of the World/Bay Laurel	0.63
Rainbow Springs (acquired by Dunellon)	0.68
City of Dunellon	0.96
Total	**2.27**
Sumter County	
Continental Country Club	0.09
Total	**0.09**
WRWSA Total	**4.90**

Section 3. Groundwater

Fresh groundwater from the Upper Floridan aquifer is the principal source of water supply for all use categories in the WRWSA four-county region. Although there is a surficial aquifer in localized areas, the lack of a confinement between the Upper Floridan and surficial aquifers in most places causes the Upper Floridan aquifer to function as a single unit and behave as an unconfined aquifer. The Lower Floridan aquifer below Middle Confining Unit 1 is increasingly being investigated for its water supply potential and the SWFWMD and SJRWMD are devoting significant resources to determining its extent, yield, water quality, and degree of confinement from the Upper Floridan aquifer.

For the WRWSA's 2010 Water Supply Plan, the SWFWMD and SJRWMD used regional groundwater flow models to assess the quantity of groundwater that could be developed without resulting in exceedances of MFL constraints. The SWFWMD used their Northern District model, which covered the entire four-county region except for the portion of Marion County in the SJRWMD. For this area, the SJRWMD used their North-Central Florida groundwater model. Because the models were developed independently, differences in assumptions, aquifer characteristics, grid spacings, and other parameters were incorporated, which caused results to differ. Following completion of the WRWSA's 2010 Water Supply Plan, the districts agreed to work together to update and expand the SWFWMD's Northern District Groundwater Flow Model (Northern District Model) to cover the entire WRWSA four-county region. Figure 4-2 shows the domain of the revised model. The update also included a number of refinements, the most important of which was a more sophisticated representation of the Lower Floridan aquifer that represents the current, albeit limited, understanding of the extent and characteristics of the aquifer.

The following is a summary of the results of the investigation using the Northern District Model to assess the availability of fresh groundwater in the Upper Floridan aquifer and the Lower Floridan aquifer below MCU 1 in the WRWSA region. A more detailed technical discussion of model development, calibration, and simulations can be found in Appendix 4-2 and the Northern District Groundwater Flow Model Version 4.0 (HydroGeologic, 2013).

1.0 Description of the Major Water Supply Aquifers

1.1 Upper Floridan Aquifer

Figure 4-3 is a geologic cross section through the WRWSA region from central Citrus County to Southeast Marion County that is presented to illustrate the important features and relationships between the Upper and Lower Floridan aquifers. The Upper Floridan aquifer is present throughout the WRWSA region and ranges in thickness from 400 to 800 feet. The Upper Floridan aquifer generally dips and thickens to the south and elevations to the top of the aquifer range from 0 feet to 100 feet below mean sea level. Where the Upper Floridan aquifer is unconfined, recharge occurs from rainfall and through the overlying surficial sediments. Where the Upper Floridan aquifer is confined, water quality tends to decrease with depth because the confinement prevents recharge of fresh water from the surface. The Upper Floridan aquifer provides the vast majority of water for public, domestic, agricultural, recreational and industrial water uses due to its general high quality and availability.

1.2 Lower Floridan Aquifer

Middle Confining Unit I underlies and provides some degree of confinement between the Upper and Lower Floridan aquifers in the eastern portion of the WRWSA region. The unit is approximately 100 to 300 feet thick and acts as a semi-confining unit with predominately vertical

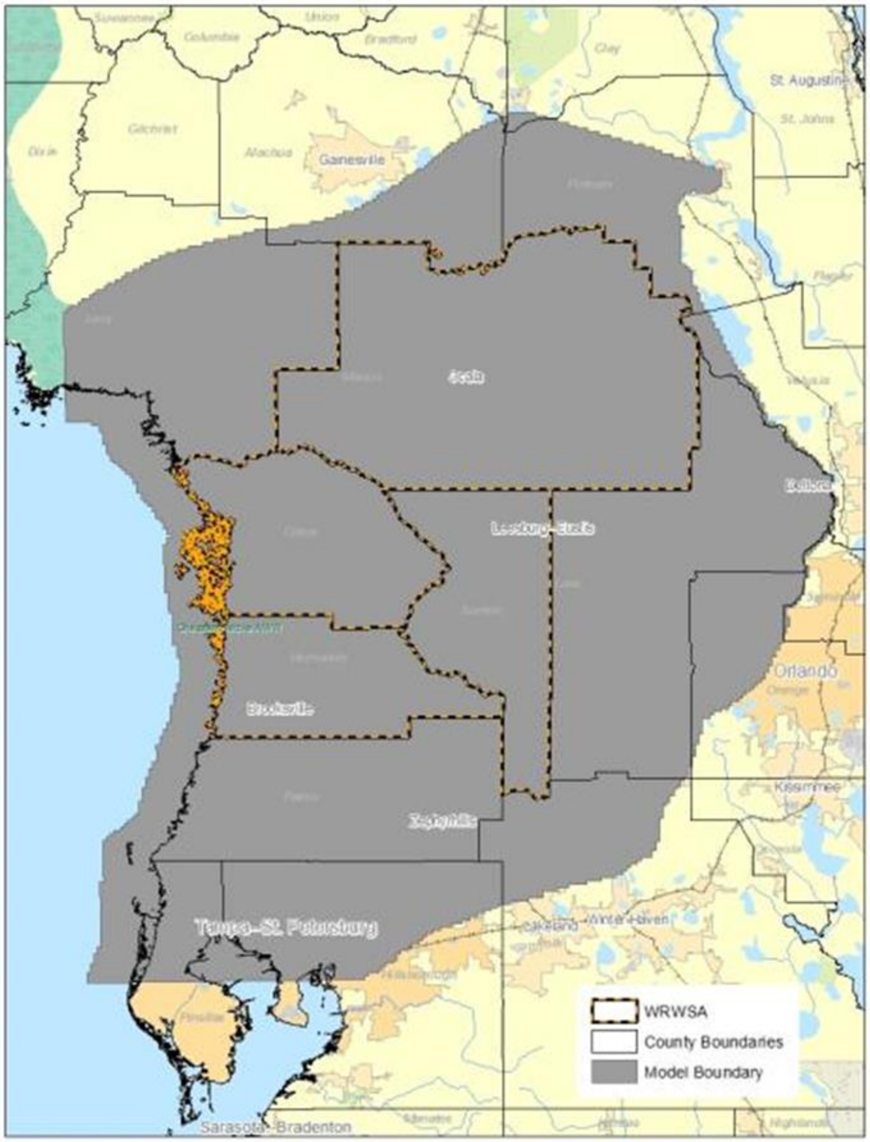

Figure 4-2. Extent of the Domain for the Revised Northern District Model.

conductivity for water flow. Data collected from a small number of test wells indicates that the water beneath Middle Confining Unit 1 is of potable quality, at least in areas that were tested.

Figure 4-4 depicts an estimate of the extent of the freshwater producing zone of the Lower Floridan aquifer as conceptualized in the Northern District Model. However, site-specific water quality analysis will be necessary to confirm the presence of potable quality groundwater or determine the level of treatment needed to meet potable standards at any proposed Lower Floridan aquifer well location. The Lower Floridan aquifer in the eastern portion WRWSA region is expected to supply approximately 6.5 mgd of groundwater for public supply and recreational use by 2035, mostly in Sumter County.

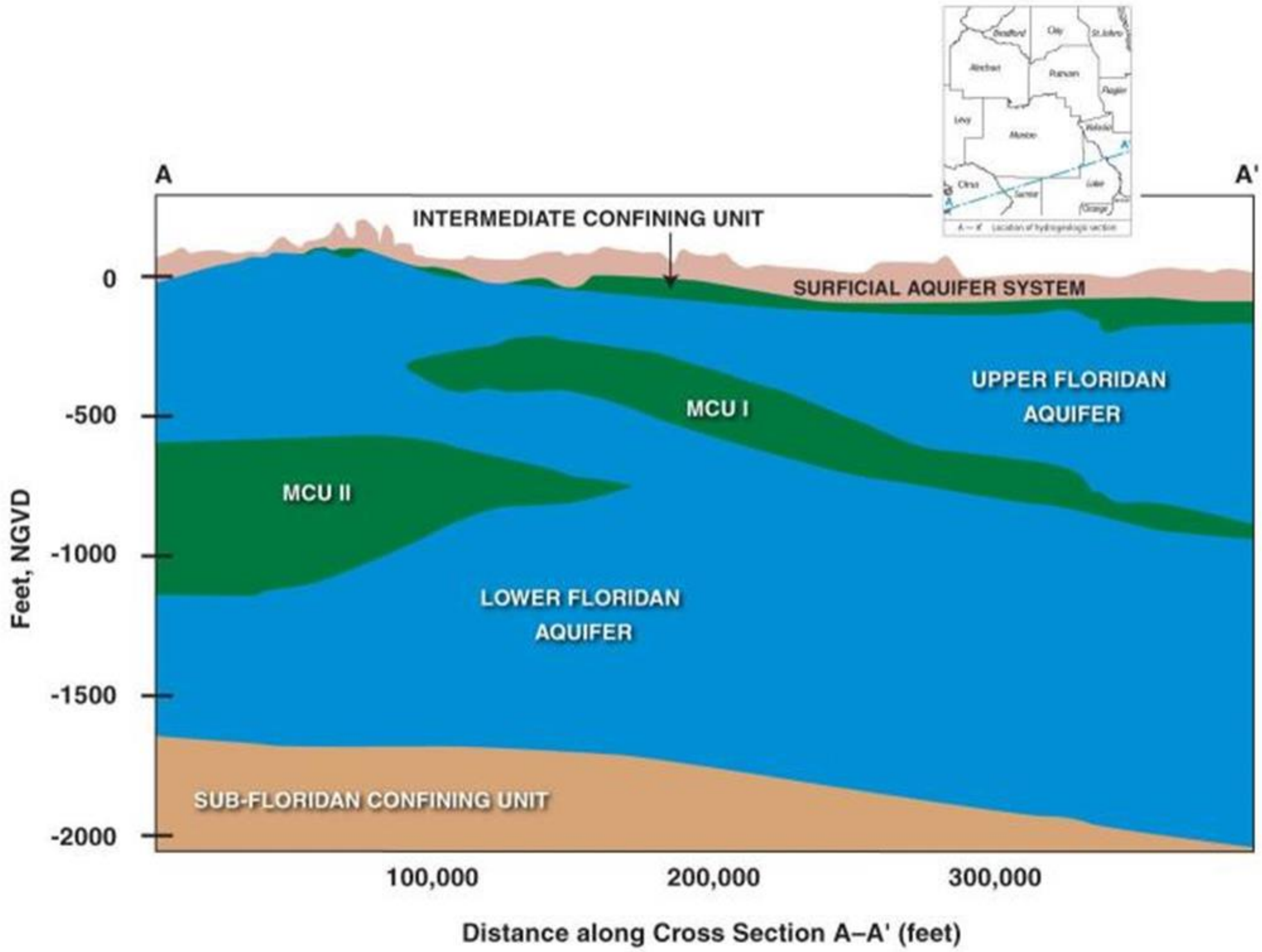

Figure 4-3. Geologic Cross Section through the WRWSA Region showing the Relationship between the Upper and Lower Floridan Aquifers and their Associated Confining Units (SWFWMD Interpretation).

Middle Confining Unit II underlies the Upper Floridan aquifer in the western portion of the WRWSA region. It varies in thickness from approximately 100 to 800 feet and is a competent confining unit (HydroGeologic, 2013). The portion of the Lower Floridan aquifer that exists beneath Middle Confining Unit II contains brackish water and may not be a significant water-bearing unit due to the presence of gypsum and anhydrite, which reduces permeability.

2.0 Groundwater Availability Analysis

The SWFWMD used the Northern District Model to conduct a comprehensive evaluation of the impacts of projected 2035 groundwater withdrawals from the Upper and Lower Floridan aquifers on MFL waterbodies in the WRWSA region. Groundwater withdrawals were set equal to the projected 2035 demand in the model domain, approximately 637 mgd 6.5 mgd from the Upper and Lower Floridan aquifers, respectively, and distributed throughout the domain based on the location of where the demands were projected to occur. The projected 2035 water demands

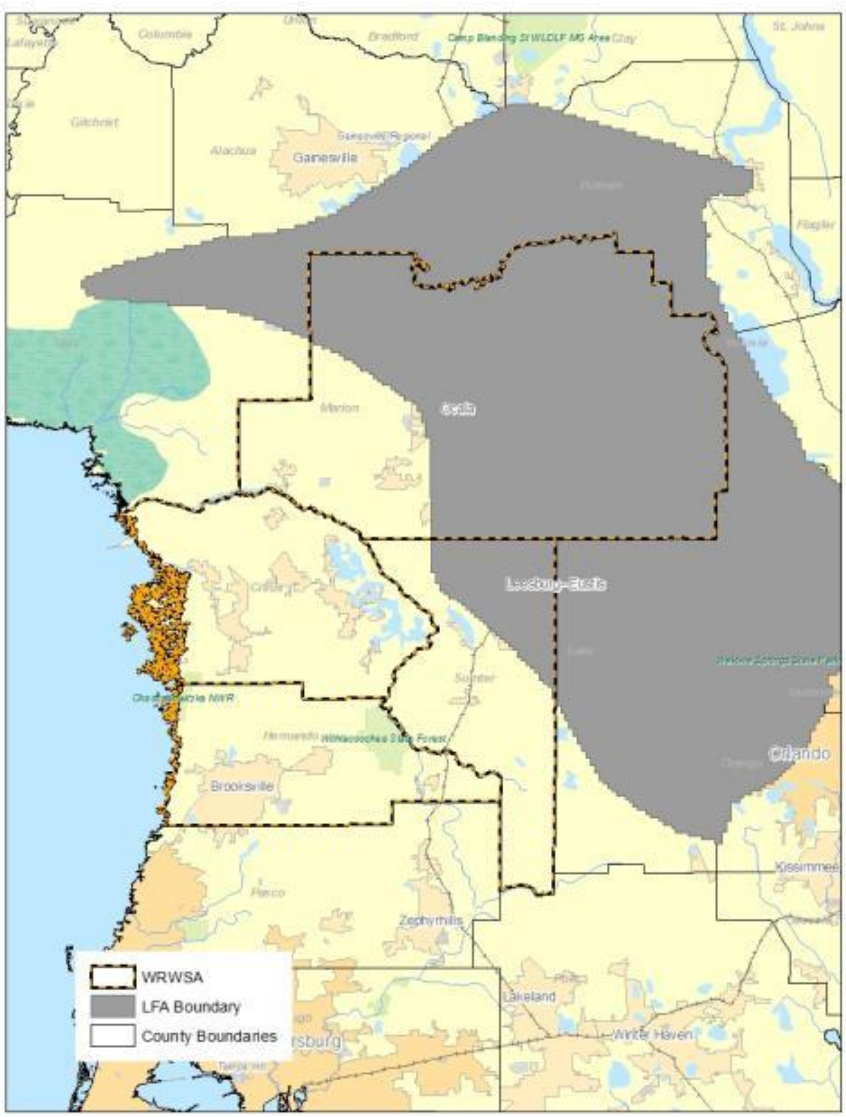

Figure 4-4. Estimated Extent of the Freshwater Producing Zone of the Lower Floridan Aquifer as Conceptualized in the Northern District Model.

used in the model were adjusted by the SWFWMD to account for water conservation and use of reclaimed water. The adjustments for water conservation included reductions of 10 percent for public supply, 10 percent for agriculture, and 20 percent for recreational/aesthetic, which were considered to be reasonable targets. The higher percentage allocated to recreation is due to the likely application of reclaimed water to some of the golf courses. The effects of reclaimed water use projected for 2035 were represented in the model as an increase in recharge in the vicinity of reclaimed water facilities (HydroGeologic, 2013).

The following is a discussion of the results of the modeling investigation that details the degree to which springs and rivers are predicted to be impacted by the 2035 projected groundwater withdrawals.

2.1 Aquifer Drawdowns

Aquifer drawdown was determined by calculating the difference in surficial and Upper Floridan aquifer water levels from pre-pumping conditions to 2035. Drawdowns predicted by the model in the surficial and Upper Floridan aquifer varied across the WRWSA. The range-of-drawdowns in each county was as follows: Citrus County, 0.0 to 0.5 feet, Hernando County, 0.0 to 3.0 feet, Sumter County, 0.0 to 4.0 feet and Marion County 0.0 to 4.0 feet. The largest drawdowns were located in the vicinity of concentrated centers of groundwater withdrawals. Appendix 4-2 contains figures showing drawdown for the surficial and Upper Floridan aquifers.

2.2 Spring Flow

Reductions in the flow of springs from pre-pumping conditions to 2035 that would result from projected groundwater withdrawals are shown in Table 4-6. Additional detail is provided in Appendix 4-2.

Table 4-6. Predicted Year 2035 Flow Declines for MFL Springs.

Spring Name	Pre-Pumpage Flow (cfs)	Predicted 2035 Flows (cfs)	2035 Percent Change	MFL Allowable Flow Reduction (%)
Southwest Florida Water Management District				
Weeki Wachee Springs and River	206.1	192.8	6.5	10.0
Chassahowitzka Springs and River	157.0	154.0	1.9	3.0
Homosassa Springs and River	258.4	250.9	2.9	3.0
Gum Slough Springs[1]	95.3	89.3	6.3	9.0
Kings Bay Springs	465.5	455.4	2.2	Under Development
Rainbow Springs and River	649.3	632.6	2.6	Under Development
St Johns River Water Management District				
Silver Springs	683.4	635.4	7.0	Under Development
Silver Glen Springs	108.0	107.9	0.1	Under Development

[1]The minimum flow for Gum Slough Springs is a staff recommendation and is not yet adopted.

2.3 River Flow

River systems in the WRWSA four-county region include the Withlacoochee and Ocklawaha rivers. Draft minimum flows have been developed for the rivers by the districts. A discussion of how the predicted changes in the baseflow of the rivers resulting from projected 2035 groundwater withdrawals affect their proposed minimum flows is included in Appendix 4-2.

Withlacoochee River - Table 4-7 shows that the predicted decline in baseflow for the Withlacoochee River at Croom and Holder, resulting from projected 2035 groundwater withdrawals, is 4.5 percent and 10.3 percent, respectively. The predicted reduction in groundwater baseflow resulting from the projected 2035 groundwater withdrawals, does not cause the Withlacoochee River to exceed the draft minimum flows at Croom or Holder.

Table 4-7. Predicted Reduction in Baseflow in 2035 for the Withlacoochee River at Croom and Holder.

River Segment	Pre-Pumpage Flow (cfs)	Predicted 2035 Flow (cfs)	Percent Flow Reduction
Withlacoochee at Croom	77.6	74.1	4.5
Withlacoochee near Holder	315.2	282.7	10.3

Ocklawaha River - Table 4-8 shows the predicted percent reduction in baseflow for the Ocklawaha River at Moss Bluff, Conner, and Eureka. SJRWMD is currently developing minimum flows for the Lower Ocklawaha River. Adopted minimum flows, along with the Lower Ocklawaha River's status with regard to the minimum flows, will be reflected in the next water supply plan update.

Table 4-8. Predicted Reduction in Baseflow in 2035 for the Ocklawaha and Silver Rivers.

River Segment Name	Pre-Pumpage Flow (cfs)	Predicted 2035 Flow (cfs)	Percent Reduction
Ocklawaha River near Moss Bluff	46.5	33.7	27.5
Ocklawaha River at Conner	806.5	741.5	8.1
Ocklawaha River at Eureka	811.9	746.7	8.0

2.4 Lakes and Wetlands

The impacts on lakes and wetlands from predicted declines in aquifer levels resulting from the 2035 projected groundwater withdrawals were not included in this analysis. This is because the Northern District Model could not accurately assess impacts to relatively small-scale features such as lakes and wetlands. The SWFWMD undertakes a separate analysis of lakes to determine compliance each year. The MFL lakes in the SWFWMD portion of the WRWSA Region are currently meeting their levels.

SJRWMD uses regional groundwater models in conjunction with surface water models to predict drawdown impacts to lakes and wetlands that have significant connection to the Floridan aquifer. There are eight MFL lakes and wetlands within the SJR portion of Marion County. Of those eight, six are predicted to meet their MFLs based on 2035 projected demand, one has no significant Floridan aquifer connection, and the other is being reevaluated.

Entities seeking permits for groundwater quantities will be required by the water management districts to demonstrate that their proposed withdrawals do not negatively impact these waterbodies.

3.0 Summary of the Water Supply Potential of Groundwater

Developing an accurate estimate of the availability of groundwater for water supply is challenging due to the existence of major uncertainties that include the ongoing process to develop MFLs, which could significantly affect groundwater availability, and lack of data in portions of the region to assess the availability of groundwater in the Lower Floridan aquifer. The results of the modeling investigation presented above demonstrate that in the SWFWMD portion of the WRWSA region, 2035 demands for all use categories can be met with groundwater with no exceedances to springs and rivers for which MFLs have been proposed or adopted. However, this result was achieved by reducing demand through water conservation and mitigating aquifer drawdowns to some degree by recharge from the use of reclaimed water. The implication of this is that groundwater from the Upper Floridan aquifer may be limited in certain areas by 2035.

Based on this information, in the SWFWMD portion of the WRWSA region, additional quantities of groundwater available from the Upper Floridan aquifer were set equal to the projected 2035 increase in total water supply demand, which is approximately 76 mgd. Additional groundwater will be available from the Upper and Lower Floridan aquifers in certain areas, however, an accurate estimate cannot be made at this time.

In the SJRWMD portion of the WRWSA region, MFLs for Silver Springs/Silver River are currently being developed by the SJRWMD and will likely impact resource availability. An analysis by SJRWMD staff indicates that the current draft MFLs would not be met under 2035 projected demands. Therefore the availability of groundwater from the Upper Floridan aquifer to meet projected demands was set equal to a range from zero to 21 mgd. Twenty-one mgd is the projected increase in total water supply demand in the SJRWMD portion of Marion County in the year 2035. While it is likely that some portion of this demand will be met by groundwater from the Upper Floridan aquifer, it is not possible to determine how much at this time. It must also be noted that groundwater from the Lower Floridan aquifer may be available to meet some portion of this demand.

Section 4. Surface Water

The Withlacoochee and Ocklawaha rivers are the only major river systems in the WRWSA four-county region. The Silver River is a run for Silver Springs and a tributary of the Ocklawaha River. The following is an assessment of the availability of water from these rivers for water supply. The Cross Florida Barge Canal in northwest Citrus County is an additional source of surface water. However, because the canal is open to the Gulf of Mexico, water quality can be very similar to that of seawater, except when water is discharging into it from the structure on Lake Rousseau. Because this is the case, a facility that would utilize water in the Barge Canal for water supply would essentially have to be capable of desalinating water with salinity near that of seawater. This is why the seawater desalination project option discussed in this chapter in Section 5 proposes to use the barge canal as its feed-water source.

1.0 Withlacoochee River

1.1 Overview

The Withlacoochee River watershed covers approximately 2,100 square miles. The 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. Within the Green Swamp near Highway 98, where the Withlacoochee River is close to the headwaters of the Hillsborough River, a low, natural saddle separates the watersheds of the rivers. The Withlacoochee River can discharge to the Hillsborough River during high flows, but overflow seldom occurs.

The upper reaches of the watershed in the Green Swamp consist mostly of agricultural lands and wetlands. The river corridor is more developed near Dade City in Pasco County but for the most part, it remains relatively rural in character. From the Lake Tsala Apopka area downstream to Dunnellon, isolated areas of development are present but much of the landscape is wilderness or rural. The main tributaries to the Withlacoochee River are Pony Creek, Grass Creek, Gator Hole Slough, Little Withlacoochee River, Jumper Creek, Panasoffkee Outlet River, Gum Slough, and Rainbow River. Several springs flow into the river, including Dobes Hole Spring, Riverdale Spring, Nichols Spring, Gum Slough Springs, Wilson Head Spring, Blue Spring, and Rainbow Springs. There are several control structures that affect flow in the Withlacoochee River including the Inglis Dam at Lake Rousseau, structures between Lake Tsala Apopka and the river, and the Wysong-Coogler Dam located two miles downstream from the mouth of the Panasoffkee Outlet River.

West of Lake Rousseau, the Withlacoochee River flows to the Gulf of Mexico where it discharges into the Withlacoochee Bay estuary. From Inglis to the Gulf, the river has been greatly altered by the construction of a lock, dam, and bypass canal. Construction of the barge canal changed the hydrologic regime of the lower portion of the Withlacoochee River. The barge canal limits the high flow conditions historically experienced by the estuary with an overall reduction to long-term average flows.

The Withlacoochee River is generally a gaining stream with increasing groundwater discharge in the downstream direction (Trommer et al., 2009). It was estimated that during the period from October 2003 to March 2007, approximately 40 percent of the total river flow at Holder was from groundwater seepage, 30 percent was from tributary flow, and 30 percent was from spring flow.

1.2 Availability Assessment

The following is an evaluation of the Withlacoochee River system's ability to provide water for potential water supply projects. The evaluation is based on the SWFWMD's proposed minimum flows at the Croom and Holder gaging stations, where the available flow record is the most comprehensive. A discussion and analysis of the yield at Lake Rousseau is also provided. The flow records from these gages were used to develop the draft minimum flows which constrain the potential river withdrawals. Anthropogenic flow declines due to changes in land use, groundwater withdrawals, climate cycles, and climate change are not considered in this evaluation. These factors would be considered during the design phase if and when a water supply project is developed on the river. The yield evaluation is subject to actual adoption of the Withlacoochee River minimum flows.

It should be noted that the combined capacity of the three facilities does not represent the quantity of water that could be developed from the river. The most likely scenario is that only one of the facilities will eventually be constructed.

The SWFWMD has proposed minimum flows for the upper, middle, and lower segments of the Withlacoochee River with official adoption scheduled for 2016. These minimum flows were developed using seasonal blocks corresponding to periods of low, medium, and high flows, and by applying the SWFWMD's percent-of-flow method to determine minimum flows.

A goal of the percent-of-flow method is to maintain the natural flow regime of the river, albeit with some flow reduction for water supply. Natural flow regimes have short-term and seasonal variations in the timing and volume of streamflow that reflect the drainage basin characteristics of the river and the climate of the region. Maintenance of the natural flow regime and its seasonal variation is linked to the integrity of biological processes within the river and its floodplain. As summarized in SWFWMD's minimum flow reports for rivers throughout the district, these processes are related to fish passage, the inundation of instream and floodplain habitats, and maintenance of adequate water levels and velocities to provide habitat suitable for the growth and reproduction of fishes and invertebrates.

The percent-of-flow method is a unique approach that allows water users to take a percentage of streamflow at the time of the withdrawal. The percent-of-flow method has been used for the regulation of water use permits in the SWFWMD since 1989, when it was first applied to withdrawals from the Lower Peace River. The method is oriented for use on rivers that still retain a largely natural flow regime. The percent-of-flow method has been applied to determine and adopt minimum flows for a series of rivers in the SWFWMD, including the freshwater segments of the Alafia River, Myakka River, and Hillsborough River, and the upper and middle segments of the Peace River.

Definition of Seasonal Flow Blocks - In the development of river minimum flows the SWFWMD uses a "building block" approach to simulate the short-term and seasonal hydrologic variations that are observed in the period of record flows. Previous minimum flow documents have identified three different building blocks within a year, each corresponding to a period of low, medium, or high flows. These blocks differ according to river. For the Withlacoochee River, Block 1, from April 28 to July 31 (Julian Day 118 to 212), is the low flow period, whereas the highest flows occur during Block 3, from August 1 to October 28 (Julian Day 213 to 301). Block 2 is comprised of the remaining days and corresponds to the medium flow. As the percent-of-flow method is applied individually to each block, the availability of water thus differs according to seasonal block.

Draft Upper and Middle Withlacoochee River Minimum Flows – Minimum flows for three USGS gage sites along the river were developed for each of the seasonal blocks. The minimum flows include flow reductions based on limiting changes in aquatic and wetland habitat availability that may be associated with seasonal changes in flow. The minimum flows also incorporate low flow thresholds based on fish passage depths, below which no withdrawals are permitted. The draft minimum flows are provided in Table 4-9 for each of the gages.

Table 4-9. Draft Minimum Flows for the Upper and Middle Withlacoochee River.

USGS Gage	Low Flow Threshold	Maximum Allowable Percent Reductions Block 1[1]	Maximum Allowable Percent Reductions Block 3[3]	Maximum Allowable Percent Reductions Block 2[2]
Croom	30 cfs (19.4 mgd)	11%	16% when discharge ≤ 400 cfs 9% when discharge > 400 cfs	16%
Wysong	60 cfs (38.8 mgd)	15%	15% when discharge ≤ 600 cfs 8% when discharge > 600 cfs	13%
Holder	150 cfs (103.4 mgd)	13%	9% when discharge ≤ 1250 cfs 7% when discharge > 1250 cfs	7%

[1]*Block 1: April 28 - July 31 (Julian Day 118-212)*
[2]*Block 2: October 29 - April 27 (Julian Day 302-117)*
[3]*Block 3: August 1 – October 28 (Julian Day 213-301)*

MFL-Adjusted Hydrographs -The draft minimum flows were applied to the long-term flow records and inspected for periodicity. A goal of the SWFWMD methodology is to maintain the long-term natural seasonal variability of a system's flow regime. The minimum flows, including the low flow thresholds, were applied to the median daily flows for the period of record for each gage to create a hypothetical minimum flows-adjusted hydrograph (Figures 4-5 through 4-7). The figures show how the overall hydrologic regime and seasonality of each block has been preserved in these scenarios at the Croom, Wysong, and Holder gages.

Croom Gage Water Supply Yield - The drainage area of the Withlacoochee River above Croom is 810 square miles. Flow records are available for the Croom gage, located approximately 18.6 miles upstream of the Outlet River from Lake Panasoffkee, from 1939 to present. The flows over the period of record for the gage were used to estimate a median quantity for allowable withdrawal based on the draft minimum flow. The estimated quantities of water available for water supply at Croom during each seasonal block are shown in Table 4-10. An estimated withdrawal of 19.8 mgd would be available on a median annual basis, with availability being lower during the dry season and higher during the wet season. Also shown in the table are the average number of days in each block when withdrawals could not occur because flows would be lower than the 30 cfs (19.4 mgd) low flow threshold. A water supply project at this location, where periodic supply interruptions would occur, could be suited for conjunctive use and/or aquifer recharge.

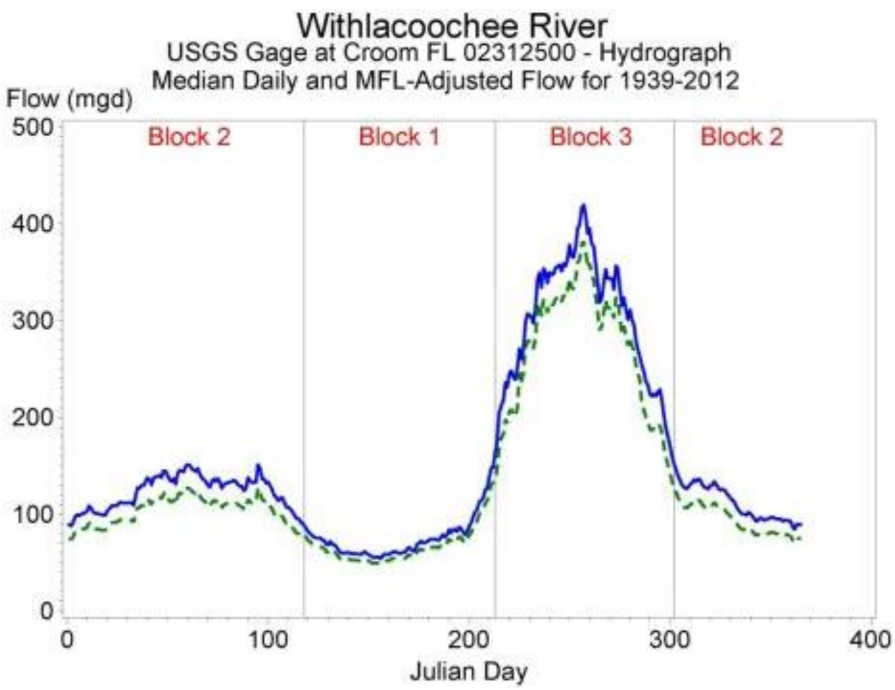

Figure 4-5. Median Daily (blue line) and Minimum Flow-Adjusted (green line) Flows (1939 - 2012) on the Withlacoochee River at Croom, by Seasonal Flow Block.

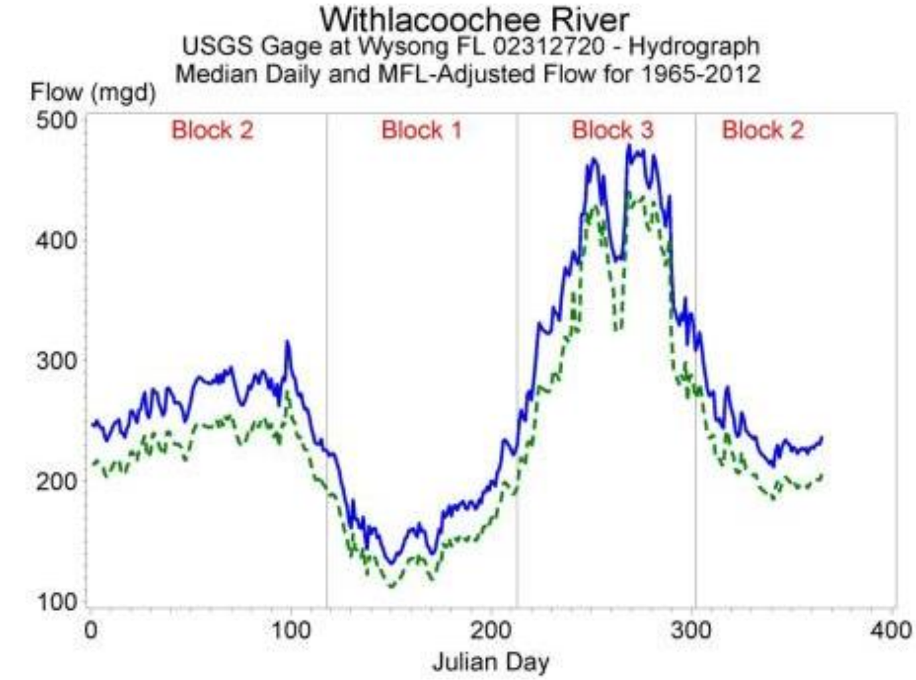

Figure 4-6. Median Daily (blue line) and Minimum Flow-Adjusted (green line) Flows (1965 -2012) on the Withlacoochee River at Wysong, by Seasonal Flow Block.

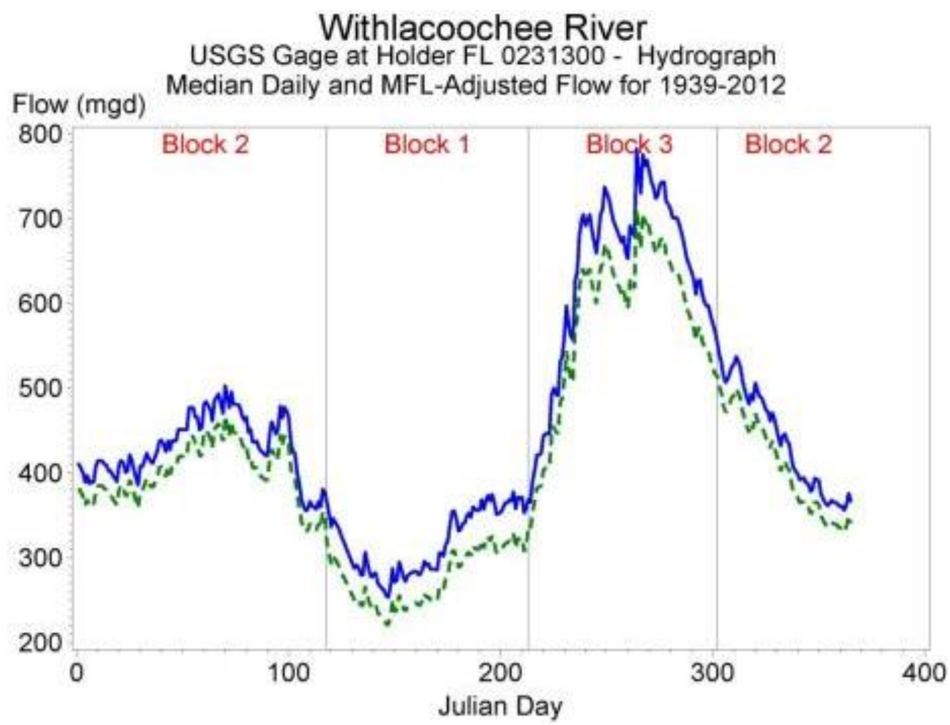

Figure 4-7. Median Daily (blue line) and Minimum Flow-Adjusted (green line) Flows (1939 – 2012) on the Withlacoochee River at Holder, by Seasonal Flow Block.

Table 4-10. Design Withdrawal from the Withlacoochee River at Croom, with Low Flow Threshold at 30 cfs (19.4 mgd).

Seasonal Block	Block 1 Apr 28 – Jul 31	Block 2 Oct 29 – Apr 27	Block 3 Aug 1 – Oct 28
Number of Days in each Block	95	181	89
Long-Term Daily Median Flow (mgd)	70.4	125.4	312.17
Draft Minimum Flow Withdrawal	11% of flow	16% of flow	16% when flow is ≤ 400 cfs 9% when flow is > 400 cfs
Daily Median Withdrawal[1] (mgd)	7.8	20.1	31.8
Average Number of Days per Block when Water would not be Available (Flows below) Low-Flow Threshold	15	18	4
Potential Annual Median Withdrawal (mgd)	**19.85**		

[1] Withdrawals assume that existing legal uses at other locations on the river do not affect available yield.

Wysong Gage Water Supply Yield - The drainage area for the Withlacoochee River above the Wysong gage is approximately 1,520 square miles. Flow records are available for the Wysong gage from 1965 to present. The flows over the period of record for the gage were used to estimate a median quantity for allowable withdrawal based on the draft minimum flow.

Flow at this gage has been influenced over the past several decades by structures that have been installed on the river in the vicinity of the gage. An inflatable fabridam structure was installed in 1964 and removed in the late 1980's after failing to perform as designed. The current structure, the Wysong-Coogler Water Conservation Structure, was constructed in 2002 to maintain upstream river elevations to allow for the diversion of water into the Tsala Apopka Chain of Lakes, restrict outflow from Lake Panasoffkee, and recharge the Upper Floridan aquifer. The current structure is an operable, inflatable dam. The regulation schedule for the dam calls for it to be lowered when river levels fall below an elevation of 39.5 feet. The Wysong structure is typically submerged, making hydraulic analysis difficult. The structure's effect on historic flows is unclear as river level data is mostly limited to what has been collected at the structure, distant USGS gaging sites, and District structures that control the flow into Lake Tsala Apopka. The relatively short operational period for the structure (2002-present) limits any reliable assessment of its effects on river flow. In the absence of data on the structure's effect on the river's flow regime, the flow data for the period of record at the Wysong gage (without consideration of changes to the structure) is the best available predictor of future flows.

The estimated quantities of water available for water supply at Wysong during each seasonal block are shown in Table 4-11. An estimated withdrawal of 33.6 mgd would be available on a median annual basis, with availability being lower during the dry season and higher during the wet season. Also shown in the table are the average number of days in each block when withdrawals could not occur because flows would be lower than the 60 cfs (38.8 mgd) low flow threshold. A water supply project at this location, where periodic supply interruptions would occur, could be suited for conjunctive use and/or aquifer recharge.

Table 4-11. Design Withdrawal from the Withlacoochee River at Wysong, with Low Flow Threshold at 60 cfs (38.8 mgd).

Seasonal Block	Block 1 Apr 28 – Jul 31	Block 2 Oct 29 – Apr 27	Block 3 Aug 1 – Oct 28
Number of Days in each Block	95	181	89
Long-Term Daily Median Flow (mgd)	171.27	259.17	386.5
Draft Minimum Flow Withdrawal	15%	13%	15% when discharge ≤ 600 cfs 8% when discharge > 600 cfs
Daily Median Withdrawal[1] (mgd)	25.69	33.69	38
Average Number of Days per Block when Water would no be Available (Flows below Low Flow Threshold)	13	11	3
Potential Annual Median Withdrawal (mgd)	**33.61**		

[1] *Withdrawals assume that existing legal uses at other locations on the river do not affect available yield.*

Lake Panasoffkee and the Tsala Apopka Chain both have adopted minimum levels. In contrast to the draft minimum flows for the Withlacoochee River system, which are based on flow criteria, the adopted minimum flows for the lake systems are based on stage criteria. There are hydraulic relationships between the river system, lake inflows and outflows, and lake stages that would require consideration in the permitting of the withdrawal. The Outlet River from Lake Panasoffkee has been structurally altered and has a complex hydraulic relationship with the river in the area of the confluence. Due to this complexity, hydraulic effects associated with a potential withdrawal structure in the river channel would require further consideration if and when the project progresses to the design and permitting phase.

Holder Gage Water Supply Yield – The drainage area of the Withlacoochee River at Holder is approximately 1,820 square miles and includes the discharge from Lake Tsala Apopka at outfall canal C-331. The Holder gage is located about 20 miles downstream of the Outlet River from Lake Panasoffkee and has a flow record starting in 1928. The flows over the period of record for the gage were used to estimate a median quantity available for withdrawal at Holder.

The estimated quantities of water available for water supply at Holder during each seasonal block are shown in Table 4-12. An estimated withdrawal of 35.6 mgd would be available on a median annual basis, with availability being lower during the dry season and higher during the wet season. Also shown in the table are the average number of days in each block when withdrawals could not occur because flows would be lower than the 150 cfs (103.4 mgd) low flow threshold. The draft minimum flow seasonal blocks and estimated withdrawal quantities for Holder are shown in Table 4-12.

Lake Rousseau Water Supply Yield - A minimum flow for the Lower Withlacoochee River (based on discharge from Lake Rousseau) has not been established, and a proxy minimum flow has not yet been estimated by the SWFWMD. It is anticipated that withdrawals could occur year round at this location due to sufficient inflows from the Rainbow River. The Rainbow River has a relatively even flow distribution due to its spring source, with a historic median flow of 681 cfs (440.1 mgd). Actual minimum flow adoption for the Lower Withlacoochee River, currently scheduled for 2016, will determine the potential yield. It might also affect possible withdrawals upstream near the Holder USGS gage. In addition, the US Army Corps of Engineers regulation schedule at the Inglis Dam would need to be considered if and when a water supply facility advances to the design and permitting phase at the Lake Rousseau outfall.

Table 4-12. Design Withdrawal from the Withlacoochee River at Holder, with Low Flow Threshold at 150 cfs (103.4 mgd).

Seasonal Block	Block 1 Apr 28 – Jul 31	Block 2 Oct 29 – Apr 27	Block 3 Aug 1 – Oct 28
Number of Days in each Block	95	181	89
Long-Term Daily Median Flow (mgd)	316.05	432.39	675.4
Draft Minimum Flow Withdrawal	13%	7%	9% when discharge ≤ 1250 cfs 7% when discharge > 1250 cfs
Daily Median Withdrawal[1] (mgd)	41.09	30.27	60.79
Average Number of Days per Block when Water would not be Available (Flows below Low-Flow Threshold)	9	7	2
Potential Annual Median Withdrawal (mgd)	**35.63**		

[1] *Withdrawals assume that existing legal uses at other locations on the river do not affect available yield.*

2.0 Ocklawaha River

2.1 Overview

The Ocklawaha River flows north from its headwaters in Lake County through the eastern half of Marion County. Significant inflows occur at the confluence with Silver River, and at Orange Creek. The Moss Bluff Dam and Rodman Dam are significant hydraulic features within the river system as it traverses Marion County into Putnam County.

River flows are recorded at three long-term USGS gages from south to north along the river system: Moss Bluff, Conner, and Eureka. Although there are gaps in these data sets, the flow records from these gages will be used to develop minimum flows which will likely constrain the potential river withdrawals. A shorter term gage is located at the Rodman Dam.

As discussed in the WRWSA's 2010 Water Supply Plan, several estimates of Ocklawaha River water availability have been developed. These estimates tend to focus on areas downstream of the confluence with the Silver River, which is known as the Lower Ocklawaha River.

2.2 Availability Assessment

Just downstream of the Ocklawaha and Silver River confluence at the Conner gage, the median flow is 585.8 mgd, and the river has a relatively even flow distribution due to the discharge of Silver Springs, the source of the Silver River. If a water supply facility were to be developed at this location, it is anticipated that raw water storage might not be necessary or would be minimal due to the relatively consistent flows from the Silver River. However, this stretch of the Ocklawaha River from SR 40 to Eureka is pending MFLs adoption which will likely limit withdrawal quantities. Locations further downstream may provide the opportunity for larger withdrawals.

The draft SJRWMD District Water Supply Plan states that preliminary estimates indicate that up to 30 mgd may be available from the river in the District's Planning Region 2 (which includes

Marion County) depending on how much is withdrawn in the District's other planning regions. The draft District Water Supply Plan also states that this estimate will be refined by MFLs that are currently being established for the river.

3.0 Summary of the Water Supply Potential of Surface Water

3.1 Withlacoochee River

Available flows are based on the SWFWMD's proposed minimum flows for the river which were developed at the Croom, Wysong, and Holder gages. It should be noted that the combined capacity of the three facilities does not represent the quantity of water that could be developed from the river. The most likely scenario is that only one of the facilities will eventually be constructed. The Holder gage is furthest downstream, and therefore, the available flow is greatest there; approximately 35.6 mgd on a median annual basis. Much larger quantities could be developed downstream at Lake Rousseau because of its location downstream of the very large inflow of the Rainbow River, fed by Rainbow Springs. The SWFWMD did not establish a minimum flow at this location so there is no estimate of flow potentially available for water supply. The quantities available at Holder will be used for the water supply potential of the Withlacoochee River, with the understanding that significantly larger quantities may be available once flow studies are completed at Lake Rousseau.

3.2 Ocklawaha River

The SJRWMD's draft District Water Supply Plan states that preliminary estimates indicate that up to 30 mgd may be available from the river in the District's Planning Region 2 (which includes Marion County) depending on how much is withdrawn in the District's other planning regions. This estimate will be refined once MFLs are adopted for the river.

Section 5. Seawater Desalination

Seawater is defined as water in a sea, gulf, bay, or ocean having a total dissolved solids concentration greater than or equal to 35,000 mg/l. Seawater can provide a stable, drought-proof water supply that is increasingly attractive as the availability of traditional supplies diminishes and advances in Reverse Osmosis (RO) membrane technology and turbine efficiency continue to reduce costs. Seawater desalination using RO is a process that produces fresh water by passing pressurized seawater through a semi-permeable membrane. The process results in fresh product water and a mineralized concentrate byproduct.

Nearly all seawater desalination facilities dispose of RO waste concentrate by surface water discharge, which entails significant environmental considerations. A National Pollution Discharge Elimination System (NPDES) permit and other local permits may be required to discharge the concentrate into surface waters. Other methods of disposing of the concentrate include deep well injection into a saline aquifer and zero liquid discharge.

1.0 Crystal River Power Station Site

The WRWSA in cooperation with the SWFWMD has been investigating the potential to develop a seawater desalination facility at the Crystal River Power Station in Citrus County. This location was chosen because of the potential to co-locate it with existing power generating facilities. The benefits of co-location include the cooling water stream and permitted outfalls of the power plant that would dilute the waste concentrate of the desalination facility to acceptable levels.

However, Duke Energy has recently shut down or will shut down all of the units that required large quantities of cooling water, so this method of waste concentrate disposal is no longer feasible. Because there are other methods of waste concentrate disposal, a seawater desalination facility may still be feasible at the site.

2.0 Investigation of Additional Sites

An investigation was conducted to determine the potential for developing sites for additional seawater desalination facilities along the coasts of Citrus and Hernando counties. The investigation concluded that developing a new site with all the necessary attributes including permitted intakes and discharges, an above sea level location near the gulf, and availability of power, water, and road access, would be highly problematic. Environmental alterations would be extensive and would include using fill material to raise the site above flood zones, filling wetlands, and dredging through seagrass flats and protected coastal zones, all of which would be extremely costly and very difficult if not impossible to permit in the present-day regulatory framework. Figure 4-8 shows that most of the land and near-shore areas west of US 19 have some level of federal or state protection. Other issues include the high level of risk in building a facility along a nearly flat coast that is experiencing sea-level rise and higher elevation storm surges.

A potential option is to locate a desalination facility east of US 19. The feedwater for such a facility would be brackish groundwater pumped from the Lower Floridan aquifer rather than seawater. The waste concentrate would be disposed of through deep well injection. At this time, evaluating the feasibility of this type of desalination option is not possible due to a lack of information on the extent, depth, water-bearing properties, and water quality of the Lower Floridan aquifer and its degree of isolation from the Upper Floridan aquifer. As the SWFWMD continues to explore and delineate the Lower Floridan aquifer, it will be possible in future updates of the WRWSA's Water Supply Plans to evaluate the feasibility of such an option.

3.0 Summary of the Water Supply Potential of Seawater Desalination

The quantity of water that could be available from desalinated seawater was set at 15 mgd. This estimate was developed for the WRWSA's 2010 Water Supply Plan and was based on a long-range forecast of the demands for utilities that could potentially be served by the facility. Although a larger quantity of water could theoretically be produced, the difficulty of disposing of the reject concentrate may make it infeasible even to produce 15 mgd.

Part B. Determination of Water Supply Deficits/Surpluses

Section 1. Summary of Available Supply from Potential Sources

Table 4-13 is a summary of the information presented above regarding the potential for demand reduction and the additional quantity of water that will potentially be available from all sources of water in each county in the WRWSA four-county region. The table shows that the total quantity available ranges from 174.8 to 195.5 mgd. This is considered a conservative estimate because of the potential for additional fresh and brackish groundwater from the Lower Floridan aquifer and much higher quantities available from the Withlacoochee River if a water supply facility were constructed below the confluence of the Withlacoochee and Rainbow Rivers.

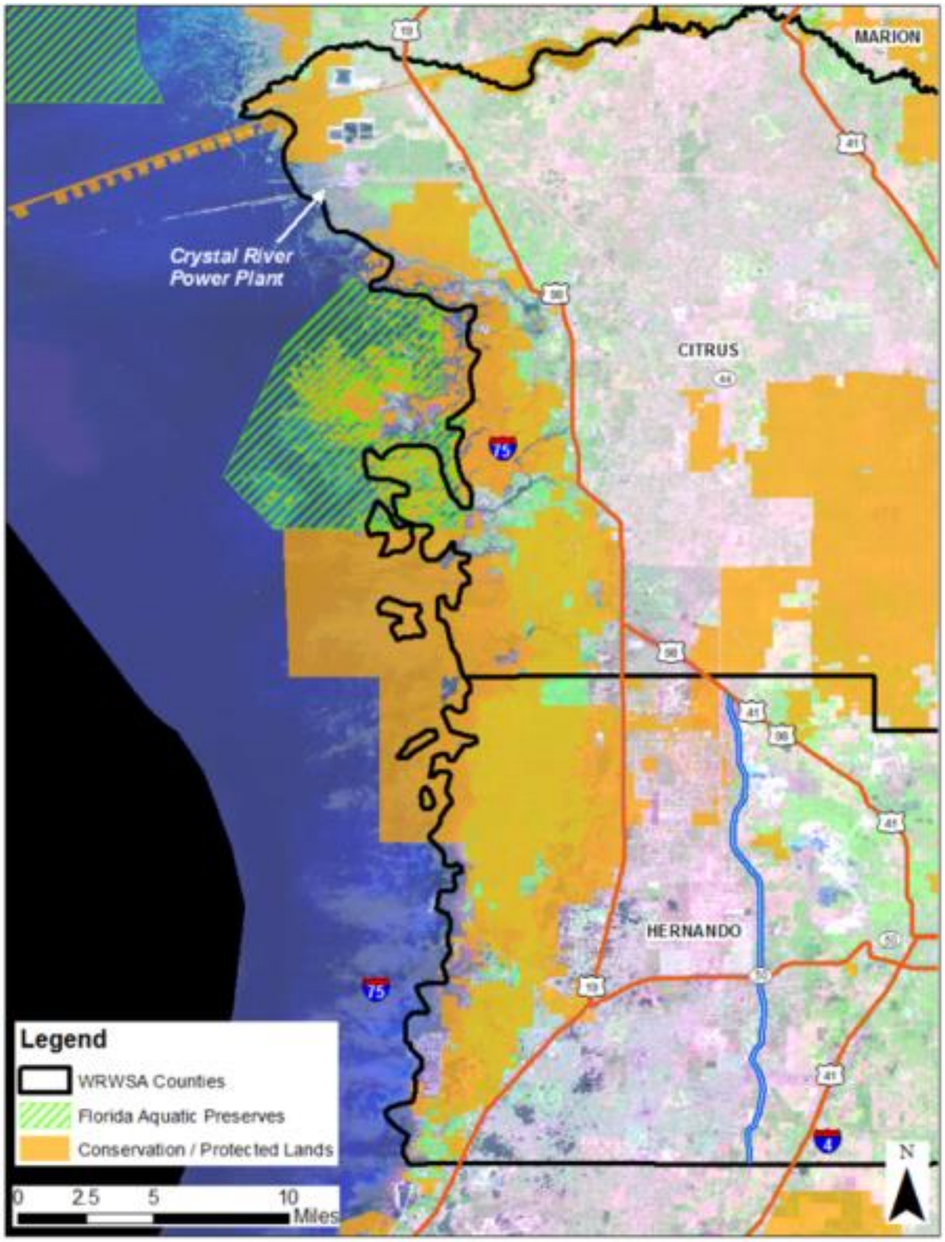

Figure 4-8. Conservation and Protected Lands and Near-Shore Areas in Coastal Hernando and Citrus Counties.

Table 4-13. Demand Reduction Potential and Future Water Availability from all Sources in the WRWSA Four-County Region (mgd).

County	Water Conservation[1]	Reclaimed Water	Groundwater (Upper Floridan Aquifer)		Surface Water		Seawater Desalination[5]	Total
			SW	SJ[2]	Withlacoochee[3]	Ocklawaha[4]		
Citrus	2.8	1.3	10.7	-	17.8		15.0	47.6
Hernando	4.9	1.2	17.2	-				23.3
Marion	3.0	2.3	18.1	0 to 20.7		30		53.5 to 74.1
Sumter	2.3	0.1	30.3		17.8			50.5
Total	**13.0**	**4.9**	**76.3**	**0 to 20.7**	**35.6**	**30**	**15.0**	**174.8 to 195.5**

[1]Potential for demand reduction based on 10 percent conservation savings through 2035 as calculated by the EZGuide model.
[2]The range of potentially available groundwater for the SJRWMD portion of Marion County is due to the uncertainty of how the MFL for Silver Springs/Silver River will affect the availability of groundwater in the Upper Floridan aquifer.
[3]This quantity is the median flow based on SWFWMD's proposed minimum flow at Holder and is evenly divided between Citrus and Sumter in this table because the river separates the counties. It is likely that much larger quantities could be available downstream at Lake Rouseau. A water supply facility could also be constructed on the Withlacoochee River in Hernando County. The table could be altered to reflect a significant quantity available from the river in Hernando, which would result in a reduction in quantities available from the river in Citrus and Sumter counties.
[4]Estimated annual average taken from the draft SJRWMD DWSP. This quantity will be modified upon adoption of MFLs for the river.
[5]This quantity is proposed for a seawater desalination facility at the Crystal River Power Station. Additional quantities are not proposed due to uncertainties with disposal of reject concentrate and the lack of other suitable sites for desalination facilities along the coast of Hernando and Citrus counties.

Section 2. Comparison of Projected Demand to Potentially Available Supply

The projected increase in demand for the planning period for all use categories in the WRWSA four-county region was compared to potentially available supplies as shown in Table 4-13. The projected additional water demand in the region for all use categories for the 2010-2035 period is approximately 96.7 mgd (Table 3-23).

The results of the modeling investigation presented previously demonstrate that in the SWFWMD portion of the WRWSA region, 2035 demands for all use categories can be met with groundwater with no exceedances to springs and rivers for which MFLs have been proposed or adopted. However, this result was achieved by reducing demand through water conservation and mitigating aquifer drawdowns to some degree by recharge from the use of reclaimed water. The implication of this is that groundwater from the Upper Floridan aquifer may be limited in certain areas by 2035.

Based on this information, in the SWFWMD portion of the WRWSA region, additional quantities of groundwater available from the Upper Floridan aquifer were set equal to the projected 2035 increase in total water supply demand, which is approximately 76 mgd. Additional groundwater will be available from the Upper and Lower Floridan aquifers in certain areas, however, an accurate estimate cannot be made at this time.

In the SJRWMD portion of the WRWSA region, MFLs for Silver Springs/Silver River are currently being developed by the SJRWMD and will likely impact resource availability. An analysis by SJRWMD staff indicates that the current draft MFLs would not be met under 2035 projected demands. Therefore the availability of groundwater from the Upper Floridan aquifer to meet projected demands was set equal to a range from zero to 21 mgd. Twenty-one mgd is the projected increase in total water supply demand in the SJRWMD portion of Marion County in the year 2035. While it is likely that some portion of this demand will be met by groundwater from the Upper Floridan aquifer, it is not possible to determine how much at this time. It must also be noted that groundwater from the Lower Floridan aquifer may be available to meet some portion of this demand.

Table 4-13 shows that the potential of demand management and all other sources to meet demand beyond 2035, even at the low end of the range, is much greater than the projected 2035 demand. What is not included in the table is the potential of the Lower Floridan aquifer to produce additional quantities of fresh and brackish groundwater that could be significant. The water management districts intend to continue their programs to develop the data necessary to accurately assess the water supply potential of the Lower Floridan aquifer during the next decade.

Chapter 5. Water Supply Project Options

This Chapter identifies water supply project options that could be developed to help public supply utilities meet their projected demands. As discussed in Chapter 4, sources of water potentially available to meet projected demand in the WRWSA four-county region include conservation, reclaimed water, groundwater, surface water, and seawater desalination. Investigations were conducted to identify reasonable project options for developing each of the sources, provide planning- level technical and environmental feasibility analyses, and to determine capital and operation and maintenance costs.

A number of the project options are of such a scale that they would likely be implemented by a utility in cooperation with one or both of the water management districts and the WRWSA. Other project options such as those involving reclaimed water and conservation could be implemented by individual utilities. It is anticipated that utilities will choose project options or combine elements of different project options that best fit their needs. Following a decision to pursue a project option identified in this Water Supply Plan, it will be necessary for the parties involved to conduct more detailed engineering, hydrologic, biologic, and financial assessments to provide the necessary technical support for developing the project option and to obtain all applicable permits.

Part A. Overview of Water Supply Project Options

Section 1. Water Conservation

In Chapter 4 it was discussed how the EZGuide water conservation model was used to determine which BMPs and other water conservation measures could be used to accomplish three different tiers of water savings; 5 percent, 10 percent, and 15 percent, for 45 public supply utilities in the WRWSA region. The potential water savings for the three tiers were presented for utility and each county. In this section, the costs of implementing the BMPs to achieve each tier of water savings are presented.

Table 5-1 describes the types of best management practices (BMPs) and other water conservation measures that were identified for implementation in the WRWSA region. The table also shows the service life of each BMP and the percentage of total water savings within the WRWSA region that is attributable to each BMP.

The table shows that the replacement of inefficient faucets with new, more efficient models would achieve the highest savings percentage. This is because this BMP has a relatively long service life and is inexpensive.

The scale of deployment and the efficiency of the recommended BMPs vary between each tier of options for each utility in the WRWSA region. For instance, toilets with different flush efficiencies (i.e., 1.1, 1.3, or 1.6 gallons per flush) may be recommended based the conservation goal, and the profile of each utility. The scale of deployment and mix of BMPs prescribed for each utility service area are dependent mainly on the following criteria:

Table 5-1. Water Conservation BMPs and Other Measures Identified for the WRWSA Region.

Public Supply Sub-Sector	Fixture Type	Service Life (Years)	% of Savings
Residential - Single & Multi - Family	Toilet	40	2.3
	Clothes Washer	11	0.0
	Shower Head	8	13.9
	Faucet	15	45.9
	Soil Moisture Sensor	5	16.3
	Non-Potable Irrigation System	25	3.6
	Irrigation Audit	5	7.5
Commercial, Institutional, & Industrial	Toilet	25	1.5
	Urinal	25	3.5
	Showerhead	8	0.7
	Faucet	15	3.9
	Pre-Rinse Spray Valve	5	0.1
	Water Audit	5	1.2
	Total		**100**
	Weighted Average, years	**12.9**	

- percentage of residential versus commercial parcels;
- age of structures;
- size of structures; and
- size of irrigable areas.

Table 5-2 presents the EZGuide modeling results showing the percent each BMP or conservation measure contributes to achieving the 15 percent water savings target, averaged for the twelve benchmark utilities. The analysis shows that in the residential sector, showerhead and faucet retrofits would be the most important BMPs, resulting in the greatest water savings in each utility service area. These results were then extrapolated to the other 33 public supply utilities as described in Chapter 4. Appendix 4-1 provides additional detail on the distribution of BMPs specified by the EZGuide model at the 5, 10, and 15 percent conservation targets for each utility in the WRWSA region. Additionally, information on the specifications of each BMP (i.e., flow rates for fixtures) can be found in the detailed EZGuide model output data included in Appendix 4-1.

One of the benefits of the EZGuide model is that it can be updated and adjusted by the utilities to tailor the prescribed menu of conservation options to fit local parameters and budgetary constraints. It is recommended that the utilities be involved in this process to ensure that appropriate BMP programs are developed for their communities at an appropriate price point.

Table 5-3 shows the estimated costs per thousand gallons of water produced to implement each conservation target for each of the WRWSA counties. The costs for each county are weighted based on their percentage of the total public supply water use in 2010 in the WRWSA four-county region. On average, the cost to meet the conservation targets ranges from $1.03/1,000 gallons for a 15 percent reduction to $0.81/1,000 gallons (for a 5 percent reduction).

Table 5-2. Percent of the 15 Percent Water Conservation Target that is Met by each BMP and Conservation Measure, Averaged for the 12 Benchmark Utilities.

BMP/Conservation Measure Type		Average Percent for Benchmark Utilities
Residential - Single and Multi-Family	Toilet	2.3
	Clothes Washer	0.0
	Showerhead	13.9
	Faucet	45.6
	Landscape and Irrigation System[1]	27.4
Institutional, Commercial, Industrial	Toilet	1.5
	Urinal	3.5
	Showerhead	0.7
	Faucet	3.9
	Pre-Rinse Spray Valve	0.1
	Water Audit	1.2
	Total	**100**

[1]*Includes irrigation audits, irrigation controllers such as soil moisture sensors, and non-potable irrigation systems .*

Table 5-3. Weighted Average Cost by County per 1,000 Gallons Associated with Achieving Water Conservation Targets.

County	2010 Water Demand (mgd)	% of 2010 WRWSA Region Water Use	Weighted Average Savings (gpcd) and Cost ($/1,000 gal) to Achieve Each Tiered Conservation Target[1]					
			15%		10%		5%	
			Savings	Cost	Savings	Cost	Savings	Cost
Citrus	16.9	17.4	23.38	0.99	15.59	0.84	7.79	0.78
Hernando	22.1	22.7	21.85	0.92	14.56	0.79	7.28	0.73
Marion	38.0	39.1	29.36	1.07	19.57	0.94	9.79	0.83
Sumter	20.1	20.7	40.12	1.10	26.75	0.92	13.37	0.85
WRWSA	**97.1**	**100.0**	**28.95**	**1.03**	**19.30**	**0.89**	**9.65**	**0.81**

[1]*Weighted average in 2010 dollars. Cost estimates assume BMPs implemented in 2010. BMPs actually phased in over planning period. It is difficult to estimate 2035 costs, as inflation rates and BMP costs during planning period cannot be reliably predicted.*

Section 2. Reclaimed Water

Reclaimed water systems in the WRWSA four-county region are generally in the early stages of development and as such, the representative project options are dominated by golf course, industrial, and new residential development options. Table 5-4 is a list of reclaimed water project options developed for the SWFWMD portion of the WRWSA region with input from utilities and other interested parties. It is recognized that the viability of some options depends on whether certain other options are developed and not all options can be developed because some would use the same reclaimed water source.

Table 5-4 Reclaimed Water Project Options in the SWFWMD Portion of the WRWSA Four-County Region

Option Name & Completion Timeframe[1]	County	Type	Supply[2]	Benefit	Capital Cost ($M)[3]	Cost/ Ben	O&M/Ben[4]
Citrus County							
Brentwood WWTP 2015-2030, Citrus Co. (reuse and AWT infrastructure)	Citrus	Sys. Exp.	2.00	1.50	$6.09	$0.98	$0.40
Citrus Beverly Hills/Rolling Oaks WWTP 2015-2030, Citrus Co.	Citrus	Sys. Exp.	-	-	See Brentwood	-	-
Crystal River WWTP to Crystal River Energy Facility, Crystal River	Citrus	Sys. Exp.	0.75	0.75	$6.23	$0.20	$0.30
Inverness WWTP 2018-2030, Inverness (AWT water quality infrastructure)	Citrus	Recharge.	1.50	1.50	$0.83	$0.13	$0.40
Meadowcrest WWTP, 2015-2030, Citrus Co.	Citrus	Sys. Exp.	TBD	TBD	TBD	TBD	$0.30
Crystal River WWTP 2020-2030	Citrus	Sys. Exp.	1.50	1.12	TBD	TBD	$0.30
Hernando County							
Hernando Airport WWTP 2015-2030 Hernando Co. (AWT water quality/recharge infrastructure)	Hernando	Recharge	3.00	3.00	$2.30	0.18	$0.40
The Glenn WWTP, 2015-2030 Hernando Co.	Hernando	Sys. Exp.	TBD	TBD	TBD	TBD	TBD
Brookridge WWTP,2015-2030, Hernando Co.	Hernando	Sys. Exp.	TBD	TBD	TBD	TBD	TBD
Ridge Man WWTP,2015-2030, Hernando Co.	Hernando	Sys. Exp.	TBD	TBD	TBD	TBD	TBD
Brksville WWTP, 2015-2030, Brooksville	Hernando	Sys. Exp.	TBD	TBD	TBD	TBD	TBD
Marion County							
Dunellon WWTP 2011-2030, Dunnellon	Marion	Sys. Exp.	0.50	0.38	$2.88	$1.56	$0.40
Ocala WWTP #1 (In Ocala in SJRWMD but sends some flows into SWFWMD)	Marion	Sys. Exp.	TBD	TBD	TBD	TBD	TBD
Sumter County							
Bushnell WWTP 2016, (AWT water quality infrastructure)	Sumter	Sys. Exp.	0.22	0.21	$1.17	$1.28	$0.40
Continental County Club WWTP, 2015-2030, Continental Utilities	Sumter	Sys. Exp.	0.12	0.09	$0.25	$0.55	$0.30
Sumter Correctional WWTP 2015-2030	Sumter	Sys. Exp.	0.02	0.01	$0.00	-	$0.30
Wildwood WWTP 2015-2030, Wildwood	Sumter	Sys. Exp.	1.00	0.75	TBD	TBD	$0.30

[1] *Represents estimated* timeframe when project *option could be completed.*
[2] *Based on 2030 WWTP flow estimates from SWFWMD's 2010 Northern Planning Region Water Supply Plan, minus 2010 utilization, minus current design/construction or anticipated reuse utilization.*
[3] *Based on conceptual project descriptions.*
[4] *The $0.30/1000 gal. supplied is based upon utility surveys. The $0.40/1000 gal supplied is the $0.30/1000 gal. plus 0.10/1000 gal. related to Denite filter O&M costs of $35,000 annually per mgd.*

Section 3. Groundwater

An analysis was conducted to identify potential groundwater project options within the WRWSA region based on the spatial distribution of public water supply demands during the planning period. The currently permitted quantities of groundwater for each public supply utility service area (permitted for more than 0.1 mgd as of 2010) were compared with 2035 projected demands to determine whether a deficit or surplus of permitted quantities groundwater will exist during the planning period. For utility service areas currently permitted for groundwater quantities equal to or in excess of their projected 2035 demand, no new quantities of groundwater were assumed to be needed.

Once deficits of permitted quantities were identified for each utility service area in each county, the WRWSA and Hernando, Citrus, and Marion county utilities and the City of Wildwood utility, met to determine the locations of potential groundwater project options that were in reasonable proximity to the utility service areas where deficits of permitted quantities were identified. Once this was accomplished, production quantities necessary from the groundwater project options to overcome the deficits of permitted quantities were determined. The production quantities for the project options were input into the Northern District Model to determine whether exceedances to MFL water bodies would occur in the vicinity of the options. The final step was to determine the infrastructure necessary to develop the wellfields and determine the costs of development and operation and maintenance. The following is an overview of this process for each of the WRWSA's four counties.

1.0 Assessment of Groundwater Surpluses/Deficits of Permitted Quantities for Public Supply Service Areas

1.1 Citrus County

Table 5-5 shows the data used to project groundwater surpluses/deficits of permitted quantities in 2035 for public supply utility service areas in Citrus County and Figure 5-1 shows the location of the service areas in the county. The table shows deficits of permitted quantities of significant magnitude for Citrus County Utilities service areas in the north-central portion of the county totaling 2.3 mgd. Following discussions between the WRWSA and Citrus County Utilities, the decision was made to investigate the possibility of expanding the Charles A. Black (CAB) Wellfield located in north-central Citrus County, to supply water to Citrus County Utilities.

Although expanding the CAB wellfield is considered the primary option for meeting the county's future demands that cannot be met with currently permitted quantities, other options the county, the WRWSA, or other users may want to consider also exist. These options would likely be smaller in scale than the CAB wellfield expansion and could contribute to meeting growing demands in specific areas of the county. Citrus County is experiencing or projected to have growth in the northwest portion of the county, including development associated with the proposed Port Citrus to be located on the Cross Florida Barge Canal. There has been recent interest in the property adjacent to Port Citrus by industrial developers who may want to site manufacturing facilities in that area, which would require significant water infrastructure expansion to provide service to the proposed development. In addition, there is the potential for

Table 5-5. Projected Goundwater Surpluses/Deficits of Permitted Quantities in 2035 for Utility Service Areas in Citrus County.

Utility Name	2010 Water Use (MGD)	2035 Demand (mgd)	Planning Period Increase in Demand (mgd)	Currently Permitted Quantity (mgd)	Planning Period Deficit / Surplus (mgd)
City Of Crystal River	0.55	0.69	0.14	0.92	0.23
City Of Inverness	1.28	1.46	0.18	1.54	0.08
Floral City Water Association	0.43	0.43	0	0.55	0.12
Citrus County (CS/PR)	2.61	5.69	3.08	3.65	-2.04
Rolling Oaks Utilities	1.4	1.48	0.08	2.5	1.02
Homosassa Water District	0.74	1.01	0.27	0.96	-0.05
Gulf Highway Land Corp.	0.11	0.1	0	0.22	0.12
Citrus County & WRWSA (CAB)	3.73	4.86	1.13	4.6	-0.26
Citrus County (SMW)	2.11	2.25	0.14	2.21	-0.04
GCP Walden Woods 1 & 2	0.08	0.08	0	0.22	0.14
Ozello Water Association	0.49	0.58	0.09	0.51	-0.07

interconnects for potable water and sewer service between Citrus County and the towns of Inglis and Yankeetown situated north of the canal in Levy County. Additional potential demands could be come about from efforts to replace individual domestic wells in the northwest area of the county that are contaminated with arsenic with county potable water supply. The demands associated with all these activities could be potentially served by development of additional groundwater quantities in the northwest region or through interconnects with the county's existing infrastructure and expansion of the CAB wellfield or other wellfields.

There are several other areas where the WRWSA or Citrus County could explore the development of upper Floridan groundwater to meet local needs, such as utilizing existing wells at the Riverside Lodge Resort just west of the Withlacoochee River along East Gulf to Lake Highway (SR44) that could serve additional growth in or in proximity to the City of Inverness; a new well(s) on the west side of the Withlacoochee State Forest on or near Cardinal Lane that could potentially serve the Sugar Mill Woods development if increasing the permitted quantities at Sugar Mill Woods proved problematic, or serve other surrounding growth; and a new well(s) on the east side of the State Forest to serve growing demands in and around Floral City and/or Inverness. There also exists the possibility of investigating the use of surface water from mine excavations owned by Citrus Mining and Timber, Inc. as growth continues and the availability of groundwater in the area becomes more limited over time. All of these source options listed here would need further investigation and would need to be evaluated for their technical, financial and environmental feasibility. The option to expand the CAB wellfield is further investigated as a primary means to meet growing demands unmet by existing permitted quantities in the county.

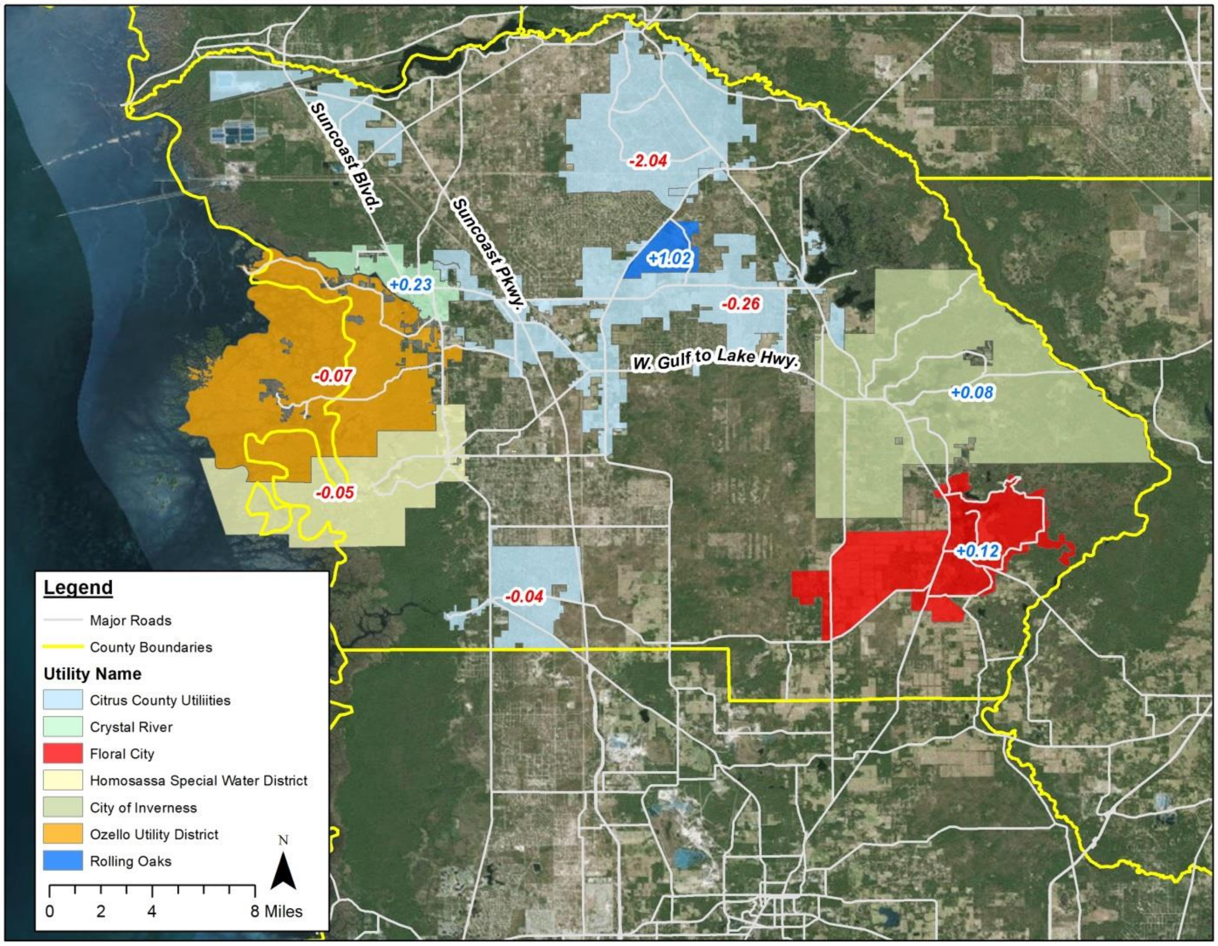

Figure 5-1. Projected Groundwater Surpluses/Deficits of Permitted Quantities in 2035 for Utility Service Areas in Citrus County.

1.2. Hernando County

Table 5-6 shows the data used to project groundwater surpluses/deficits of permitted quantities in 2035 for public supply utility service areas in Hernando County and Figure 5-2 shows the location of the service areas in the county. The table shows that the service areas for Hernando County Utilities have significant groundwater surpluses through 2035 and the City of Brooksville has a slight surplus. The lack of deficits of permitted quantities indicates that public water supply demands in Hernando County can be met with existing permitted groundwater quantities through 2035. Therefore, there was no need to identify additional groundwater project options.

Table 5-6. Projected Groundwater Surpluses/Deficits of Permitted Quantities in 2035 for Utility Service Areas in Hernando County.

Utility & Service Area	2010 Water Demand (mgd)	2035 Demand (mgd)	Planning Period Increase in Demand (mgd)	Currently Permitted Quantity (mgd)	Planning Period Deficit or Surplus (mgd)
Hernando County Utilities (West Hernando)	17.75	21.77	4.02	22.71	+0.94
Hernando County Utilities (East Hernando)	0.93	1.23	0.3	3.82	+2.59
Hernando County Utilities (Seville)	0.01	0.03	0.02	0.32	+0.29
City of Brooksville	1.53	2.41	0.88	2.49	+0.08

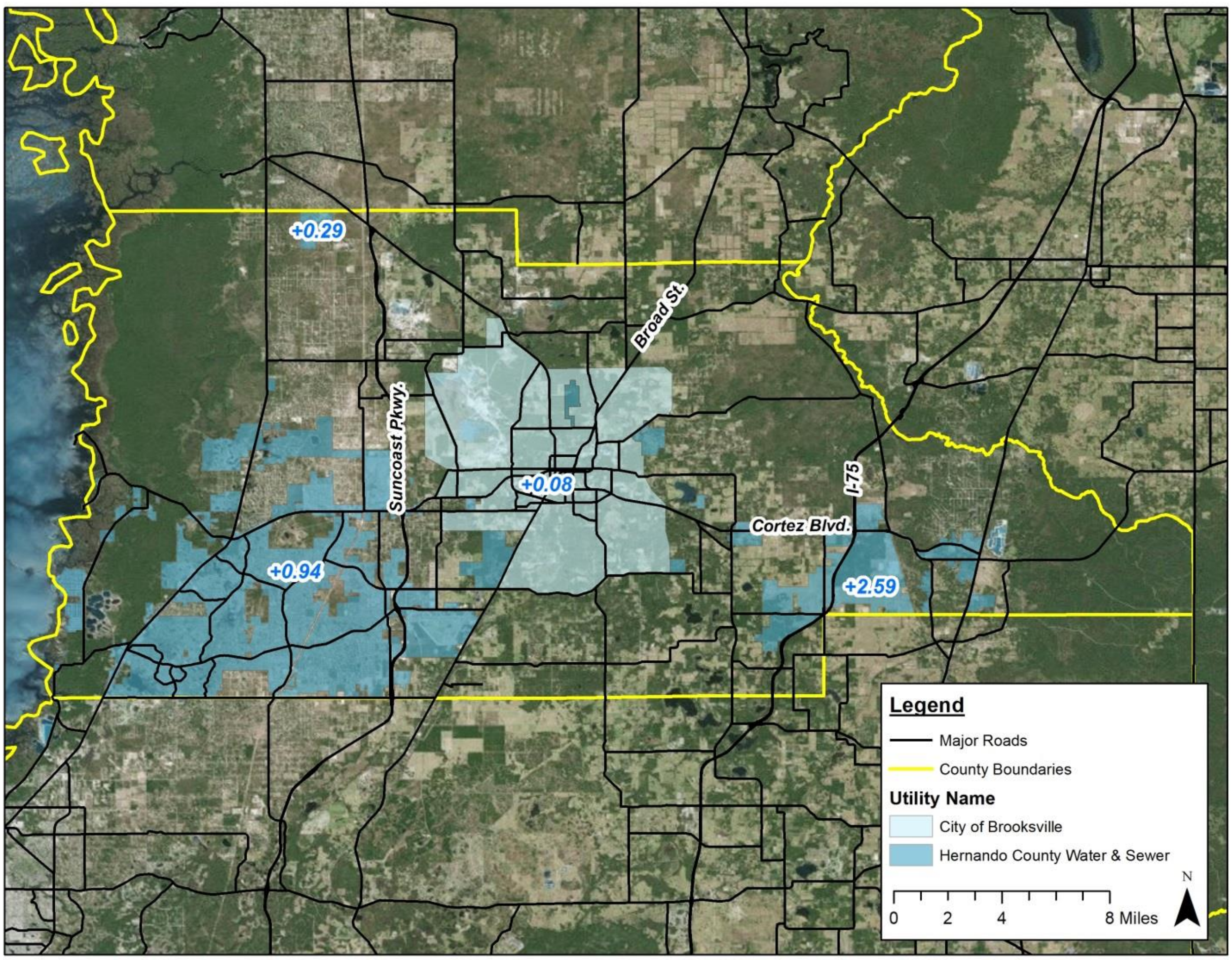

Figure 5-2. Projected Groundwater Surpluses/Deficits of Permitted Quantities in 2035 for Utility Service Areas in Hernando County.

1.3 Marion County

SWFWMD Portion - Table 5-7 shows the data used to project groundwater surpluses/deficits of permitted quantities in 2035 for public supply utility service areas in the SWFWMD portion of Marion County and Figure 5-3 shows the location of the service areas in the county. The table shows deficits of permitted quantities of significant magnitude for Bay Laurel, Windstream, and Marion Utilities totaling 3.42 mgd. It may be possible to meet these deficits through increases in their permitted quantities or through interconnections with utilities that have excess capacity.

A deficit of 5.43 mgd is projected for Marion County Utilities in 2035 in the south-central portion of the county. Following discussions between the WRWSA and Marion County Utilities, the utility indicated an interest in meeting this deficit through the development of a groundwater project option that would utilize the Upper Floridan aquifer in the Marion Oaks area.

Table 5-7. Projected Groundwater Surpluses/Deficits of Permitted Quantities in 2035 for Utility Service Areas in the SWFWMD Portion of Marion County.

Utility Name	2010 Water Demand (mgd)	2035 Demand (mgd)	Planning Period Increase in Demand (mgd)	Currently Permitted Quantity (mgd)	Planning Period Deficit / Surplus (mgd)
Bay Laurel CDD	2.12	5.05	2.93	2.56	-2.49
Marion Utilities, Inc.	0.13	0.14	0.01	0.2	0.06
Utilities Inc. of Fl	0.13	0.2	0.07	0.28	0.08
Marion Co. Util. Dpt.	5.21	11.52	6.31	6.09	-5.43
Sun Communities	0.12	0.12	0	0.15	0.03
Marion Util., Inc.	0.12	0.16	0.04	0.29	0.13
Century Fairfield Vill.	0.07	0.07	0	0.10	0.03
Assoc. Mar. Landing	0.18	0.19	0.01	0.18	-0.01
City of Dunnellon	0.54	0.68	0.14	1.6	0.92
Mar. Util. Spruce Crk	1	1.65	0.65	1.18	-0.47
Windstream Util. Co.	0.6	1.09	0.49	0.63	-0.46

SJRWMD Portion - Table 5-8 shows the data used to project groundwater surpluses/deficits of permitted quantities in 2035 for utility service areas in the SJRWMD portion of Marion County. Figure 5-4 shows the service areas in the county. The table shows deficits of permitted quantities of significant magnitude for the City of Bellview Utilities and Sunshine Utilities totaling 1.7 mgd. It may be possible to meet these deficits through interconnections with utilities that have excess capacity. Marion County Utilities has a deficit of permitted quantities of 5.1 mgd in the southeast-central portion of the county. Following discussions between the WRWSA and Marion County Utilities, the utility indicated an interest in meeting this deficit through the development of a groundwater project option that would utilize the Lower Floridan aquifer near Silver Springs. Thorough testing of aquifer characteristics and modeling of the potential impacts will be necessary to demonstrate that the Lower Floridan aquifer is a viable water supply option in the area.

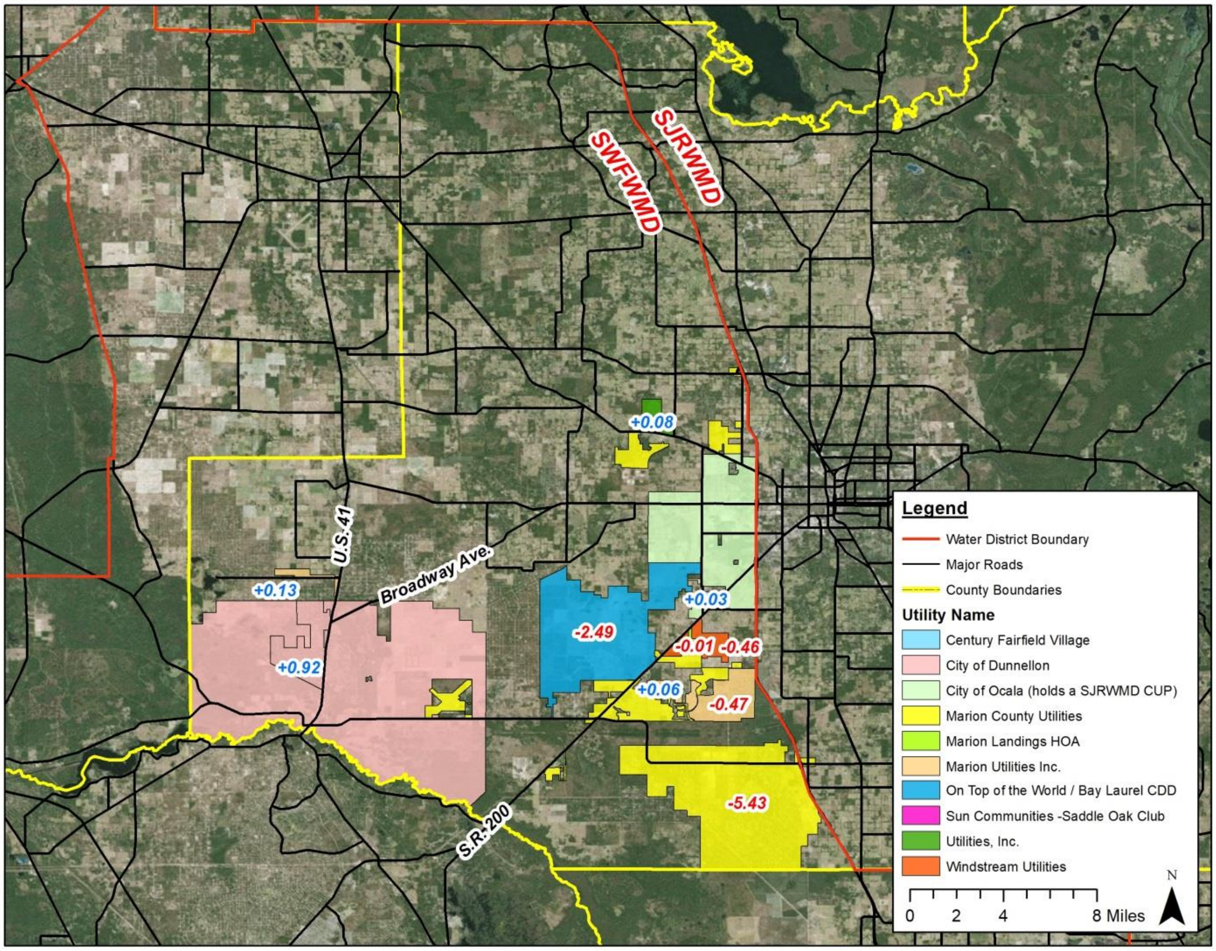

Figure 5-3. Projected Groundwater Surpluses/Deficits of Permitted Quantities in 2035 for Utility Service Areas in the SWFWMD Portion of Marion County.

1.4 Sumter County

Table 5-9 shows the data used to assess groundwater surpluses/deficits of permitted quantities for public supply utility service areas in Sumter County in 2035 and Figure 5-5 shows the location of the service areas in the county. The table shows deficits of permitted quantities of significant magnitude for the City of Wildwood Utilities in the northeastern portion of the county totaling 4.08 mgd. Following discussions between the WRWSA and the City of Wildwood Utilities, it was decided to investigate a groundwater project option that would produce from the Lower Floridan aquifer at the City's southern wellfield.

Table 5-8. Projected Groundwater Surpluses/Deficits of Permitted Quantities in 2035 for Public Supply Utility Service Areas in the SJRWMD Portion of Marion County.

Utility Name	2010 Water Demand (mgd)	2035 Demand (mgd)	Planning Period Increase in Demand (mgd)	Currently Permitted Quantity (mgd)	Planning Period Deficit / Surplus (mgd)
Sunshine Utilities / South Marion Regional System	0.51	0.66	0.15	0.15	-0.51
Tradewinds Utilities Inc	0.12	0.13	0.01	0.13	0
Residential Water Systems / High Pointe	0.26	0.26	0	0.33	0.07
Ocala East Villas	0.08	0.08	0	0.12	0.04
Sunshine Util./ Ocala Hts	0.12	0.14	0.02	0.1	-0.04
Rolling Greens Comm.	0.36	0.36	0	0.43	0.07
Aqua Util. Fl./Ocala Oaks	0.17	0.22	0.05	0.29	0.07
Marion County Utilities - Consolidated WUP	8.54	11.54	3	6.44	-5.10
Oak Bend Mble Home Pk	0.08	0.08	0	0.11	0.03
Marion Util./Fore Acres	0.12	0.12	0	0.15	0.03
Marion Util./Green Fields - Indian Pines	0.12	0.12	0	0.19	0.07
Sunshine Util. Sun Ray Est	0.22	0.22	0	0.23	0.01
City of Belleview	1.47	2.42	0.95	1.27	-1.15
Grand Lake RV & Golf Resort	0.11	0.11	0	0.11	0
City of Ocala	13.09	15.53	2.44	17.54	2.01

Table 5-9. Projected Groundwater Surpluses/Deficits of Permitted Quantities in 2035 for Public Supply Utility Service Areas in Sumter County.

Utility Name	2010 Water Use (mgd)	2035 Demand (mgd)	Planning Period Increase in Demand (mgd)	Currently Permitted Quantity (mgd)	Planning Period Deficit / Surplus (mgd)
Lk Pan. Water Assoc.	0.24	0.27	0.03	0.41	0.14
Continental C.C.	0.27	0.29	0.02	0.45	0.16
City Of Bushnell	0.57	0.65	0.08	1.37	0.72
City Of Webster	0.1	0.15	0.05	0.1	-0.05
Cedar Acres, Inc.	0.04	0.05	0.01	0.13	0.08
City Of Wildwood	2.91	9.06	6.15	4.98	-4.08
The Villages	11.86	17.69	5.83	17.69	0.00

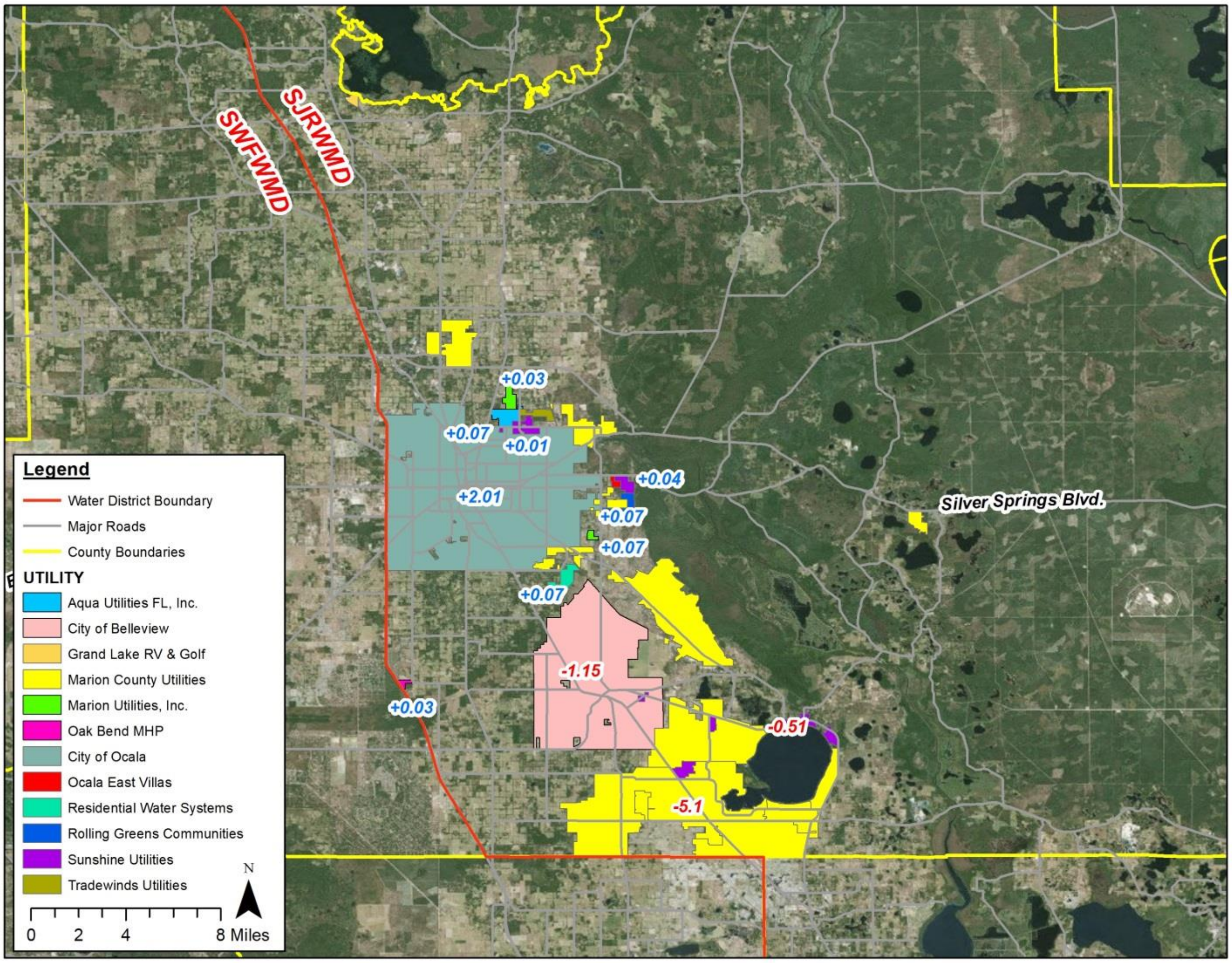

Figure 5-4. Projected Groundwater Surpluses/Deficits of Permitted Quantities in 2035 for Public Supply Utility Service Areas in the SJRWMD Portion of Marion County.

2.0 Groundwater Project Options

As discussed above, four groundwater project options (locations shown in Figure 5-6) were identified and recommended for further analysis:

- Option 1 – WRWSA Charles A. Black Wellfield Expansion, Central Citrus County;
- Option 2 – City of Wildwood Lower Floridan Aquifer Well, City of Wildwood's Southern Wellfield, Sumter County;
- Option 3 – Marion County Utilities Marion Oaks Upper Floridan Aquifer Wellfield, Southwest-Central Marion County; and
- Option 4 – Marion County Utilities, Lower Floridan Aquifer Wellfield, Near Silver Springs, Southeast-Central Marion County.

Regarding the groundwater project options proposed by Marion County Utilities, two Lower Floridan aquifer options were proposed as shown above. Regarding the Marion Oaks Option, the Northern District Model does not represent the fresh water extent of the Lower Floridan aquifer reaching as far west as Marion Oaks. Therefore, the groundwater quantities for the Marion Oaks option are represented in the model and in this Plan as Upper Floridan aquifer withdrawals.

2.1 Investigation of Impacts of Groundwater Withdrawals from Proposed Project Options

Once locations for the groundwater project options were proposed, it was necessary to determine whether groundwater withdrawals from the options would cause exceedances of MFLs for nearby waterbodies. This was accomplished using the Northern District Model, configured as discussed in Chapter 4, Section 3, Subsection 2.0, where it was used to assess the availability of fresh groundwater in the Upper and Lower Floridan aquifers. Similar to the modeling investigation conducted in Chapter 4, groundwater withdrawals were set equal to the projected 2035 demand in the region and distributed throughout the region based on the location of existing withdrawals. Also similar to the Chapter 4 simulation, the projected 2035 water demands used in the model were adjusted to account for the effects of water conservation and use of reclaimed water. The adjustments for water conservation included reductions of 10 percent for public supply, 10 percent for agriculture, and 20 percent for recreational/aesthetic. The effects of reclaimed water use projected for 2035 were represented in the model as an increase in recharge in the vicinity of reclaimed water facilities (HydroGeologic, 2013).

For the entire model domain, the simulation included approximately 637.6 mgd of withdrawals from the Upper Floridan aquifer and 6.5 mgd from Lower Floridan aquifer. However, approximately 16.7 mgd of the 2035 withdrawals were redistributed from the service areas where the deficits of permitted quantities discussed above were identified, to the locations of the proposed groundwater project options. Table 5-10, shows the quantities of water redistributed to each project option location.

The results of the modeling investigation were very similar to the investigation presented in Chapter 4 (see Appendix 4-2 for additional information). With the 16.7 mgd of withdrawals redistributed to the locations of the proposed project options, in the SWFWMD portion of the WRWSA region, the 2035 demands for all use categories can be met with groundwater with no exceedances to springs and rivers for which MFLs have been proposed or adopted. However, similar to the investigation described in Chapter 4, groundwater supplies will be sufficient to meet demands through 2035 only if demand is reduced significantly by water conservation and aquifer drawdowns are offset to some degree by recharge from the use of reclaimed water.

In the SJRWMD portion of the WRWSA region, MFLs for Silver Springs/Silver River are being developed by the SJRWMD and will likely impact resource availability. Based on current analyses, the current draft MFLs would not be met under 2035 projected demand. The SJRWMD is working on tools to assist in the development of a prevention/recovery strategy.

Prior to the implementation of any of the groundwater project options, extensive testing and evaluation would be required at each site to determine whether the withdrawals would cause exceedances of proposed or adopted MFLs. Testing would likely include construction of test wells, aquifer performance testing, and water quality evaluations and groundwater modeling.

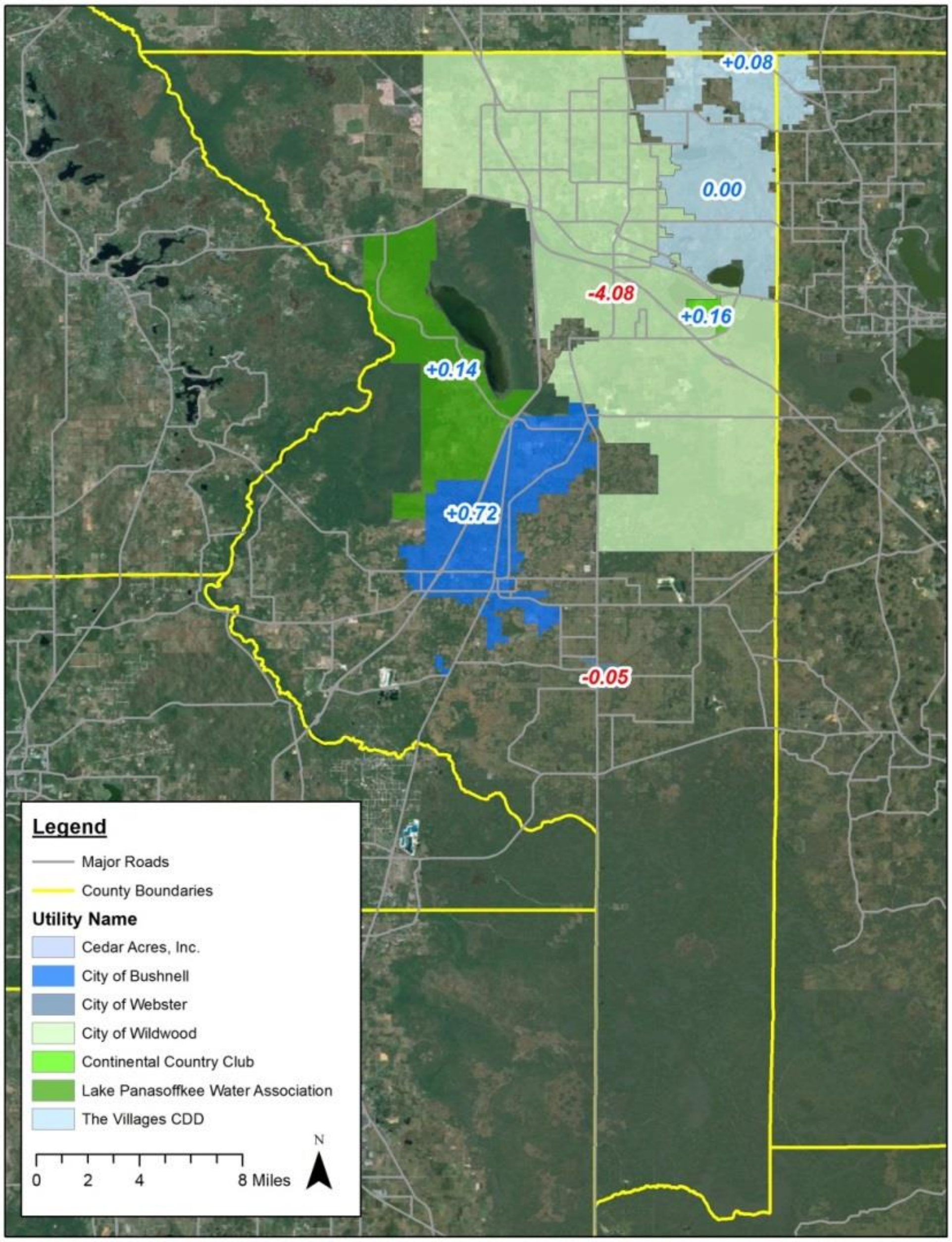

Figure 5-5. Projected Groundwater Surpluses/Deficits of Permitted Quantities in 2035 for Public Supply Utility Service Areas in Sumter County.

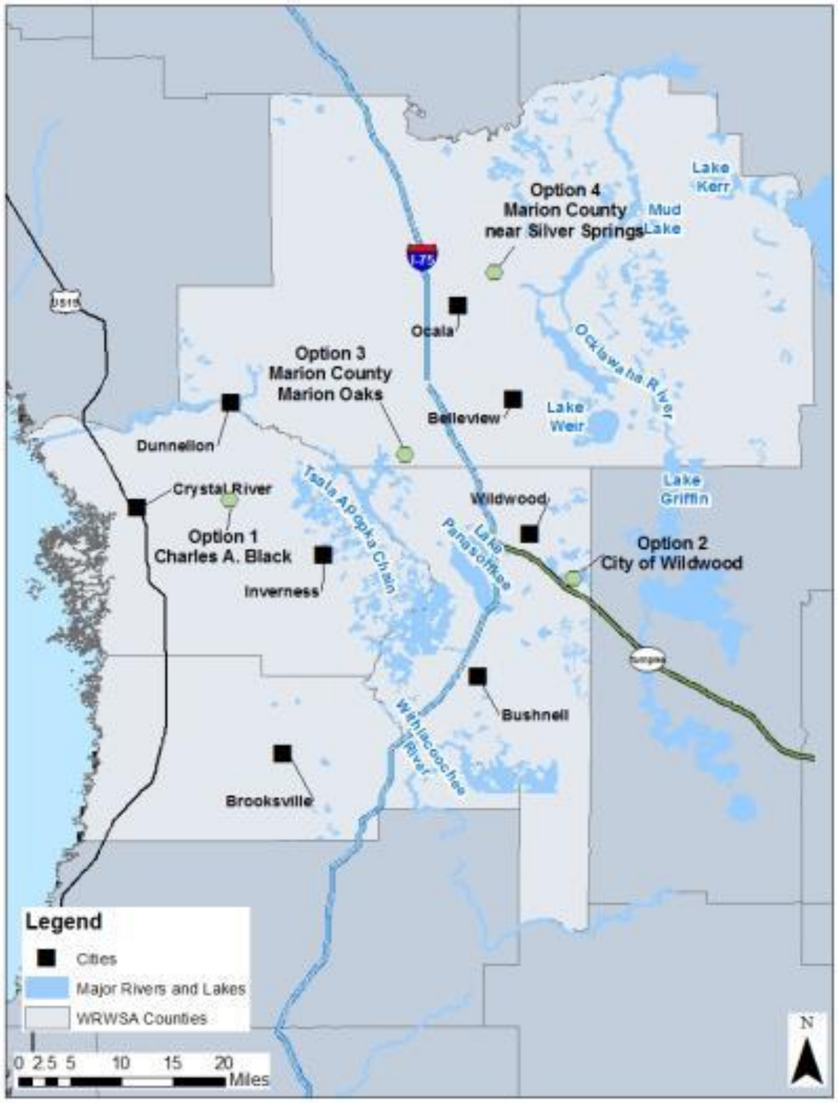

Figure 5-6. Location of the Four Recommended Groundwater Project Options.

Table 5-10. Location and Quantity of Redistributed Water Supply Demands

Utility Source	Redistributed Quantity (mgd)	Redistribution Location
Citrus County Utilities (20002842.01 & 20007879.003)	2.08	Option 1. Charles A.Black Upper Floridan Aquifer Wellfield Exp.
City of Wildwood (20008135.009)	4.08	Option 2. City of Wildwood Southern Lower Floridan Aquifer Wellfield
Marion County Utilities (SWFWMD) (20006151.01)	5.43	Option 3. Marion Oaks Upper Floridan Aquifer Wellfield
Marion County Utilities (SJRWMD)(Cup No. 4578)	5.10	Option 4. Marion County Lower Floridan Aquifer Wellfield

2.2 Cost Estimates

The following is an overview of the infrastructure necessary for the groundwater project options and a planning-level estimate of their capital, operation and maintenance, equivalent annual, and unit production costs. These costs are defined below.

- Capital Cost - total cost needed to bring a project to a commercially operable status.
- Operation and Maintenance Cost - operating expenses are associated with operating a facility.
- Equivalent Annual Cost - cost per year of owning and operating an asset over its entire lifespan.
- Unit Production Cost – cost per 1000 gallons.

Groundwater Project Option 1 – WRWSA Charles A. Black Wellfield Expansion - The Charles A. Black (CAB) water supply system consists of seven groundwater production wells and water treatment facilities; CAB-1 and CAB-2. CAB-1 consists of five production wells, disinfection equipment, storage tanks, and distribution piping equipment. CAB-2 consists of two production wells, disinfection equipment, storage tanks, and distribution piping equipment. Design capacity of the wells is 17.06 mgd and rated capacity (largest well out of service) is 11.88 mgd. The capacity of the water treatment facilities is 14.5 mgd.

The CAB's current permitted production is 4.6 mgd average annual and 6.6 mgd peak day. The goal of Project Option 1 is to expand the production of the system by 2.34 mgd to 6.94 mgd and the peak capacity to 9.9 mgd. Because the rated capacity of the existing wells is 11.88 mgd and capacity of the existing treatment system is 14.5 mgd, the current system has the capacity to supply the increased quantities without upgrades to its infrastructure. However, because the facility's permitted groundwater withdrawals are only 4.6 mgd, it would be necessary to obtain an increase of at least 2.34 mgd in average annual withdrawals from the SWFWMD.

Groundwater Project Option 2 – City of Wildwood Utilities Lower Floridan Aquifer Wellfield Near CR-501 - The City of Wildwood has proposed developing a Lower Floridan aquifer well and water treatment plant near the existing CR-501 (Coleman) water treatment plant. The following are the specifications and costs for the project option.

Capital Cost Estimate – Capital costs are based on the following assumptions and are included in Table 5-11:

- two Lower Floridan aquifer wells, 18-inches in diameter, costing $300,000 each and $150,000 per pump for a total cost of $900,000;
- required annual average capacity of this project option is 4.08 mgd and the current City of Wildwood peaking factor for the maximum day demand is 1.4 so it is assumed that the capacity of the wells and water treatment facility will need to be 5.85 mgd (rounded up to 6.0) (water treatment facility cost based on cost of the groundwater treatment facility for the northwest Marion County groundwater project option with a capacity of 15 mgd, as outlined in the 2010 WRWSA Water Supply Plan and the City of Wildwood's 2012 Champagne Farms Preliminary Design Report, with a capacity of 6.0 mgd);
- a significant separation between the two wells is assumed (one located approximately 1,000 feet from the treatment facility and one located 1.25 miles from the facility), the raw water transmission pipeline from the distant well to the treatment facility would be 16

inches in diameter, 6,600 feet in length, and would intersect a 24 inch diameter pipeline at the well located near the treatment facility, which would carry the quantities from both wells approximately 1,000 feet to the treatment facility (cost per inch diameter per foot of pipeline is $9.00);

- land costs of $5,000 per acre are included for a 5-acre footprint for each supply facility, plus 18 percent acquisition cost;
- easement acquisition costs of $0.75 per square foot (e.g., $32,760 per acre) are included in the capital cost (wells are assumed to be separated by 1.25 miles with a 20 foot easement for a pipe diameter less than 16 inches); and
- non-construction capital costs include a 20 percent allowance for construction contingency and 25 percent allowance for engineering design, permitting, and administration.

Table 5-11. Groundwater Project Option 2, City of Wildwood Utilities Lower Floridan Aquifer Wellfield, Capital Cost Estimate.

Description	Total Cost
2 Lower Floridan Aquifer Wells	$600,000
Well Pumps	$300,000
Water Treatment and Storage Facility	$2,256,000
Raw Water Transmission Main	$1,166,400
Land Acquisition and Easement	$276,000
Subtotal Construction Capital Cost	**$4,598,400**
Non-Construction Capital Cost (45%)	**$2,069,280**
Total	**$6,667,680**

Operation and Maintenance Cost Estimate – Annual operation and maintenance (O&M) costs include labor, power, and chemical costs necessary for operation; and renewal and replacement (R&R) costs for equipment, and are included in Tables 5-12.

Table 5-12. Groundwater Project Option 2, City of Wildwood Utilities Lower Floridan Aquifer Wellfield Operation & Maintenance Cost Estimate.

Description	Total Cost
Labor	$300,000
Chemicals	$75,000
Power	$200,000
Equipment Renewal & Replacement	$105,000
Transmission Renewall & Replacement	$78,000
Total	**$758,000**

Unit Production Cost Estimates – Unit production cost is a function of the capital costs, debt service, annual O&M costs and the amount of water produced. For this analysis, the debt service is based on a 30-year project lifecycle at 3.75 percent interest (2013 federal discount rate for water resource projects). Unit production cost for this project option is included in Table 5-13.

Table 5-13. Groundwater Project Option 2, City of Wildwood Utilities Lower Floridan Aquifer Wellfield, Unit Production Cost Estimate.

Description	Total Cost
Total Capital Cost	$6,667,680
Annual O&M Cost	$758,000
Equivalent Annual Cost:	**$1,128,548**
Unit Production Cost ($/1000 gal)	**$0.52**

Groundwater Project Option 3 – Marion County Utilities Marion Oaks Upper Floridan Aquifer Wellfield, Southwest-Central Marion County - As discussed above, Marion County Utilities originally proposed this project option as producing from the Lower Floridan aquifer. However, based on the SWFWMD's current understanding of the Lower Foridan aquifer, the fresh water extent of the aquifer does not extend as far west as Marion Oaks. Therefore, costs were based on production from the Upper Floridan aquifer.

Capital Cost Estimate – Capital costs are based on the following assumptions and are included in Table 5-14:

- two Upper Floridan aquifer wells, 18-inches in diameter, costing $150,000 each and $150,000 per pump for a total cost of $600,000;
- required annual average capacity of this project option is 5.43 mgd and current Marion Oaks peaking factor for maximum day demand is 1.6, so it is assumed that capacity of the wells and water treatment facility will need to be 8.7 mgd (rounded to 9.0 mgd) (water treatment facility cost based on cost of the groundwater treatment facility for the northwest Marion County groundwater project option with a capacity of 15 mgd, as outlined in the 2010 WRWSA Water Supply Plan and the City of Wildwood's 2012 Champagne Farm Preliminary Design Report, with a capacity of 6.0 mgd);
- a significant separation between the two wells is assumed (one located 1,000 feet from the treatment facility and one located 1.25 miles from the facility), the raw water transmission pipeline from the distant well to the treatment facility would be 16 inches in diameter, 6,600 feet in length, and would intersect a 24 inch diameter pipeline at the well located near the treatment facility, which would carry the quantities from both wells approximately 1,000 feet to the treatment facility (cost per inch diameter per foot of pipeline is $9.00);
- land costs of $5,000 per acre are included for a 5-acre footprint for each supply facility, plus 18 percent acquisition cost;
- easement acquisition costs of $0.75 per square foot (e.g., $32,760 per acre) are included in the capital cost (wells are assumed to be separated by 1.25 miles with a 20 foot easement for a pipe diameter less than 16-inches); and
- non-construction capital costs include 20 percent and 25 percent allowance for construction contingency and engineering design, permitting, and administration, respectively.

Table 5-14. Groundwater Project Option 3, Marion County Utilities Marion Oaks Upper Floridan Aquifer Wellfield, Capital Cost Estimate.

Description	Total Cost
2 Upper Floridan Aquifer Wells	$300,000
Well Pumps	$300,000
Water Treatment and Storage Facility	$3,338,400
Raw Water Transmission Main	$1,166,400
Land Acquisition and Easement	$276,000
Subtotal Construction Capital Cost	**$5,380,800**
Non-Construction Capital Cost (45%)	**$2,421,360**
Total	**$7,802,160**

Operation and Maintenance Cost Estimates – Annual operation and maintenance costs include labor, power, and chemical costs necessary for operation; and renewal and replacement costs for equipment, and are included in Tables 5-15.

Table 5-15. Groundwater Project Option 3, Marion County Utilities Marion Oaks Upper Floridan Aquifer Wellfield, Operation & Maintenance Cost Estimate.

Description	Annual Cost
Labor	$300,000
Chemicals	$75,000
Power	$200,000
Equipment Renewal & Replacement	$105,000
Transmission Renewal & Replacement	$78,000
Total	**$758,000**

Unit Production Cost Estimate - Unit production cost is a function of the capital costs, debt service, annual O&M costs and the amount of water produced. For this analysis, the debt service is estimated based on a 30-year project lifecycle at 3.75 percent interest (2013 federal discount rate for water resource projects). Unit production cost for this project option is included in Table 5-16

Table 5-16. Groundwater Project Option 3, Marion County Utilities Marion Oaks Upper Floridan Aquifer Wellfield, Unit Production Cost Estimate.

Description	Total Cost
Total Capital Cost	$7,802,160
Annual O&M Cost	$758,000
Equivalent Annual Cost:	**$1,191,596**
Unit Production Cost ($/1000 gal)	**$0.36**

Groundwater Project Option 4 – Marion County Utilities, Lower Floridan Aquifer Wellfield, Near Silver Springs, Southeast-Central Marion County - Marion County has proposed developing a Lower Floridan aquifer wellfield located near Silver Springs in southeast-central Marion County. The following cost estimates are based on the assumptions that site specific testing and groundwater modeling will show a Lower Floridan aquifer wellfield at this location to be a viable water supply option and that water quality meets potable standards.

Capital Cost Estimate – Capital costs are based on the following assumptions and are included in Table 5-17:

- two Lower Floridan aquifer wells, 18-inches in diameter, costing $300,000 each and $150,000 per pump for a total cost of $900,000;
- required annual average capacity of this project option is 5.1 mgd and the current Marion Oaks peaking factor for the maximum day demand is 1.6 so it is assumed that the capacity of the wells and water treatment facility will need to be 8.16 mgd (rounded up to 8.2 mgd) (water treatment facility cost based on cost of the groundwater treatment facility for the northwest Marion County groundwater project option with a capacity of 15 mgd, as outlined in the 2010 WRWSA Water Supply Plan and the City of Wildwood's 2012 Champagne Farm Preliminary Design Report, with a capacity of 6.0 mgd);
- water treatment facility costs are based on assumption of potable quality water from the Lower Floridan aquifer at the proposed location and if actual water quality does not meet potable standards, the cost associated with the water treatment facility will be higher;
- a significant separation between the two wells is assumed (one located approximately 1,000 feet from the treatment facility and one located 1.25 miles from the facility), the raw water transmission pipeline from the distant well to the treatment facility would be 16 inches in diameter, 6,600 feet in length, and would intersect a 24 inch diameter pipeline at the well located near the treatment facility, which would carry the quantities from both wells approximately 1,000 feet to the treatment facility (cost per inch diameter per foot of pipeline is $9.00);
- land costs of $5,000 per acre are included for a 5-acre footprint for each supply facility, plus 18 percent acquisition cost;
- easement acquisition costs of $0.75 per square foot (e.g., $32,760 per acre) are included in the capital cost (wells are assumed to be separated by 1.25 miles with a 20 foot easement for a pipe diameter less than 16-inches); and
- non-construction capital costs include allowances of 20 percent for construction contingency and 25 percent for engineering design, permitting, and administration.

Table 5-17. Groundwater Project Option 4, Marion County Utilities Lower Floridan Aquifer Wellfield, Near Silver Springs, Capital Cost Estimate.

Description	Total Cost
2 Lower Floridan Aquifer Wells	$600,000
Well Pumps	$300,000
Water Treatment and Storage Facility	$3,088,200
Raw Water Transmission Main	$1,166,400
Land Acquisition and Easement	*$276,000*
Subtotal Construction Capital Cost	**$5,425,600**
Non-Construction Capital Cost (45%)	**$2,441,520**
Total	**$7,867,120**

Operation and Maintenance Cost Estimate - Operation and maintenance costs include labor, power, and chemical costs necessary for operation; and renewal and replacement costs for equipment, and are included in Tables 5-18.

Table 5-18. Groundwater Project Option 4, Marion County Utilities Lower Floridan Aquifer Wellfield Near Silver Springs, Operation & Maintenance Cost Estimate.

Description	Total Cost
Labor	$300,000
Chemicals	$75,000
Power	$200,000
Equipment Renewal & Replacement	$105,000
Transmission Renewal & Replacement	$78,000
Total	**$758,000**

Unit Production Cost Estimate - Unit production cost is a function of the capital costs, debt service, annual O&M costs and the amount of water produced. For this analysis, the debt service is estimated based on a 30-year project lifecycle at 3.75 percent interest (2013 federal discount rate for water resource projects). Unit production costs for this project option are included in Table 5-19

Table 5-19. Option 4, Marion County Utilities Lower Floridan Aquifer Wellfield Near Silver Springs, Unit Production Cost Estimates.

Description	Total Cost
Total Capital Cost	$7,867,120
Annual O&M Cost	$758,000
Equivalent Annual Cost	**$1,360,807**
Unit Production Cost ($/1000 gal)	**$0.40**

Section 4. Surface Water

The analysis that determined the availability of surface water in the rivers for public supply water use was presented in Chapter 4. The surface water options identified below are based on the Withlacoochee River System's flow characteristics, future demand for water supply in the region, and associated environmental resource data. Use of surface water entails sophisticated means of treatment, management of the variability in quantity and quality of source waters, and management of associated environmental impacts to downstream ecology and water resources. These characteristics should be identified and addressed at the permitting level prior to initiation of specific surface water projects.

1.0 Withlacoochee River

1.1 Project Options

Surface water project options are proposed for three locations on the Withlacoochee River for comparative purposes: North Sumter, Holder, and Lake Rousseau.

Figure 5-7 shows the proposed location of the facilities and Table 5-20 provides information on the configuration and capacity for each of the project options. It is important to understand that it is unlikely that more than one of these facilities would be constructed on the river so the proposed capacities of the three options should not be thought of as a potential cumulative withdrawal.

The proposed capacities for these project options are those that were used in the WRWSA's 2010 Water Supply Plan. These were loosely based on collective long-range planning demands beyond 2035. Because the updated 20-year demand projections in this Water Supply Plan are not significantly different from those determined for the 2010 plan, it was not considered necessary to revise the capacities of the project options from the 2010 Plan.

Because the flow of the Withlacoochee River decreases significantly during the spring dry season, there are a significant number of days when withdrawals for water supply at the North Sumter and Holder locations would be limited or prohibited altogether to ensure that proposed minimum flows would not be exceeded (Chapter 4, Section 4). A water supply facility at one of these locations could operate conjunctively as part of an interconnected, regional system. During high-flow periods the facility would produce water from the Withlacoochee River at full capacity and the production of groundwater facilities that would be part of the system could be reduced or ceased altogether. During low-flow periods, the river facility would decrease or cease production and the groundwater facilities would be in full production. By utilizing groundwater during periods of low flow, the project would not require a costly reservoir. Because the wellfields could be rested for significant intervals, impacts from groundwater withdrawals on other MFL waterbodies could be reduced.

Three criteria were utilized to determine specific locations for the facilities:

- public ownership to limit land acquisition costs;
- site of sufficient size to accommodate facilities necessary for supply from that reach of the river (treatment plant, reservoir, etc.); and,
- site had to be close to the raw water intake and have road access.

Based on these requirements, potential sites for the project options were identified. The following sections present planning-level project information for each site including project location, facility layouts, river intake, and raw water pumping facilities.

1.1 North Sumter Option

The North Sumter site is on the Panasoffkee Outlet Property owned by the SWFWMD, is adjacent to the Withlacoochee River and Outlet River and has access to SR 315A. It is approximately 1118 acres in size and is sufficient to accommodate the water supply facilities for the 10 mgd conjunctive use project. The Wysong-Coogler Water Conservation structure is approximately 1.8 miles downstream of the intake.

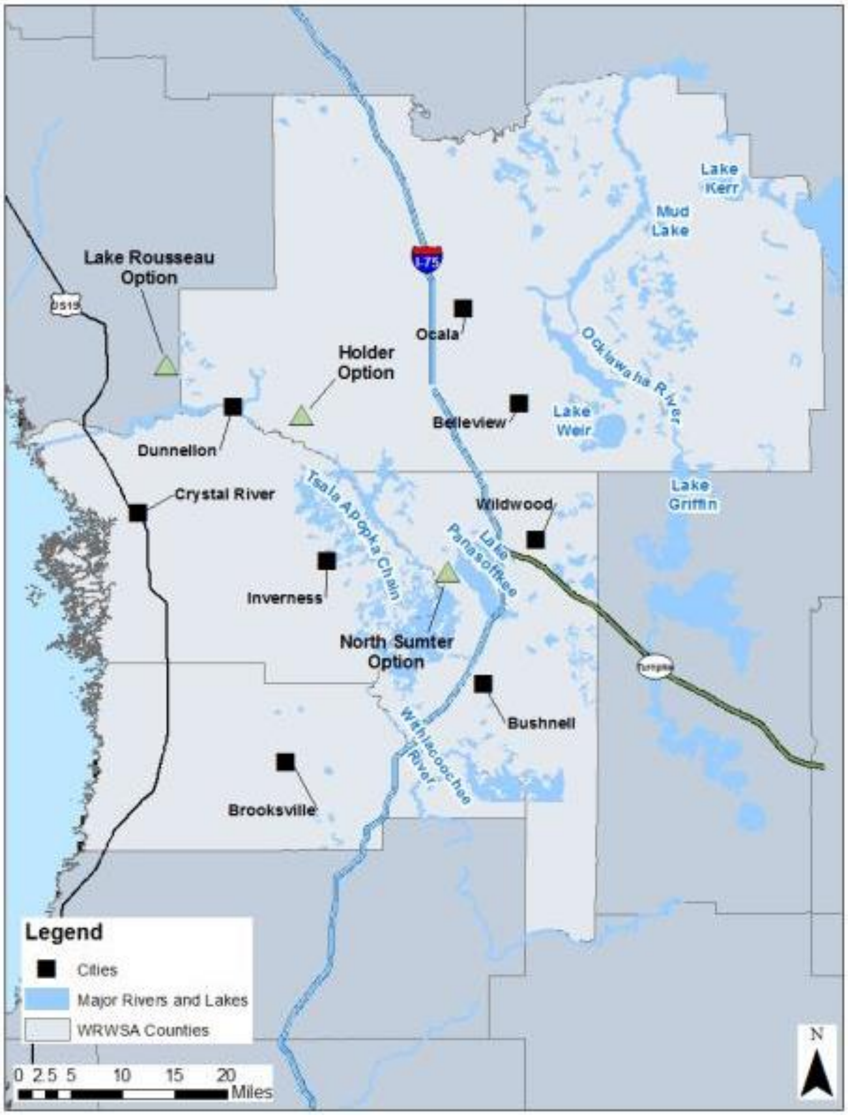

Figure 5-7. Proposed Location of the Withlacoochee River Water Supply Project Options.

1.2 Holder Option

The Holder site is on the Halpata Tastanaki Preserve owned by the SWFWMD in Marion County, northeast of the town of Holder. The site is adjacent to the Withlacoochee River and has access to SR 200. The site is approximately 8,146 acres in size and is sufficient to accommodate the 25 mgd water supply facilities including a raw water storage reservoir.

1.3 Lake Rousseau Option

The Lake Rousseau site is located in Levy County. Lake Rousseau is approximately 3 miles to the south of the proposed location. The site consists of more than 10 parcels owned by the Florida Department of Agriculture and Consumer Services (FDACS) with a total area of approximately 7,200 acres. The site has access to SR 336 and is sufficient to accommodate the 25 mgd water supply facilities.

Few publicly owned properties meeting the selection criteria were identified in the vicinity of Lake Rousseau. The identified site would require approximately 4 miles of raw water transmission north from the lake and a comparable length of finished water transmission south towards the pipeline corridors. A better suited location south or east of the lake should be able to reduce overall transmission lengths by five to 10 miles. While the location criteria indicated the facility needed to be on publicaly owned land, in this case, the cost of purchasing property (20 to 25 acres) closer to the intake may be less costly than the 5 to 10 miles of transmission pipe which has an estimated cost of $8.7 million. That option should be explored if this location is considered in the future.

2.0 Option Components

2.1 River Intake

A concrete intake structure is proposed on the bank of the river at locations reasonably proximate to the potential treatment plant sites. The intake would consist of a submerged reinforced concrete weir structure. The weir would be set at an elevation equal to the water elevation, below which no withdrawals could occur to ensure compliance with MFL criteria. Floating barriers and screens would be installed to prevent entry into the structure. Design of the structure would address FDEP criteria for impingement and entrainment of aquatic organisms. Generally, an intake velocity of less than 2.0 feet per second would be developed and the screen design would prevent access by listed species. A detailed study of the effect of the river intake on the natural environment in the area and on the river flow regime would need to be performed during design and permitting to determine the most environmentally acceptable locations and designs of the intake structures.

2.2 Raw Water Pump Station

A raw water pump station would be constructed next to the intake structure. Water would flow from the intake structure through a culvert or large diameter pipe to the wet well of the raw water pump station. The pump station would include two or more vertical turbine pumps to pump raw water from the wet well to the head of the treatment plant. For the North Sumter and Lake Rousseau options, the capacity of the pump station would be the same as the design capacity of the project. For the Holder option, the capacity of the pump station would be twice the capacity of the project in order to fill the reservoir during high flow periods. Standby pump capacity would be provided in accordance with the Ten State Standards and Chapter 62-550, Florida Administrative Code (F.A.C). The wet well would meet the hydraulic needs of the pumps but would not provide storage. The raw water pump station would pump the raw water to the treatment plant or reservoir through a large diameter concrete pipe.

2.3 Storage Reservoir (Holder Option Only)

The reach in the area of the Holder gage may be an appropriate setting for reservoir storage due to MFL limitations that would restrict the periods when the facility could withdraw from the river. The following is an overview of the conceptual design for a reservoir to support a 25 mgd year-round supply in the Holder area.

Reservoir Size - The purpose of the reservoir would be to store raw water during the wet months for treatment and supply during the dry season when withdrawals from the river would be reduced or prohibited. To properly size the reservoir, a thorough water balance would need to be prepared that would include river withdrawals based on adopted MFLs, rainfall, seepage losses, and evaporation rates. Further evaluation of the statistical frequency and duration of deficit periods, and of their relationship with the low-flow regime, would be required to optimize the size the reservoir and refine the estimate of reliability. The reservoir for this conceptual phase of the project will be sized for a 120 day storage period. This storage period for the Holder option correlates to the storage volume:

120 days storage * 25 mgd = 3.0 billion gallons

A storage depth of 20 feet is assumed. The area of the reservoir with this storage depth would be approximately 461 acres. Five feet of free board would be provided in accordance with 62-572, F.A.C regulations. This would bring the height of the reservoir berm to 28 feet with the accommodation of rainfall from large storm events.

Field Evaluations - Field testing to evaluate site geology to document that there are no sinkholes and that the area is not susceptible to sinkhole formation would be needed. If the potential for sinkhole development were to be identified, alternative site locations or specific construction contingency plans would be required. Soil tests would determine soil percolation rates and potential seepage losses. Because the site is underlain by highly permeable limestone, the reservoir would be lined to prevent excessive water loss.

Engineering Considerations - The reservoir would be designed to include inside slope protection to protect against erosion from wave runup, seepage control on the outside slope and a spillway for emergency overflows. Inside slopes would be protected from erosion by soil-cement planting, stair step protection systems, vegetated berms, and optimization of interior slopes. A blanket system and perimeter toe-drain would collect seepage and return it to the reservoir.

Transfer Pump Station - To convey raw water from the reservoir to the water treatment plant, a transfer pump station would be required. The station would have three or more horizontal split-case centrifugal pumps.

2.4 Water Treatment Facility

This section presents the evaluation of surface water treatment facilities for the options. The WRWSA's 2010 Water Supply Plan is the basis for much of this analysis.

Basis of Design - In Florida, FDEP has jurisdiction over drinking water standards described in Chapter 62-550 and 62-555, FAC. The primary drinking water standards, which are health-based and include the control of pathogens, are described in Rule 62-550.310, F.A.C., while the Secondary Drinking Water Standards are contained in Rule 62-550.320. Secondary standards generally apply to the aesthetic qualities of water (appearance, taste, and odor) that are typically desired for public acceptance and use. All primary and secondary standards are enforced for potable water supplies in Florida and, as such, compliance with all standards will be necessary when planning for and designing a water treatment facility.

Minimum capacity criteria for water supply facilities are described in Chapter 62-550, FAC. FDEP has jurisdiction over these criteria, which include design requirements for supply capacity, high service pumping capacity, stand-by power, and storage. Key criteria are discussed below.

Water Treatment Plant Components - The treatment facility would require an area of approximately 10 acres for a 10 mgd facility and 20 acres for a 25 mgd facility. The facility would include treatment operations and processes to efficiently and cost effectively treat raw surface water to a quality that would meet local, state, and federal regulations. The treatment process would be a common treatment train for a fresh surface water supply, based on comparable facilities in west-central Florida. The treatment process would depend on the water quality at the site. The Withlacoochee River is not currently used for potable supply, so further pilot study or jar testing would be required to evaluate the full range of raw water quality that may be experienced. Water quality data would be gathered to characterize the full range of flow conditions in the river. The major elements of the treatment facility would likely include:

- activated Carbon for removal of taste and odor;
- coagulation/flocculation/sedimentation for removal of organic and inorganic particulate constituents and dissolved organic matter;
- sand filtration for polishing filtration, removal of finer particulates and organic matter;
- disinfection via addition of chloramines;
- addition of chemicals for pH stability, corrosion inhibition, and scale control in the transmission system; and
- finished water storage and pumping.

Membrane processes are becoming increasingly common in the treatment of surface water and offer considerable advantages to conventional processes in the areas of taste and odor control and disinfection byproduct formation. This process will likely require conventional pre-treatment and filtration to protect the membranes. This type of system may be considered during design when a project location is confirmed and water quality data has been gathered.

Finished Water Storage - Storage for product water would be provided in case of transmission interruption or other conflicts with the delivery and use system. Two or more storage tanks would be provided on site for plant downtime and transmission system interruptions. FDEP requirements for minimum storage stipulate that the total storage capacity of the facility meet at least 25 percent of the maximum daily demand of the system. For conceptual design, it is assumed that 50 percent of the projected average daily demand is sufficient storage to meet the storage requirements. The maximum daily demand and storage requirements would be determined during design and permitting through coordination with utility end users. Storage would be provided by circular pre-stressed concrete storage tanks, constructed in accordance with AWWA D-110 (e.g., a composite similar to a CROM tank). The site would include enough area to install a future storage tank to meet expansion needs.

Finished Water Pump Station - To transfer water from the treatment facility to the communities served, a dedicated finished water pumping system would be installed. This system would consist of three or more horizontal split-case pumping units (possibly with variable speed drives) and would be controlled using pressure levels in the downstream transmission/distribution system, water levels in downstream storage tanks, or both. Results from the hydraulic modeling of the finished water transmission system would be used to establish sizing and selection requirements for the finished water pumping system.

Residuals Management - The sludge processing system would consist of an equalization tank (EQ tank), gravity thickener, and sludge dewatering system. Residuals from the treatment processes would be routed to the EQ tank. From the EQ tank, residuals would be metered to the gravity thickener where they would settle to the tank bottom. Supernatant would be decanted and recycled back to the head of the plant and thickened sludge would be collected from the bottom of the thickener by a scraper and pumped to the belt filter presses for dewatering. All dewatering equipment would be housed in a sludge dewatering building.

The disposal method for dewatered sludge would be evaluated in preliminary design and could include land application or landfilling. Depending on the environmental requirements of the disposal method, its selection would affect the final design of the sludge processing system and disposal costs. Preliminary design would include identification of the preferred method and costs associated with sludge disposal.

2.5 Transmission System

To deliver finished water to users, a finished water transmission system would be evaluated, designed, and constructed. A conceptual transmission system for each option was prepared for this element of the project. The transmission route typically assumes that water will be provided to utilities at an approximate location within the respective service area, via easements acquired along public rights-of-way. Proposed pipe routes are located along county or state roads. Careful planning and consideration should be given to the location where the finished water supply would be routed and connected into the existing water distribution systems in the local area. Actual pipeline routes and points of connection will be identified during design and permitting through coordination with the participating utility.

Conceptual Transmission Design - The conceptual design of the transmission piping is based on the planning demands presented above and the overall capacity of the project. Hydraulic modeling and coordination with participating utilities would be performed during design and permitting to determine the actual transmission requirements. Actual transmission sizes would be based on maximum daily flows determined by participating utilities.

Typical flow velocities for average daily flows for large transmission systems are about 5 feet per second. Maximum daily flows may increase the flow velocities to the range of 6-8 feet per second assuming a typical peaking factor of 1.5. The transmission design assumes that the existing local supply facilities will support peak needs for participating utilities, with limited support for peak flows provided by the new facility.

Normal pipeline life expectancy of 40 years exceeds the demands projected for this study. Ductile iron pipe (DIP) is assumed as the pipeline material but other pipeline materials including cement-lined prestressed concrete and polyvinyl chloride (PVC) could be evaluated during preliminary design. The pipeline routes and sizes for the conceptual transmission systems are presented in the following sections.

Since proposed pipeline routes are located along county or state roads, consideration should be given to potential road upgrades in the future. To avoid future pipe relocation, easement along the pipeline corridors should be acquired. Easement width would be 30 feet for pipes 16 inches or larger and 20 feet for smaller pipes.

The locations of the connection points to the distribution systems of the different municipalities are approximate. The actual alignment would be determined during design and permitting. Finalizing the locations of the points of connection in later phases of the project would result in different pipe lengths and would also impact the conceptual cost estimate described in the following section. End users would be responsible for interconnection and distribution of combined water to their respective users.

North Sumter Option Transmission System – this transmission system could supply the City of Wildwood and The Villages from the North Sumter Withlacoochee River Option. Table 5-21 summarizes the specifications.

Table 5-21. North Sumter Option Finished Water Transmission System Specifications.

Pipeline Size (inches)	Pipeline Length		Easement Area
(inches)	(feet)	(miles)	(acres)
36	68,145	12.9	46.9
20	46,245	8.8	31.8
Total:	**114,390**	**21.7**	**78.7**

Holder Option Transmission System Specifications – this system could supply Hernando County's Western Service Area, northwest Citrus County, and the City of Ocala from the Holder Withlacoochee River Option. Table 5-22 summarizes the specifications.

Table 5-22. Holder Option Finished Water Transmission System Specifications.

Pipeline Size	Pipeline Length		Easement Area
(inches)	(feet)	(miles)	(acres)
48	8,440	1.6	5.8
42	69,460	13.2	47.8
36	109,230	20.7	75.2
24	69,660	13.2	48.0
12	13,090	2.5	6.0
Total:	**269,880**	**51.2**	**182.8**

Lake Rousseau Option Transmission System Specifications – this transmission system could supply Hernando County's Western Service Area, northwest Citrus County, and the City of Ocala from the Lake Rousseau Withlacoochee River Option. For this option, a raw water transmission system would also be required to deliver raw water from the intake location to the treatment plant. Tables 5-23 and 5-24 summarize the specifications for the raw water and finished water transmission systems, respectively.

Table 5-23. L ake Rousseau Option Raw Water Transmission System Specifications.

Pipeline Size	Pipeline Length		Easement Area
(inches)	(feet)	(miles)	(acres)
48	22,704	4.3	13.6
Total:	**22,704**	**4.3**	**13.6**

Table 5-24. Lake Rousseau Option Finished Water Transmission System Specifications.

Pipeline Size	Pipeline Length		Easement Area
(inches)	(feet)	(miles)	(acres)
48	36,615	6.9	25.2
42	69,990	13.3	48.2
36	109,230	20.7	75.2
24	104,415	19.8	71.9
12	13,090	2.5	6.0
Total:	**333,340**	**63.2**	**226.5**

2.6 Blending

For utilities that receive potable supply from both groundwater and surface water, differences in water chemistry should be considered. This will require review of the treated surface water supply characteristics, existing groundwater supply of the utilities, the construction materials of the utilities' distribution systems, and the disinfection and corrosion issues associated with blending potable water from different sources.

The primary issues with blending are water quality as it relates to the disinfectant residual, disinfection byproduct (DBP) formation, and pipeline corrosion. Surface water contains higher levels of total organic compounds (TOC) and pathogens such as *Giardia*, and requires a different level of disinfection than groundwater. The TOC in surface water tends to increase levels of DBPs in comparison to groundwater. Potable water standards must be met in the transmission system in accordance with Rule 62-550.310, F.A.C and meeting the disinfection and corrosion control needs in the transmission system will affect the design of the utility's blending facility.

After treated water from one source mixes with that from another source, changes in distribution system water chemistry can affect the stability of pipe coatings and disrupt the biofilms that protect pipes from corrosion. An increase in DBPs can also occur, either cumulatively or due to source interactions among multiple disinfectant types. The blending of groundwater and surface water must consider the combined water chemistry in the utility distribution system. Ultimately, potable water standards must be met in the blended water.

Each utility's source water and distribution system characteristics will be different. Therefore, it will be the responsibility of the utility to blend the water within their system and distribute water to their customers, and the determination of costs and the distribution infrastructure needed to properly blend groundwater and surface water falls with the individual utility. The method of blending and associated treatment processes to meet primary and secondary drinking water standards must also be determined by each utility.

3.0 Cost Estimates

Planning-level cost estimates were revised for this Water Supply Plan update and are presented in this section. Estimates are based on the text above that detailed the configuration and components of each project option. The cost estimating methodology is based on the methodology established in CH2M Hill (2004). Additional details on cost definitions and the cost estimation methodology are presented below.

The following elements are included in the cost estimates:

- construction cost is the total amount expected to be paid to a qualified contractor to build the required facility;
- non-construction capital cost is an allowance for construction contingency, engineering design, permitting and administration for the facility;
- land cost is the market value of the land required for the facility;
- land acquisition cost is the estimated cost of acquiring the land, exclusive of the land cost;
- operation and maintenance (O&M) cost is the estimated annual cost of operating and maintaining the facility when operated at average day capacity;
- capital cost is the sum of construction cost, non-construction capital cost, land cost, and land acquisition cost;
- unit production cost is the annual lifecycle cost of the facility divided by the annual water production rate;
- interest or discount rate is the time value of money criteria for the facility; and
- equivalent annual cost is the annual lifecycle cost of the facility based on service life and time value of money criteria.

3.1 Capital Cost Estimates

A summary of planning-level capital cost estimates for project option is presented in Tables 5-25 through 5-27. Capital cost estimates are based on the following criteria:

- raw water intake structure based on $0.75 per gallon;
- treatment facility construction cost based on $3.00 per gallon (actual costs of Tampa Bay Water facility expansion and Peace River facility construction were $2.6 and $3.1 per gallon, respectively);
- annual O&M costs based on 15 percent of water treatment and storage facility capital costs;
- pipeline costs based on $9.00 per linear foot per inch diameter of pipe; and
- reservoir cost estimated by increasing the cost in the WRWSA 2010 Water Supply Plan by 4 percent based on increases in fuel and material costs (US Energy Information Association).

Non-construction capital cost estimates are applied at 45 percent of the construction cost and include:

- twenty percent allowance for construction contingency;
- twenty five percent allowance for engineering design, permitting, and administration;
- easement acquisition costs of $0.75 per square foot (e.g., $32,760 per acre) are included in the capital cost; and
- Land costs of $5,000 per acre plus 18 percent acquisition cost.

Table 5-25. North Sumter Option Capital Cost Estimate.

Description	Total Cost (2013 dollars)
Raw Water Intake & Pump Station	$7,500,000
Raw Water Transmission (2000 ft, 36" diameter)	648,000
Water Treatment and Storage Facility	$30,000,000
Transmission System	$30,400,000
Land and Easement Acquisition	$2,600,000
Subtotal construction capital cost	$71,148,000
Non-construction capital cost (45%)	$32,016,000
Total	**$103,164,000**

Table 5-26. Holder Option Capital Cost Estimate.

Description	Total Cost (2013 dollars)
Raw Water Intake & Pump Station	$18,750,000
Raw Water Transmission (4000 ft, 48 " diameter)	$1,728,000
Raw Water Storage Reservoir[1,2]	$96,804,000
Water Treatment and Storage Facility	$75,000,000
Transmission System	$81,800,000
Land and Easement Acquisition	$6,200,000
Subtotal construction capital cost	$280,282,000
Non-construction capital cost (45%)	$126,127,000
Total	**$406,409,000**

[1] *The construction cost assumes the reservoir will be lined.*
[2] *Actual MFL adoption and consideration of supplemental sources will affect reservoir costs.*

Table 5-27. Lake Rousseau Option Capital Cost Estimate.

Description	Total Cost (2013 dollars)
Raw Water Intake & Pump Station	$18,750,000
Raw Water Transmission	$9,800,000
Water Treatment & Storage Facility	$75,000,000
Transmission System	$101,680,000
Land and Easement Acquisition	$6,200,000
Subtotal construction capital cost	$211,400,000
Non-construction capital cost (45%)	$95,100,000
Total	**$306,500,000**

3.3 Operation and Maintenance Cost Estimates

Operation and maintenance costs include labor, power, and chemical costs necessary for operation; and renewal and replacement costs for equipment maintenance and membrane replacement. As discussed above, annual O&M costs were considered to be 20 percent of treatment facility capital costs and are included in Tables 5-29 through 5-31.

3.4 Unit Production Cost Estimates

Unit production cost is a function of the capital costs, debt service, annual O&M costs and the amount of water produced. For this analysis, the debt service is estimated based on a 30-year project lifecycle at 3.75 percent interest (2013 federal discount rate for water resource projects). Unit production costs for the three options are included in Tables 5-28 through 5-30.

Table 5-28. North Sumter Option Operation and Maintenance and Unit Production Cost Estimates.

Description	Total Cost
Total Capital Cost	$103,164,000
Annual O&M Cost	$4,500,000
Equivalent Annual Cost:	**$10,300,000**
Unit Production Cost ($/1000 gal)[1]	**$2.82**

[1]Unit production costs assume continuous operation; however, the facility is expected to provide conjunctive supply. Actual MFL adoption will determine whether this facility can be a year-round or conjunctive supply.

Table 5-29. Holder Option Operation and Maintenance and Unit Production Cost Estimates.

Description	Total Cost
Total Capital Cost	$406,409,000
Annual O&M Cost	$11,250,000
Equivalent Annual Cost:	**$34,100,000**
Unit Production Cost ($/1000 gal)	**$3.74**

Table 5-30. Lake Rousseau Operation and Maintenance and Unit Production Cost Estimates.

Description	Total Cost
Total Capital Cost	$306,530,000
Annual O&M Cost	$11,300,000
Equivalent Annual Cost:	**$28,500,000**
Unit Production Cost ($/1000 gal)	**$3.12**

4.0 Long-Range Planning Considerations

Long transmission distances exist between most of the locations for these options and the demand centers. The length of transmission in some cases is such that economies of scale associated with service to multiple users will be diminished by the need for transmission. For example, a small or conjunctive withdrawal from the Withlacoochee River reach upstream of Holder is likely to prove more cost-effective for northeastern Sumter County utilities than a similar withdrawal from Lake Rousseau, which would require about 15 miles of additional transmission and regional-scale participation.

5.0 Aquifer Recharge Project Option

5.1 Description

The Aquifer Recharge Project Option would use the Withlacoochee River to recharge the Upper Floridan aquifer. River water would be recharged through a recharge basin/reservoir then withdrawn from the Upper Floridan aquifer down gradient of the recharge reservoir. A shallow reservoir would be excavated to provide storage of river water and subsequent aquifer recharge. Since this project option does not require treatment or transmission, it is expected to be cost effective as compared to other alternatives. The project configuration is presented below and Figure 5-8 shows the proposed location.

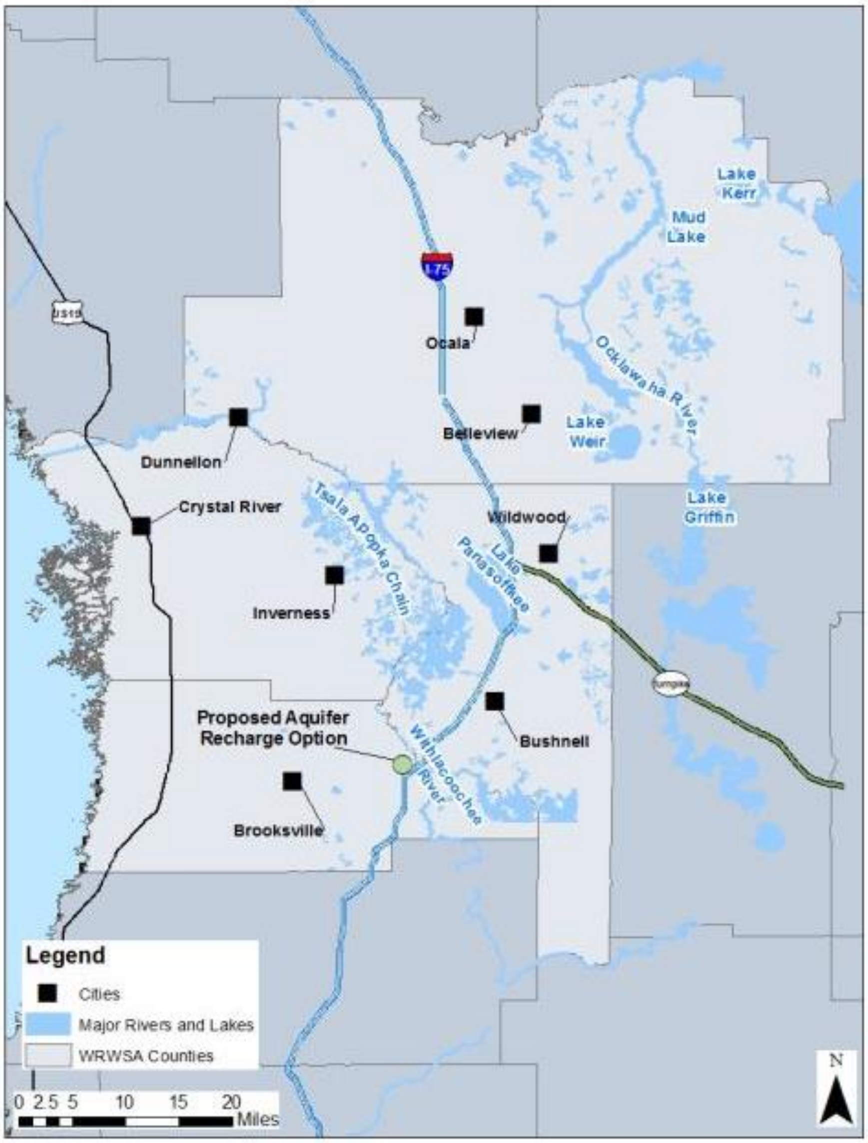

Figure 5-8. Proposed Location of an Aquifer Recharge Facility.

5.2 Areas and Users Served

Since the project option would recharge the Upper Floridan aquifer, it could serve any user that relies on groundwater in the groundwater basin where the project is located. The North-Central Western Florida groundwater basin includes all of Citrus, Hernando, and Sumter counties. However, recharge effects would decline with distance from the project, so it is unlikely that the entire basin would be considered for benefit. Coordination with the SWFWMD will be required to identify a service area for the project. Local groundwater modeling would be required to identify the specific area where groundwater users could be served.

5.3 Site Selection

Criteria used to evaluate potential sites for the location of the recharge facility included:

- public ownership to minimize or eliminate land costs;
- sufficient size to accommodate a storage/recharge reservoir; and
- close to the raw water intake with road access.

Due to the general northwesterly flow of the Upper Floridan aquifer, sites located towards the southern end of the WRWSA region were preferred. Based on these requirements, a potential site for the recharge facility was identified.

5.4 Hydrogeology and Recharge Potential

In the vicinity of the potential reservoir, the surface geology is undifferentiated Tertiary / Quaternary sediments, locally consisting of fine grained quartz sands to approximately 30 feet depth overlying approximately 10 feet of sandy clay. The surficial sediments overly the Ocala Limestone of the Upper Floridan Aquifer. The top of the Upper Floridan aquifer is approximately 44 feet below land surface.

Based on the nearby geologic log from ROMP 99x-1, the confining material is a sandy clay to clayey sand approximately 10 feet thick. The vertical hydraulic conductivity of this material can range from 0.03 to 0.003 feet per day. The vertical hydraulic gradient between the reservoir and the Floridan aquifer was estimated based on a reservoir surface elevation of 70 feet and Upper Floridan aquifer potentiometric surface of 49 feet. Based on the 323 acre footprint of the reservoir and the estimated hydraulic conductivity and gradient, estimated recharge potential ranges from 650,000 gpd to 6.5 mgd.

The potential for a "short circuit" through the surficial sediments back to the river was evaluated by comparing the head in the reservoir to the stage in the Withlacoochee River. The median river stage adjacent to the reservoir was estimated to be 50.9 feet (approximately 8 miles down-stream from the Trilby gage location). Return flow through the surficial aquifer was estimated by calculating the flow through an area of surficial sands between the reservoir and the river. The cross sectional area is estimated as 31 feet height times 2500 feet length of the eastern boundary of the reservoir site. Horizontal hydraulic gradient is estimated as reservoir head (70 feet) minus river stage (50.9 feet) divided by the average distance to the river (500 feet). Horizontal hydraulic conductivity is estimated to be 10 feet per day. Based on these numbers, return flow to the river would be approximately 200,000 gallons per day. Based on a the estimate of Upper Floridan aquifer recharge using the middle of the vertical hydraulic conductivity range for confinement at the site, this return flow represents 5.9 percent of the recharge potential to the Upper Floridan aquifer.

Upper Floridan aquifer heads in the proposed project area were estimated to be approximately 49 to 50 feet NGVD. The median river stage adjacent to the reservoir is estimated to be approximately 50.9 feet NGVD. That the river stage is slightly higher than the Upper Floridan aquifer head is expected if this portion of the river is a recharge area. Comparison of flows between the Trilby and downstream Croom gages shows a decrease in flow from Trilby to Croom when the discharge is normalized by drainage area. The river-stage/aquifer-head relationship and comparison of flow measurements between the USGS gages on either side of the proposed reservoir site are consistent with the site being in a recharge area.

5.5 Upper Floridan Aquifer Water Quality

It is likely that water quality in the Upper Floridan Aquifer will not be affected by recharge of river water through the proposed recharge basin, owing to the relatively thick sequence of sands and clay confinement overlying the Upper Floridan aquifer. Site specific drilling and geotechnical investigations would be needed to characterize the site specific geology to document that there are no sinkholes in the project area, and that the site is not susceptible to sinkhole formation.

5.6 Withlacoochee River Withdrawals

As previously discussed, the recharge potential of the facility would range from 650,000 gpd to 6,500,000 gpd, depending on specific vertical hydraulic conductivity conditions at the site. Based on the SWFWMD's proposed minimum flow at the Croom gage, approximately 19.8 mgd could be available from the river on a median annual basis to supply this option. Based on the 323 acre reservoir footprint, an annual evaporative loss from the reservoir is estimated at 1.2 mgd. By subtracting the annual evaporative loss from the river withdrawal, a possible flow to recharge of 14.3 mgd is estimated.

The flow available from the river over the lifetime of this option can be affected by a number of factors including anthropogenic flow declines (due to changes in land use, groundwater withdrawals, etc) and climate change. These factors and their potential effect on the design river withdrawal will be considered during preliminary design. Additionally, this project analysis does not consider the effects of this withdrawal on other potential alternative projects.

5.7 Design Considerations

River Intake Structure - A detailed study of the effect of the intake on the river environment in the area and on the river flow regime would need to be performed to place the intake structure in the most environmentally compatible location. The concrete intake structure would be on the west bank of the river, approximately 2.4 miles west of State Road 93. A shoreline intake is proposed for the project. The intake would be a submerged reinforced concrete weir structure. The weir would be set at an elevation equal to the water elevation of the river below which no withdrawals could occur. A floating barrier and bar screens would be installed to prevent entry into the structure.

Reservoir Design - Land surface elevation of the site is approximately 50 to 80 feet NGVD. The reservoir footprint would be 323 acres, and would be developed to maximize surface area within the constraints of the parcel and design water levels. The reservoir footprint would generally avoid wetlands and provide a 100-foot buffer to adjoining parcels. It would also provide a 500-foot buffer to the Withlacoochee River to reduce the potential for "short-circuiting" or recharge returning to the river rather than the Upper Floridan aquifer. To circumvent the need for FDEP dam safety requirements, the reservoir would be limited to five feet of water depth with an additional foot of freeboard. The berm width would be 12-feet with 2:1 side slopes. The constructed bottom elevation would be 65 feet NGVD. Fill excavated from the site would be used to construct the berm.

5.8 Cost Estimates

The configuration of the aquifer recharge project option was used to develop a conceptual cost estimate. The cost estimate is presented in this section. The following elements are included in the cost estimate:

- construction cost is the total amount expected to be paid to a qualified contractor to build the required facility;
- non-construction capital cost is an allowance for construction contingency, engineering design, permitting and administration for the facility;
- land cost is the market value of the land required for the facility;
- land acquisition cost is the estimated cost of acquiring the land, exclusive of the land cost;
- operation and maintenance cost is the estimated annual cost of operating and maintaining the facility when operated at average day capacity;
- capital cost is the sum of construction cost, non-construction capital cost, land cost, and land acquisition cost;
- unit production cost is the annual lifecycle cost of the facility divided by the annual water production rate;
- interest or discount rate is the time value of money criteria for the facility; and
- equivalent annual cost is the annual lifecycle cost of the facility based on service life and time value of money criteria.

Capital Cost Estimate - The capital cost for the aquifer recharge facility is presented in Table 5-31. The raw water intake structure, pump station and transmission were based on $0.75 per gallon. The non-construction capital cost was applied at 45 percent of the construction cost. This includes a 20 percent allowance for construction contingency (unknown conditions and/or changed field conditions) and a 25 percent allowance for engineering design, permitting, and administration.

Table 5-31. Aquifer Recharge Capital Cost Estimate.

Item No.	Description	Total Cost
1	Raw Water Intake, Pump Station, Transmission[1]	$4,875,000
2	Aquifer Recharge Reservoir	$10,590,000
	Subtotal Construction Capital Cost	**$15,465,000**
	Non-Construction Capital Cost (45%)	**$6,959,250**
	Total Capital Cost	**$22,424,250**

[1]*The maximum recharge capacity is assumed for river intake and transfer pump station costs.*

Operation and Maintenance Cost Estimate - O&M includes labor and power costs necessary for operation, and renewal and replacement costs for equipment maintenance. Labor costs were based on an estimated workforce needed to operate the facility. This assumes the facility would be remotely operated. Power costs were estimated based on equipment operation.

Renewal and replacement costs were based on a combination of annual needs and project lifecycle of 30 years. These costs are estimated to be 1 percent of the construction cost. Table 5-32 provides a summary of these costs.

Table 5-32. Aquifer Recharge Operation and Maintenance Cost Estimate.

Item No.	Description	Estimated Annual Costs – Aquifer Recharge Capacity	
		6.5 mgd	0.65 mgd
1	Labor	$39,000	$39,000
2	Power	$55,000	$5,000
3	Equipment Renewal & Replacement	$173,000	$38,000
	Total	**$267,000**	**$82,000**

Unit Production Cost Estimate - Unit production cost is a function of the capital costs, debt service, annual O&M costs and the amount of water produced. For this analysis, the debt service is estimated based on a 30-year project lifecycle at 3.75 percent interest. Table 5-33 provides a summary of these costs.

Table 5-33. Aquifer Recharge Unit Production Cost Estimate.

Item No.	Description	Aquifer Recharge Capacity	
		6.5 mgd	0.65 mgd[1]
1	Total Capital Cost	$22,424,250	$22,424,250
2	Annual O&M Cost	$267,000	$82,000
	Equivalent Annual Cost:	**$896,314**	**$711,314**
	Unit Production Cost ($/kgal)	**$0.38**	**$0.30**

[1]0.65 mgd unit cost assumes pump station and river intake capacity for the maximum potential recharge capacity. Actual unit cost at a lower recharge capacity would reflect a lower capacity pump station and river intake.

Section 5. Seawater Desalination

1.0 Crystal River Power Station

The concept of a seawater desalination project in the region was initially proposed and evaluated in the SWFWMD's 1992 Needs and Sources Plan. Since that time, Tampa Bay Water constructed the nation's largest seawater desalination facility on Tampa Bay and co-located it with the Tampa Electric Company's Big Bend Power Plant. The benefit of this combined operation is the ability to utilize the power plant's cooling water discharge system to dilute the waste concentrate discharged by the desalination facility. This results in a more cost-efficient and environmentally acceptable seawater desalination process.

The Crystal River Power Station, owned and operated by Duke Energy, is located near the Gulf of Mexico in Citrus County (Figure 5-9). The WRWSA's 2010 Water Supply Plan proposed a seawater desalination option at the Power Station that would produce 15 mgd of potable water to supply customers in Citrus and Hernando counties. For the purposes of re-evaluating the seawater desalination project option for this water supply plan update, a facility with similar production capacity and distribution system configuration is assumed but waste concentrate disposal options, regulatory criteria, and estimated costs are updated.

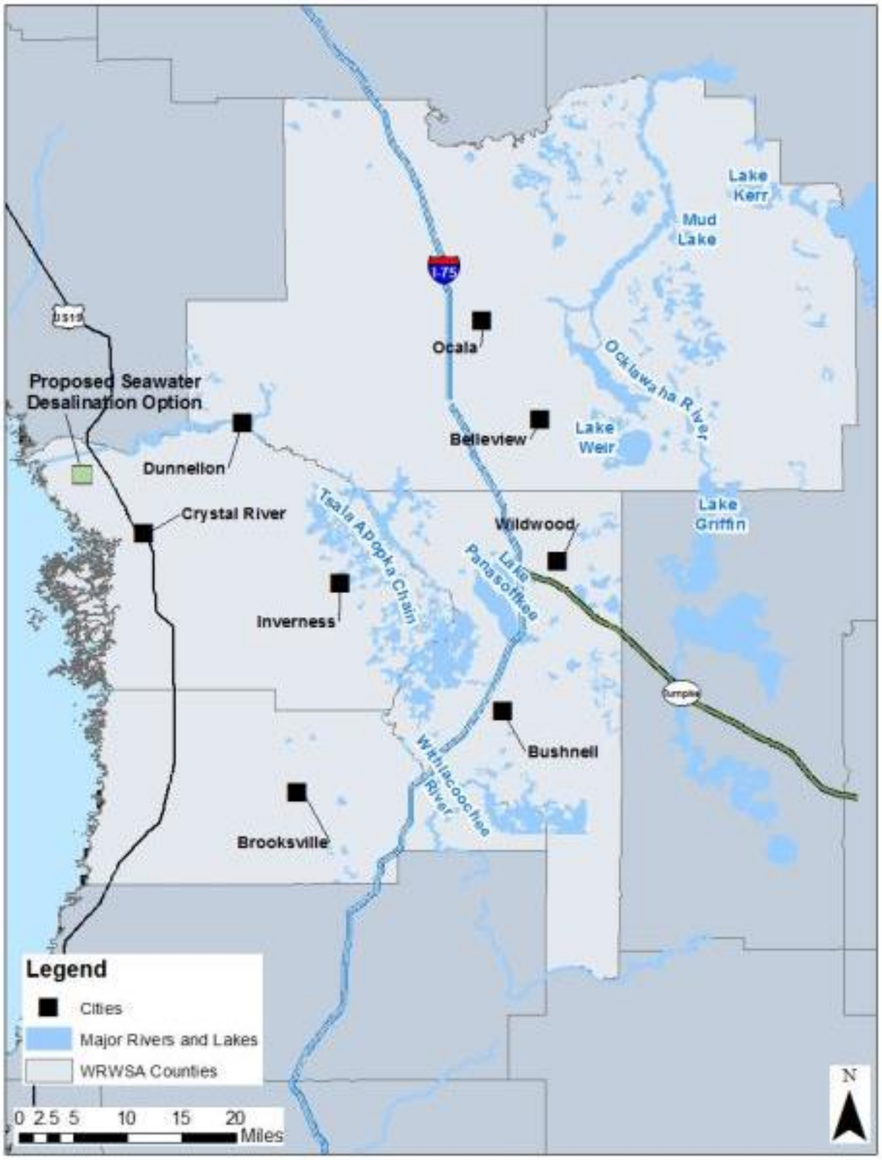

Figure 5-9. Proposed Location of a Seawater Desalination Facility.

1.1 Seawater Source and Intake Location

Seawater, as a source water, does not require a water use permit from the SWFWMD and is not limited by any regulatory limitations other than the concentrate disposal regulations imposed by the FDEP. The withdrawal location for this option is the Cross Florida Barge Canal seaward of the Inglis Dam. Since this location receives large freshwater discharges from Lake Rousseau, water quality data in the barge canal were reviewed to identify potential issues.

Salinity (total dissolved solids measured in parts per thousand (ppt)) is the critical water quality driver for desalination. The salinity in the Barge Canal typically fluctuates between 15 to 20 ppt, and can vary from completely fresh (0 ppt) to seawater (35 ppt). This is due to the regulation schedule of the Inglis Dam, which routes freshwater discharges from Lake Rousseau to the

Barge Canal. When discharges occur, they reduce salinity in the Barge Canal and create a wedge effect where saltier water remains at depth and fresher water flows at the surface.

The typical salinity range of 15 to 20 ppt that occurs in the Barge Canal is highly desirable in comparison to direct seawater, because fresher, less saline waters reduce operating costs for the desalination process. However, the facility would need to be designed to deal with the variability in Barge Canal water. For example, a more extensive pretreatment system would be needed during periods when Lake Rousseau is discharging to the Barge Canal in order to remove constituents such as dissolved organic carbon that would impact performance of reverse osmosis membranes. These additional or enhanced components would increase capital and operating costs.

1.2 Facility Design

This section presents the conceptual facility design for the seawater desalination project option. The facility would include treatment operations and processes to convert seawater into potable (finished) water with quality meeting all requisite local, state and federal regulations.

Basis of Design - In Florida, the FDEP has jurisdiction over the drinking water standards described in Chapter 62-520 and 62-550, F.A.C. All primary and secondary standards are enforced for potable water supplies in Florida and as such, compliance with all standards must occur when planning for and designing a water supply facility. Minimum capacity criteria for water supply facilities are described in Chapter 62-550, F.A.C. The FDEP has jurisdiction over these criteria, which include design requirements for supply capacity, high service pumping capacity, stand-by power and storage.
The treatment and appurtenant facilities would require an approximate 10 acre site. The treatment process would be membrane reverse osmosis, which is a proven and cost effective method that in widespread use. The major elements of the facility are discussed below.

Raw Water Intake - A concrete intake structure is proposed on the south bank of the Barge Canal that would consist of a submerged reinforced concrete weir. A floating barrier and screens would prevent entry into the structure. The design of the structure would address the FDEP criteria for impingement and entrainment of aquatic organisms. The screen design would prevent access by species such as manatees and sea turtles. A detailed study of the effect of the Barge Canal intake on the environment in the area would need to be performed during design and permitting to determine the final location and design of the intake structure.

Raw Water Pump Station and Transmission - The raw water pump station would be constructed next to the intake structure. Water would flow from the intake structure through a culvert or large diameter pipe to the wet well of the raw water pump station. The pump station would include two or more vertical turbine pumps with an estimated total capacity of 17,365 gpm (25 mgd assuming a 60 percent treatment efficiency) to pump raw water from the wet well to the head of the treatment facility. Standby pump capacity would be provided in accordance with the Ten State Standards and Chapter 62-550, F.A.C. The wet well would meet the hydraulic needs of the pumps but would not provide storage since adequate year-round flow is available in the Barge Canal. The raw water pump station would pump the raw water to the desalination plant through a large diameter coated ductile iron pipe.

Pretreatment - Raw water pretreatment will be designed based upon a comprehensive pilot plant study program encompassing the full range of raw water quality that may be experienced. The goal of pretreatment is to remove compounds such as dissolved organic material and suspended solids that could prematurely clog the reverse osmosis membranes. A chemical fed coagulation-flocculation-filtration pretreatment system similar to that of the Tampa Bay Seawater Desalination Plant is proposed. The residuals from the pretreatment stage would be disposed of offsite. As discussed previously, when Lake Rousseau is discharging into the Barge Canal a more extensive pre-treatment system would be necessary. Potential pretreatment process options that could be considered include adding a sedimentation stage, ballasted flocculation, and dissolved air flotation stage.

Reverse Osmosis Membrane Treatment - Removal of dissolved solids and other constituents remaining after pre-treatment would be performed by a pressurized reverse osmosis system. Multiple passes through reverse osmosis membranes are normally required to maintain reasonable operating pressures. Design criteria for potable water are 500 mg/l total dissolved solids, but this value will vary depending on the configuration of the end users distribution system. The 500 mg/l criteria assumes that the desalinated product can be blended with treated waters from other sources prior to distribution by the receiving utility to consumers. Blending desalinated water with treated waters from other sources prior to distribution to the end users is a common practice which helps to stabilize the finished water before reaching the customers. It should be well within the capability of the nearby utilities to blend the desalinated water with groundwater to achieve a desired TDS level.

Disinfection and Stabilization - Product water from the reverse osmosis system will be highly aggressive as nearly all of its constituents will have been removed and will require addition of chemicals for pH stability, corrosion inhibition, and scale control in the transmission system. The final configuration of post membrane chemical addition will be affected by the selection of disinfectant method, the transmission line material, and blending considerations identified in preliminary design. Post membrane product water would be disinfected with a hypochlorite solution prior to entering the storage tank and transmission line.

Finished Water Storage - Two storage tanks would be provided on site for plant downtime and transmission system interruptions. The FDEP requirements for minimum storage stipulate that the total storage capacity of the facility meet at least 25 percent of the maximum daily demand of the system. For conceptual design, it is assumed that 50 percent of the projected average daily demand is sufficient storage to meet the storage requirements. The maximum daily demand and storage requirements will be determined during design and permitting through coordination with utility end users. Storage will be provided by pre-stressed concrete storage tanks. The site will be developed with enough area to install a future storage tank to meet expansion needs.

Finished Water Pump Station - To transfer water from the treatment facility to end users, a finished water pumping system would be installed. This system would consist of three or more

horizontal split-case pumping units with variable speed drives and would be controlled using pressure levels in the downstream transmission/distribution system, water levels in downstream storage tanks, or both. Results from the hydraulic modeling of the finished water transmission system would be used to establish sizing and selection requirements for the finished water pumping system.

Support Facilities - Support facilities would include chemical storage tank facilities; parking; electrical feed and distribution system; stormwater management system; landscaping and buffer zones; and, lighting. An operations/maintenance/administration building would be constructed to support the overall operations of the water treatment plant and staff. The building would have an area from which the various plant operations can be monitored and controlled, a work space, and on-site laboratory.

There will be a supervisory control and data acquisition (SCADA) system that includes a central computer for video display, data storage, and reports. Operation monitoring will include online control systems and process monitoring for changes in flow, pH, temperature, conductivity, total dissolved solids, silt density index, pressure across the membranes in the process and in the cartridge filters, water recovery, and microbial parameters. Control system concepts will include SCADA and consideration of distributed control system conversions to enable the incorporation of smart technologies into the plant.

1.3 Evaluation of Waste Concentrate Disposal Options

Desalination of seawater creates a waste concentrate stream that must be managed and disposed of in accordance with FDEP regulations. The following is a discussion of disposal options for waste concentrate. These include dilution and discharge in power plant cooling water, deep well injection, zero liquid discharge, and ocean outfall.

Dilution and Discharge in Power Plant Cooling Water - Co-locating a seawater desalination facility with an existing water cooled power plant, as was proposed in the WRWSA's 2010 Plan, provides the advantage of using an existing outfall structure and blending with the power plant cooling water discharge, thereby diluting the concentrate discharge to environmentally acceptable levels.

The Power Station includes four coal-fired generating units with a combined capacity of 2,302 megawatts (MW) and a nuclear unit with a capacity of 825 MW. The two coal-fired units (Units 1 and 2) and the nuclear unit (Unit 3) use seawater for once-through cooling. The combined maximum permitted cooling discharge flow for these facilities is 1,898 mgd. These units utilize a common seawater intake and discharge system through a canal that discharges the cooling flow beyond the shoreline.

Since the completion of the WRWSA's 2010 Water Supply Plan, Duke Energy has significantly revised their plans for power generation at the Power Station. Specifically, Unit 3 (nuclear unit) has been permanently retired and its associated once-through cooling water flow of 979.2 mgd is no longer in service. In addition, Units 1 and 2 are likely to be retired by the end of 2020, which will eliminate their once-through cooling water flows of 918.7 mgd. Units 4 and 5 use closed-cycle cooling towers and do not have the significant once-through cooling water flows associated with Units 1-3. Therefore, by the year 2020, there will no longer be a reliable long-term cooling water outflow to provide dilution of concentrate for a future seawater desalination facility (personal communication, Duke Energy, May 2013).

Deep Well Injection - Deep well injection enables concentrate to be pumped into confined subsurface rock formations that are below the underground source of drinking water. It is a reasonable method for concentrate disposal provided that long-term operation can be maintained without degrading potable aquifers. Well depths are typically thousands of feet depending on the geological conditions at the site. Injection well systems generally consist of an injection pump, conveyance system to the injection well and a wellbore, which is protected by a multiple casing strings set at various depths and cemented in place. The nature of the substrata must be carefully considered in selecting a suitable location for injection. Injection zones must have a total dissolved solids level greater than 10,000 mg/l, and at least one overlaying confining layer separating the targeted injection zone from potable aquifers. Such a disposal system will face significant technical and environmental hurdles. Deep well injection costs depend on the concentrate volume, distance from the plant to the injection point, well depth and diameter, pumping pressure, emergency storage, and regulatory permitting and monitoring requirements.

A key element of any deep well injection program is to conduct a feasibility study, which is designed to address permitting requirements. The study typically includes the drilling of exploratory well(s), which would provide information needed to confirm deep well feasibility and criteria for the design and construction of a test injection well.

Zero Liquid Discharge (ZLD) - ZLD technologies and brine volume minimization include thermal based technologies, pressure driven and electric potential driven membrane technologies and alternative technologies. ZLD thermal technologies such as brine concentrators and crystallizers have been proven at full industrial scale applications and have operational experience and reliable cost data, and therefore, are evaluated in this report.

Reduction of waste concentrate to a dry salt is typically done in two steps starting with brine concentration through an initial evaporative process to concentrate the waste and then through a secondary system to reduce it to a dry salt. A brine concentrator uses vapor compression and thermal evaporation in a packed tower to reduce the concentrate to a slurry that can be solidified in an evaporation pond or crystallized. The capital and operating costs of brine concentrators are extremely high. Because of the corrosive nature of many concentrates, brine concentrators are usually built with expensive materials including titanium, molybdenum and stainless steel. With energy requirements in the range of 60-90 kWh/1,000 gallons, this technology has only been considered economical for use in power plants and other industrial settings. However, brine concentrators have small footprints and can simplify the permitting process and may be feasible in areas where other options are not available.

In the second step of ZLD, crystallization, the salt slurry is reduced to dry salt and distilled water through forced circulation vapor. The technology used for crystallizers includes conveyance pipe to the crystallizer, the vapor compression chamber, a heat exchanger, seed slurry storage and delivery system, a recirculation pump and a vapor compressor. The energy requirements of crystallizers are even higher than that of brine concentrators, requiring approximately 200-250 kWh/1,000 gallons. Like brine concentrators, crystallizers have small footprints and may be feasible in areas where other options are not available.

Ocean Outfall - An ocean outfall constitutes a long pipeline to a certain depth and distance into the Gulf of Mexico with a diffuser structure at the end. The outfall pipeline and diffuser would be designed by modeling the plume to provide the dilution/dispersion levels and mixing zones required by the permit, such that the salinity levels and marine life in the receiving body would not be adversely affected.

An opinion of outfall pipeline costs was developed in this report from a review of similar studies conducted in Florida. The pipeline would discharge approximately 6 miles offshore at a depth of approximately 20 feet. Since the onshore component of the outfall pipeline would be 3.7 miles in length, the total length of the outfall pipeline would be approximately 9.7 miles. The concentrate conveyance costs are closely related to the concentrate volume and the distance to the discharge outfall. The outfall capital costs depend on outfall diameter, length, piping material and diffuser system configuration. Depending on site conditions, the costs for an ocean outfall range from 5 to 30 percent of the total desalination plant construction expenditures. The higher end of this range applies to desalination facilities with fresh water production capacity of 10 mgd or more.

1.4 Environmental Monitoring

Monitoring of the plant concentrate discharge will be required in accordance with the type of final concentrate disposal system selected. If deep well injection is utilized, it will be regulated by the FDEP under the Underground Injection Control (UIC) program, which has primacy in Florida for implementing EPA rules and regulations governing deep well injection. If ZLD (brine concentrate coupled with crystallizer) is utilized, the process would be regulated under the Resource Conservation and Recovery Act (RCRA) as membrane concentrates are considered as solid waste.

When concentrate is further processed to produce brine or a solid, the increased concentrations of constituents may render the waste toxic, hazardous or otherwise of concern, even when they are of no concern at the initial concentrate level. Although brine or solids from concentrate are not ignitable, toxic, reactive or corrosive by RCRA definitions, hazardous waste concerns are associated with constituents in the original raw water or constituents added during processing that become concentrated enough to cause the brine or solids to be hazardous. Solids not containing hazardous materials and not containing naturally occurring radionuclide material (NORM) may be disposed of in a landfill suitable for industrial waste. However, treating concentrate containing NORM would increase the radionuclide concentrations in the residual solids creating technologically enhanced naturally occurring radioactive materials (TENORM). Whether concentrate processed through ZLD would result in a more highly regulated waste is dependent on the concentrate characteristics.

Discharges to surface waters of the state of Florida must comply with the applicable water quality standards at the point of discharge. If “end of pipe” exceedances of numerical criteria as established in the F.A.C. exist and the outfall operator can show that source reduction or pollutant control are not technically or economically feasible, Florida regulations allow the applicant to demonstrate that it qualifies for a zone of mixing in the receiving water around the point of discharge. Therefore, it is likely that mixing zones would be needed for the conceptual ocean outfalls for the concentrate. If ocean/gulf outfall option is chosen, there will be a need for environmental monitoring to meet the NPDES permit limits.

1.5 Transmission Systems

To deliver finished water produced by the desalination facility to users, a finished water transmission system would need to be evaluated, designed and constructed. This feasibility analysis is based on the seawater desalination option that was evaluated in the WRWSA's 2010 Plan, which included a conceptual transmission system. The transmission route typically assumes that water will be provided to utilities at an approximate location within the respective service area, via easements acquired along public rights-of-way. Proposed pipeline routes would be located along county or state roads. A raw water transmission system would also be required to deliver raw water from the intake location to the treatment plant. Actual pipeline routes and points of connection would be identified during design and permitting through coordination with the participating utility.

Conceptual Transmission Design - The conceptual design of the transmission piping is based on the average day demands of the users and the overall capacity of the project. Since raw water storage would not be provided at the intake structure, the raw and finished water transmission systems would be designed on the same basis. Hydraulic modeling and coordination with participating utilities would be performed during design and permitting to determine the actual transmission requirements. Actual transmission sizes would be based on maximum daily flows determined by participating utilities. The transmission design assumes that the existing local supply facilities would support peak needs for participating utilities, with limited support for peak flows provided by the new facility.

The raw water pipeline material would be coated ductile iron. Alternative materials such as concrete, fiberglass, and high-density polyethylene could be considered during design. Ductile iron pipe is also assumed as the finished water pipeline material. Other pipeline materials including cement-lined reinforced concrete and PVC may be evaluated during preliminary design. The pipe lengths and sizes are presented in Tables 5-34 and 5-35 for the transmission system. Since the proposed pipe routes would most likely be located along county or state roads, consideration should be given to potential road upgrades in the future. In order to avoid future pipe relocation, easement along the pipeline corridors should be acquired. Easement width would be 30 feet for pipes 16 inches or larger and 20 feet for smaller pipes.

Table 5-34. Seawater Desalination Raw Water Transmission System.

Pipeline Size	Pipeline Length		Easement Area
inches	feet	miles	acres
42	19,708	3.7	13.6

Table 5-35. Seawater Desalination Finished Water Transmission System.

Pipeline Size	Pipeline Length		Easement Area
inches	feet	miles	acres
42	67,665	12.0	46.6
36	115,320	21.8	79.4
12	2,125	0.4	1.0
Totals:	**185,110**	**34.2**	**127.0**

1.6 Blending Water with Utility Distribution Systems

If finished water will not provide dedicated service, the differences in the water chemistry between treated groundwater and treated seawater present potential issues that must be considered by utilities in the planning process. This will require review of the treated seawater supply characteristics, existing groundwater supply of the end user, the construction materials of the distribution system, and disinfection and corrosion issues associated with blending potable water from different sources.

The primary issues with blending are water quality as it relates to the disinfectant residual, disinfectant bi-products formation and pipeline corrosion. Post-membrane water is highly aggressive and must be chemically stabilized prior to introduction into a transmission system. In addition, the choice of disinfectant will affect byproduct formation. Potable water standards must be met in the transmission system and meeting the disinfection and corrosion control needs in the desalination plant's transmission system would need to be addressed.

After treated water from one source mixes with that of another source, changes in distribution system water chemistry can affect the stability of pipe coatings and biofilms that protect pipes from corrosion. An increase in disinfection bi-products can also occur, either cumulatively or due to source interactions among multiple disinfectant types. The blending of groundwater and seawater must consider the combined water chemistry in the utility distribution system.

1.7 Cost Estimates

The configuration of the facility as proposed in the WRWSA's 2010 Plan was used to develop planning-level cost estimates. Although the methodology for cost estimation established in

CH2M Hill (2004) was kept as the basis of this estimate, actual plant and piping costs were used to update the previously presented costs. The following elements are included in the cost estimate:

- construction cost is the total amount expected to be paid to a qualified contractor to build the required facility;
- non-construction capital cost is an allowance for construction contingency, engineering design, permitting and administration for the facility;
- land cost is the market value of the land required for the facility;
- land acquisition cost is the estimated cost of acquiring land, exclusive of the land cost;
- operation and maintenance cost is the estimated annual cost of operating and maintaining the facility when operated at average day capacity;

- capital cost is the sum of construction cost, non-construction capital cost, land cost and land acquisition cost;
- unit production cost is the annual lifecycle cost of the facility divided by the annual water production rate;
- interest or discount rate is the time value of money criteria for the facility; and
- equivalent annual cost is the annual lifecycle cost of the facility based on service life and time value of money criteria.

Capital Cost Estimate - A summary of planning level capital costs for the seawater desalination project option is presented in Table 5-36. Costs are estimated for three waste concentrate disposal methods; deep well injection, ZLD technologies, and ocean disposal. The non-construction capital cost was applied at 47 percent of the construction cost. This includes a 22 percent allowance for construction contingency and a 25 percent allowance for engineering design, permitting and administration. Easement acquisition costs of $0.75 per square foot ($32,760/acre) are included in the capital cost. Land costs of $5,000/acre are included for the 10-acre footprint of the supply facility, plus 18 percent acquisition cost.

Operation and Maintenance Cost Estimate – Operation and maintenance includes labor, power, and chemical costs necessary for operation; and R&R for equipment maintenance and membrane replacement. Labor costs were based on an estimated workforce needed to operate the facility. Chemical costs were based on estimated usage and vendor quotes. Power costs were estimated based on current rates and equipment operation needs. R&R costs were based on a combination of annual needs and project lifecycle of 30 years. The operating costs for this desalination process are considerable due to high power consumption and periodic membrane replacements. Table 5-37 provides a summary of the O&M costs for the seawater desalination project option.

Unit Production Cost Estimates - Unit production cost is a function of the capital costs, debt service, annual O&M costs and the amount of water produced. For this analysis, the debt service is estimated based on a 30-year project lifecycle at 3.75 percent interest (2013 federal discount rate for water resource projects). Table 5-38 provides a summary of these costs for the seawater desalination project option utilizing three waste concentrate disposal methods; deep well injection, ZLD technologies, and ocean disposal.

1.8 Crystal River Power Station Site Conclusion

Since the completion of the WRWSA's 2010 Water Supply Plan, Duke Energy has significantly revised their plans for power generation at the Crystal River Power Station. Specifically, Unit 3 (nuclear unit) has been permanently retired and its associated once-through cooling water flow of 979.2 mgd is no longer in service. In addition, Units 1 and 2 are likely to be retired by the end of 2020, which will eliminate their once-through cooling water flows of 918.7 mgd. Therefore, by the year 2020, there will no longer be a reliable long-term cooling water outflow to provide dilution of concentrate for a future seawater desalination facility. Although there are other options for disposal of waste concentrate, these are much more technically complex and expensive. Without the ability to dilute the waste concentrate with cooling water, locating a seawater desalination facility at the power station has become significantly more problematic.

Table 5-36. Capital Costs of a 15 mgd Seawater Desalination Project Option Utilizing three Different Methods for Waste Concentrate Disposal.

Description	Total
Deep Well Injection for Waste Concentrate Disposal	
Raw water intake and pump station	$13,503,000
Raw water transmission	$7,385,000
Water treatment and storage facility	$56,526,000
Finished water transmission	$61,472,000
Land and easement acquisition	$5,390,000
Deep well injection Concentrate Disposal System	$6,612,000
Subtotal construction capital cost	$150,888,000
Non-construction capital cost (47%)	$70,916,000
TOTAL	**$221,804,000**
ZLD Technology for Waste Concentrate Disposal	
Raw water intake and pump station	$13,503,000
Raw water transmission	$7,385,000
Water treatment and storage facility	$56,526,000
Finished water transmission	$61,472,000
Land and easement acquisition	$5,390,000
ZLD Concentrate Disposal System	$86,684,000
Subtotal construction capital cost	$230,960,000
Non-construction capital cost (47%)	$108,551,000
TOTAL	**$339,511,000**
Ocean Outfall for Waste Concentrate Disposal	
Raw water intake and pump station	$13,503,000
Raw water transmission	$7,385,000
Water treatment and storage facility	$56,526,000
Finished water transmission	$61,472,000
Land and easement acquisition	$5,390,000
Ocean Outfall Concentrate Disposal System	$63,607,000
Subtotal construction capital cost	$207,883,000
Non-construction capital cost (47%)	$97,705,000
TOTAL	**$305,588,000**

Table 5-37. Operations and Maintenance Costs of a 15 mgd Seawater Desalination Project Option Utilizing three Different Methods for Waste Concentrate Disposal.

Description	Estimated Annual Costs
Deep Well Injection for Waste Concentrate Disposal	
Labor	$869,000
Chemicals	$2,735,000
Power	$10,248,000
Equipment Renewal & Replacement	$3,839,000
Transmission Renewal & Replacement	$326,000
Deep well injection Concentrate Disposal System	$667,000
TOTAL	**$18,684,000 per year**
ZLD Technology for Waste Concentrate Disposal	
Labor	$869,000
Chemicals	$2,735,000
Power	$10,248,000
Equipment Renewal & Replacement	$3,839,000
Transmission Renewal & Replacement	$326,000
ZLD Concentrate Disposal System	$25,450,000
TOTAL	**$43,467,000 per year**
Ocean Outfall for Waste Concentrate Disposal	
Labor	$869,000
Chemicals	$2,735,000
Power	$10,248,000
Equipment Renewal & Replacement	$3,839,000
Transmission Renewal & Replacement	$326,000
Ocean Outfall Concentrate Disposal System	$594,000
TOTAL	**$18,611,000 per year**

Table 5-38. Unit Production Cost Estimate of a 15 mgd Seawater Desalination Facility Utilizing Deep Well Injection for Concentrate Disposal.

Description	Total Cost
Deep Well Injection for Waste Concentrate Disposal	
Total capital cost	$221,804,000
Annual O&M cost	$18,684,000
Equivalent Annual Cost	$31,125,000
Unit production cost	**$5.68 per thousand gallons**
ZLD Technology for Waste Concentrate Disposal	
Total capital cost	$339,511,000
Annual O&M cost	$43,467,000
Equivalent Annual Cost	$62,509,000
Unit production cost	**$11.42 per thousand gallons**
Ocean Outfall for Waste Concentrate Disposal	
Total capital cost	$305,588,000
Annual O&M cost	**$18,611,000**
Equivalent Annual Cost	$35,751,000
Unit production cost	**$6.53 per thousand gallons**

[1]*The construction cost within the total capital cost includes a 22% contingency.*
[2] *30-year amortization at 3.75%.*

Part B.Development Priority for Water Sources and Project Options

This part of the Water Supply Plan outlines the priority of development of the water supply sources discussed in Chapter 4. It also provides a timeframe for when the water supply project options, discussed previously in this chapter, would be developed. The water sources include:

- water conservation;
- reclaimed water;
- groundwater;
- surface water (Withlacoochee and Ocklawaha rivers); and
- seawater desalination.

The priority for development is divided into three periods; near-term, mid-term, and long term. Near term is the ten-years that would encompass the first half of the 20-year planning period for this Water Supply Plan from 2015 through 2025. Mid-term is the second half of the planning period from 2025 through 2035. Long term is the period beyond the 2035 end of the planning period.

Section 1. Near-Term Period (2015-2025)

1.0 Water Conservation and Reclaimed Water

The water management districts will continue to actively encourage public supply utilities in the WRWSA four-county region to implement water conservation measures and develop reclaimed water project options to maximize the efficient use of their reclaimed water. This is especially important in light of the SWFWMD's requirement that a per capita water use of 150 gpd be achieved in its northern region by 2019. The districts will help public supply utilities achieve a higher level of conservation and reclaimed water use through technical assistance and financial incentives and through their regulatory programs. The WRWSA has implemented a grant program that since its inception in 1999-2000, has appropriated $1,454,631 to local government conservation projects in the region. A list of some of these projects is included in Table 5-39. The WRWSA should look for additional opportunities to partner with the districts and their member governments to expand and enhance this program.

Table 5-39. List of Water Conservation and Reclaimed Water Projects Co-Funded by the WRWSA.

Conservation Project Option	Cooperator	Project Duration	WRWSA Contribution
Water Conservation and Outreach Program	Citrus County Utilities	2002-2013	$282,300
Reclaimed Water Reuse Feasibility Study	City of Crystal River	2010	$8,000
Water Conservation and Water-Quality Protection Program	Hernando County	2003-2013	$498,783
Water Conservation Program	Marion County	2009-2013	$162,650
Xeriscape Demonstration Project	City of Ocala	2010	$8,000
Water Conserve 04	Sumter County	2005	$19,500
Regional Irrigation System Evaluation	SWFWMD	2011-2013	$196,100
UF Water Conservation Campaign	University of Florida	2002	$6,000
Total			**$1,181,033**

2.0 Lower Floridan Aquifer Evaluation and Enhancement of the Northern District Groundwater Model

The water management districts will continue their efforts to evaluate the water supply potential of the Lower Floridan aquifer through their exploratory well drilling and testing programs. The districts will use the data obtained from these programs to enhance the Northern District Model to more accurately evaluate the water supply potential of the Lower Floridan aquifer. The WRWSA partnered with the districts and Marion County to expand and enhance the Northern District Model, contributing $37,500 toward the effort in 2012/2013. The WRWSA should continue to encourage and support the Districts' efforts to evaluate the Lower Floridan aquifer and enhance the Northern District Model.

3.0 Development of Fresh Groundwater Supplies

The demand projections presented in Chapter 3 and the assessment of deficits of permitted quantities by utility service area in each county in Chapter 4, are used here to demonstrate that the groundwater project options presented in Chapter 5, Section 3, will need to be developed during the near-term period. The WRWSA should investigate opportunities to be involved in the development of these project options, as owner/operator of the facilities, as owner of the facilities with operation delegated to the utility, or by simply providing some level of support for the utility in its effort to develop the option. The WRWSA should also work with its member governments to begin planning for limited regional interconnection and sharing of groundwater systems.

3.1 Citrus County

Based on currently permitted groundwater quantities, there will be a number of deficits of permitted quantities as shown in Chapter 4, Section 3. The most significant include 2.08 mgd and 0.26 mgd for service areas of Citrus County Utilities in the north-central portion of the county. A portion of this demand can be met by the Charles A. Black Wellfield Expansion project option. Based on current use vs. permitted quantities, it is likely that this project option would be needed during the near-term period.

3.2 Marion County (SWFWMD)

Based on currently permitted groundwater quantities there will be a number of deficits of permitted quantities as shown in Chapter 4, Section 3. The Marion County Utilities deficit of 5.43 mgd can be met by the Marion Oaks Upper Floridan aquifer groundwater project option. Based on current use vs. permitted quantities, it is likely that this project option would be needed during the near-term period.

3.3 Marion County (SJRWMD)

Based on currently permitted groundwater quantities there will be a number of deficits of permitted quantities as shown in Chapter 4, Section 3. The Marion County Utilities deficit can be met by the Silver Springs Lower Floridan aquifer groundwater project option, assuming that testing and modeling show that the option would not cause exceedances of MFL waterbodies. Based on current use vs. permitted quantities, it is likely that this project option would be needed during the near-term period.

3.4 Sumter County

Based on currently permitted groundwater quantities there will be a deficit of permitted quantities for the City of Wildwood's service area of approximately 4.1 mgd, as shown in Chapter 4, Section 3. This demand can be met by the Lower Floridan aquifer groundwater project option. Based on current use vs. permitted quantities, it is likely that this project option would be needed during the near-term period.

Section 2. Mid-Term Period (2025-2035)

1.0 Water Conservation and Reclaimed Water

Similar to the near-term period, the water management districts will continue to actively encourage and support public supply utilities to implement water conservation and reclaimed water project options. The WRWSA should continue to expand and enhance its program of financial support for its member governments to develop water conservation options.

2.0 Lower Floridan Aquifer Evaluation and Enhancement of the Northern District Model

By the beginning of the mid-term period, it is probable that the water management districts will have increased their understanding of the water supply potential of the Lower Floridan aquifer. This will enhance their capability to determine to what degree and where in the region the aquifer will contribute to meeting projected water supply demands.

It is anticipated that the Lower Floridan aquifer will be increasingly used to meet demand in Sumter and Marion counties where it is most likely to contain potable water. The WRWSA could have a role in facilitating the development of the aquifer in these areas and in distributing the water between utilities.

Section 3. Long-Term Period (Beyond 2035)

1.0 Water Conservation and Reclaimed Water

Similar to the near- and mid-term term periods, encouraging public supply utilities to implement water conservation measures and to develop reclaimed water project options through their incentive and regulatory programs, will continue to be a priority of the water management districts. The WRWSA should continue to expand and enhance its program of financial support for its member governments to develop water conservation measures.

2.0 Development of Groundwater Supplies

As part of the development of Water Supply Plan updates during this period, the WRWSA should include a feasibility analysis of all aspects of brackish groundwater systems including facility locations, production quantities, infrastructure, concentrate disposal methods, costs and potential customers.

3.0 Withlacoochee and Ocklawaha Rivers

It is only when groundwater supplies from the Lower Floridan Aquifer are within a decade of becoming fully utilized that the development of supplies from the Withlacoochee River will begin to be considered. As explained previously, the current lack of understanding of the availability of groundwater from this aquifer makes it difficult to predict when this could occur but it may be between 2035 and 2040 when serious efforts begin to develop this source. The Ocklawaha River may developed much earlier due to implications of the adopted MFLs for Silver Springs/Silver River or since the river may be utilized to supply areas of the SJRWMD that are outside of the WRWSA four-county region.

4.0 Seawater Desalination

As explained previously in this chapter, the difficulty of disposing of the waste concentrate and the overall high cost of this project option make it unlikely that it will be seriously considered for implementation unless new technologies are developed that overcome these issues and all other less-costly sources have been utilized to their full extent.

Chapter 6. WRWSA Regional Water Supply Framework

This chapter explains how the WRWSA can lead the development of an integrated regional water supply system over the next several decades. The key issues include water supply infrastructure and the timing of its development, evolution of the necessary governance structure between the WRWSA and its member governments, and interactions with the water management districts in regard to funding and creating an environment conducive to the Authority's expansion to meet the needs of its member governments.

Part A. The Case for Regionalization of Water Supplies

Section 1. Introduction

One of the most important conclusions of this Water Supply Plan is that groundwater from the Upper Floridan aquifer, the sole source of supply that has historically met demands of all use categories in the WRWSA four-county region, may become increasingly limited in certain areas by the year 2035. Although the Lower Floridan aquifer has the potential to supply significant quantities of potable groundwater, the extent of its freshwater zone is limited to the eastern portions of the WRWSA region. The consequence of this is that some utilities will no longer have the luxury of simply drilling a well near their population centers to meet their demand.

It is this lack of readily accessible, low cost water that will provide the impetus for the regionalization of water supply facilities in the WRWSA region, just as it did for the counties that are part of Tampa Bay Water and the Peace River Manasota Regional Water Supply Authority in the central and southern portion of the SWFWMD and just as regional approaches have become a necessity in central Florida.

The concept of regionalization of water supply facilities in Florida continues to be encouraged at the state and regional level. The state of Florida has promoted regional water supply development by creating incentives through the "Water Protection and Sustainability Program," initiated with the passage of Senate Bills 360 and 444. The program provides funding for projects that are regional and collaborative and use alternative water supplies as source water. Although state funding has been lacking in recent years, renewed funding is expected in the future due to the Legislature's continued focus on water quality and water supply issues. The SWFWMD and SJRWMD also encourage regional planning and development among local governments in the development of water supply projects.

Section 2. Benefits of Regionalization

The advantages of joining with other local governments to address water supply issues is the opportunity to share common concerns and arrive at solutions that would not otherwise be possible for a single local government because of geographic, resource, or funding constraints. Education, information sharing, and focused research or data-gathering are other benefits of a collective, as opposed to an individual, approach to water supply issues. Having the opportunity to meet and discuss the concerns and positions of the various local governments is beneficial to all the parties. These discussions will lead to a better understanding between the members, thus making it easier to find mutually acceptable solutions to common problems and building trust between the members.

With funding priority given to regional projects by the districts, there is a clear opportunity to defray some of the costs of projects that involve more than one local government. Initially, smaller projects may be undertaken in order to gain experience working together. The WRWSA currently implements a water conservation grant program to assist local governments in improving water conservation efforts within the region, and funds residential irrigation audits to provide site-specific evaluation for optimizing the use of water through landscaping techniques and efficient irrigation systems. These efforts demonstrate that the WRWSA can provide effective assistance in meeting the future water needs of the region.

A major advantage to a regional approach to projects is the economy of scale. For example, it is unlikely that an individual local government in the WRWSA region could develop a water supply from the Withlacoochee River due to the high cost of such an option. However, the WRWSA could develop the water supply and transmission system in cooperation with the SWFWMD and the water could be wholesaled to any local governments needing additional supply. This would reduce the costs that individual governments would otherwise incur.

Additional advantages of regionalization of water supply facilities include:

- ability to take advantage of conjunctive use, where both groundwater and alternative sources are available and can be managed to mimic natural hydrologic cycles;
- helping to ensure that adequate water supplies are available to meet growing demands for member governments and participating water supply utilities;
- spreading the cost of developing alternative water supplies, such as the Lower Floridan aquifer or surface water projects and achieving economies of scale;
- providing for a diversity of water sources so that availability and reliability during droughts is increased; and
- increasing reliability of water delivery by providing emergency interconnects between utility systems.

Part B. Evolution of a Regional Water Supply System

The following section outlines a possible sequence of steps to achieve regionalization of water supply systems and what the WRWSA's involvement could be during near-term, mid-term, and long-term periods. The information for each of the three periods is divided into 1) water supply projects, 2) governance, and 3) interactions with water management districts.

Section 1. Near-Term Period (2015-2025)

Although the Upper Floridan aquifer appears to be capable of meeting the majority of demands through 2035 in the SWFWMD portion of the WRWSA region, the Lower Floridan aquifer will be increasingly developed, especially in Marion and Sumter counties where the aquifer is more likely to contain potable quality water.

In the SJRWMD portion of the WRWSA region, MFLs for Silver Springs/Silver River are currently being developed by the SJRWMD and will likely impact the availability of groundwater in the SJRWMD portion of the WRWSA region. Based on preliminary analyses, the current draft MFLs would not be met under 2035 projected demand. The SJRWMD is currently working on tools to assist in the development of a prevention/recovery strategy and the WRWSA could have a role in facilitating the development and transmission of alternative supplies in the area.

1.0 Water Supply Projects

The WRWSA's most significant regional water supply effort to date is its financial support to its member governments to enhance their water conservation efforts. This support has been especially important given the SWFWMD's 150 gallons per capita per day water use requirement that must be met by 2019. The WRWSA should continue this support and should look for ways to enhance and expand the program.

An early step in the process of regionalization would be for the WRWSA to investigate opportunities to be involved in the development of the four groundwater project options presented in Chapter 5, Section 3; the Charles A. Black Wellfield Expansion in Citrus County, two Wellfields in Marion County for Marion County Utilities, and a wellfield for the City of Wildwood Utilities in Sumter County. The WRWSA's role could include owning and operating the facilities or owning the facilities with operation delegated to the local utility.

Another important step would be to identify and support the development of small-scale interconnects between water supply systems. In Chapter 4, Section 3, deficits of permitted quantities were identified for a number of municipalities in the WRWSA region. There may be opportunities for some of these municipalities to be supplied by interconnects with other water supply systems. The following are a number of potential local-scale system interconnects that could be accomplished during the near-term period:

- interconnecting Citrus County Utilities with Yankeetown in Levy County - the WRWSA's expanded Charles A. Black Wellfield could provide the necessary water supply;
- interconnecting Citrus County Utilities with the City of Inverness - the WRWSA's expanded Charles A. Black Wellfield could provide the necessary water supply;
- interconnecting a future Champagne Farms Lower Floridan aquifer wellfield in northern Sumter County with Marion County Utilities - the WRWSA could potentially own and operate the wellfield; and
- interconnecting utilities in Marion County that will have water surpluses of permitted quantities with those that are projected to have deficits.

2.0 Governance

The WRWSA's governance structure was recently revised and is considered to be sufficient to continue supporting water conservation and to assist in the development of the small-scale water supply projects and interconnects discussed above. However, the WRWSA is in the process of negotiating a new agreement with Citrus County for the operation of the Charles A. Black Wellfield. The original agreement, which was executed in the early 1990s, has become outdated due to the rapid rate of expansion of the quantity of water supplied by the wellfield and it is recommended that it be renegotiated. In addition, the agreement would need to be renegotiated prior to implementing the proposed project option to increase the permitted quantities of the wellfield by over 2 mgd.

3.0 Water Management District Support

The SWFWMD's 2014-2018 Strategic Plan promotes regional approaches to water supply planning and development and outlines the benefits of regional systems. The Strategic Plan also states that the District is partnering with the WRWSA to promote regional water supply planning and development. Both the SJRWMD and SWFWMD give funding priority to multijurisdictional projects. This is in accordance with section 373.(8)(f)7, Florida Statutes, which provides that when the districts are selecting projects for financial assistance, "significant weight" is to be given to "whether the project will be implemented by a multijurisdictional water supply entity or regional water supply authority."

For the WRWSA to evolve into a truly regional entity that oversees and operates a system to supply water to the four-county region, the WRWSA's member governments should utilize the WRWSA as the entity that can foster the development of regional water sources and work with the WRWSA when developing projects to meet their future water supply needs.

Section 2. Mid-Term Period (2025-2035)

1.0 Water Supply Projects

By the beginning of the mid-term period, it is probable that the water management districts will have increased their understanding of the water supply potential of the Lower Floridan aquifer. This will enhance their capability to determine to what degree and where in the region the aquifer will contribute to meeting projected water supply demands.

It is anticipated that the Lower Floridan aquifer will be increasingly used to meet demand in Sumter and Marion counties where it is most likely to contain potable water. This may be especially true in eastern Marion County due to the Silver Springs/Ocklawaha MFLs. The WRWSA could have a role in facilitating the development of the aquifer in these areas and in distributing the water between utilities.

2.0 Governance

During the mid-term period, as the process to develop the first regional water supply projects is initiated, the WRWSA's governance structure would need to be evaluated to determine its suitability to oversee and operate a regional system. Issues that would need to be considered include membership and voting structure, ownership and funding of facilities and operations, authorization to hire staff to operate and maintain facilities and provide administrative and technical support, water rate structures, and a dispute resolution process. These issues are discussed in detail in Part B of this chapter. It is recommended that a revision of the governance structure be developed proactively to ensure that the appropriate measures are in place to avoid issues that have been experienced by other water supply authorities.

3.0 Water Management District Support

In the Tampa Bay area, following adoption of the Partnership Agreement and the creation of Tampa Bay Water in the late 1990s, the SWFWMD provided hundreds of millions of dollars in cost share funding to Tampa Bay Water to develop alternative water supply projects that included a seawater desalination facility, a surface water supply system with an off-stream reservoir, a regional water treatment facility, and a regional transmission system. The

SWFWMD also provided cost-share funding during the past decade to the Peace River Manasota Regional Water Supply Authority for expansion of its water treatment system and construction of an off-stream reservoir and it continues to fund a significant portion of the cost of the Authority's regional transmission system.

The SWFWMD provided these large amounts of funding to the water supply authorities for the express purpose of mitigating some of the negative environmental impacts that had resulted from the over development of fresh groundwater from the Upper Floridan aquifer. Within the WRWSA's four-county region, the water management districts have not yet found it necessary to adopt a prevention or recovery strategy for any of the currently adopted MFLs, unlike other parts of the state where such prevention and recovery strategies exist. The WRWSA members should request funding for regional water projects through the WRWSA to ensure continued compliance with established MFLs and to ensure that environmental impacts that occurred in other parts of the state due to withdrawals be avoided in the WRWSA area.

Section 3. Long-Term Period (Beyond 2035)

1.0 Water Supply Projects

It is during this period that new groundwater supplies from the Upper Floridan aquifer may become increasingly difficult to obtain in certain areas and as a result, groundwater development from the Lower Floridan aquifer will become even more important.

Figure 4-4 shows the estimated boundary of the freshwater producing zone of the Lower Floridan aquifer based on best available information to date. Because the freshwater zone is located well to the east of Citrus and Hernando counties, these counties will not have the ability to develop this aquifer as a freshwater supply. This may present an opportunity for the WRWSA to begin the planning for development of Lower Floridan aquifer groundwater systems in Sumter and Marion counties that would be interconnected with water utilities in Hernando and Citrus counties. During this period, the WRWSA could also lead or support an investigation to determine the potential of the Lower Floridan aquifer in Hernando and Citrus counties to supply small-scale brackish groundwater desalination facilities. If such systems proved to be feasible, the WRWSA could own and operate them.

As part of the planning for the interconnected systems discussed above, they would be designed with the objective of eventual incorporation into a larger regional transmission system that would be accessible to the large utilities in the WRWSA region. Such a system would be supplied by a diversity of sources including fresh and brackish groundwater and eventually surface water from the Withlacoochee River and possibly the Ocklawaha River.

During this period, the regional transmission system could begin to be developed. The first phase could be the interconnection of Lower Floridan aquifer groundwater systems in Sumter and Marion counties with water utilities in Hernando and Citrus counties and potential brackish groundwater desalination facilities supplied by the Lower Floridan aquifer in Hernando and Citrus counties.

The next phase could be the construction of a regional transmission system that would likely be constructed in phases over many years. It would be sized to meet the build-out demands of the municipalities that would be its customers.

The final step would be the construction of systems to use surface water from the Withlacoochee and Ocklawaha rivers and the ability to incorporate this supply into the regional system. The planning of facilities to use water from the Withlacoochee River would likely occur in the decade prior to full utilization of the Lower Floridan aquifer. The Ocklawaha River could be developed much sooner since it is a potential source for other portions of the SJRWMD.

2.0 Governance

By the beginning of the long-term period, a governance structure should be in place that will allow for the regional sharing of water supplies from a diverse set of water supply facilities. This will become a reality as each phase of the regional transmission system is completed.

3.0 Water Management District Support

During this period it will be crucial for the districts to provide cost-share funding to the WRWSA at levels similar to what has been provided to Tampa Bay Water and the Peace River Authority during the past 15 years. This funding will be necessary to develop the phases of the regional transmission system and surface water projects on the Withlacoochee and Ocklawaha Rivers.

Part C. Governance

An important consideration in deciding whether to create, modify, or join a regional water supply authority is to determine the resulting advantages and disadvantages that would inure to its members. The extent of the benefits or detriments to members is often directly related to the governance structure of the entity, which can and does vary widely under Florida law.

In addition to the WRWSA, there are two other water supply authorities within the SWFWMD; Tampa Bay Water and the Peace River Manasota Regional Water Supply Authority (Peace River Authority). The governance structure of these authorities may provide helpful contrasts to the WRWSA if and when it considers options for modifying its current governance structure.

Section 1. Governance Issues

As discussed above, it would be during the mid-term period, as the process to develop the first regional water supply projects is initiated, that the WRWSA's governance structure would need to be evaluated to determine its suitability to oversee and operate a regional system. Issues that would need to be considered include membership and voting structure, ownership and funding of facilities and operations, water rate structures, and a dispute resolution process. These issues are discussed in detail below.

1.0 Authorizing Mechanism

Water Supply Authorities are authorized pursuant to Sections 163.01 and 373.13, Florida Statutes, which provides broad powers to local governments who join together for the purpose of developing, recovering, storing and supplying water for county or municipal purposes. The local government members of the WRWSA, through the Revised and Restated Interlocal Agreement dated January 14, 2014, have authorized the full range of powers for the WRWSA that are provided for in Section 373.713. Unlike Tampa Bay Water, the WRWSA has no other specific statutory direction or limitations. (Compare, Section 373.715, Florida Statutes, relating to the West Coast Regional Water Supply Authority, predecessor to Tampa Bay Water).

Tampa Bay Water was created in 1998 through Interlocal and Partnerships Agreements executed by its six member governments (Hillsborough, Pasco and Pinellas counties, and the cities of New Port Richey, St. Petersburg and Tampa). The water supply authority was created as a means to end litigation between its member governments by creating new alternative water supply sources to dramatically decrease groundwater withdrawals. Although it existed as a water supply authority prior to 1998, it was substantially changed in 1998 to resolve the longstanding litigation over water withdrawals in the region. It is authorized by 373.715(2)(b), Florida Statutes, to develop, store and transport water; and to provide, sell, and deliver water for county or municipal purposes and uses. It is required by statute to design, construct, operate and maintain facilities in locations and at time necessary to ensure an adequate water supply is available to all citizens within its geographic territory.

The Peace River Authority was also created by an interlocal agreement executed pursuant to Section 163.01, Florida Statutes, and authorized pursuant to Section 373.313, Florida Statutes. It is currently operating pursuant to the Second Amended Interlocal Agreement dated October 5, 2005, executed by Charlotte, DeSoto, Manatee and Sarasota counties. The boundaries of the Peace River Authority are all of DeSoto, Manatee and Sarasota counties, and those parts of Charlotte County which are under the jurisdiction of the SWFWMD.

2.0 Membership and Voting Structure

The WRWSA Interlocal Agreement specifies the membership of the Authority to consist of 13 members: two representatives each from Citrus, Hernando, and Sumter counties, three representatives from Marion County, and one joint municipal representative from cities within each of the four counties. Representatives and alternates are designated by the respective member government and must be either a local government commission or council member, or a staff member of the respective local government. A quorum is declared when a majority of the counties have at least one member present, except that all counties must be represented by at least one county commissioner for purposes of approving the annual budget. Each governing board member has one vote, and a simple majority vote is required for all actions of the Authority. Although unstated in the Interlocal Agreement, the addition of new members or change to voting structure would require the agreement of all members of the Authority for the simple reason that one cannot amend an agreement without the consent of the parties to it unless that power is reserved within the original agreement.

Tampa Bay Water's board of directors consists of nine members, all of whom must be elected officials: two directors each from Hillsborough, Pasco and Pinellas counties and one director from each of the cities of New Port Richey, St. Petersburg and Tampa. Each director has one vote, and the affirmative vote of not less than five directors is needed to approve most actions. Six directors must vote, (1) to approve contracts with private or public entities to purchase or sell water, or for the operation or management of facilities owned or operated by Tampa Bay Water, (2) to assume ownership, operation or control of water supply facilities that may have a material adverse rate impact on the members, and (3) to sell or otherwise dispose of any Tampa Bay Water facilities.

Each of the four counties that comprise the Peace River Authority appoints one director to the Authority Board, who must be a member of the Board of County Commissioners. Alternate directors may also be appointed and need not be a member of the county commission. Each member has one vote, and there are no requirements for extraordinary votes except that admission of new members (and amendment of the Inter-local Agreement to reflect new members) must be by unanimous vote.

Although having a different number of voting members on a board or different quorum requirements are types of weighted voting, there are many other variations of weighted voting that may be considered. For example, a water supply authority may choose to specify certain actions that require an extraordinary vote, such as two-thirds or three-fourths of its voting members. This might be done for actions such as purchasing a water supply facility or incurring debt. In this regard, it is noted that state law requires approval of the electors in each county or municipality to be included with a levy of ad valorem taxes, not to exceed 0.5 mills, regardless of the voting mechanism of the authority (see, s. 373.713(2)(a), Florida Statutes).

Weighted voting variations also include:

2.1 Weighting Vote on Population of Local Government Represented

The WRWSA has implemented a type of weighted voting based on population by having a different number of representatives for the counties included within its membership. In addition, if the contributions to support the water supply authority are based in part on the population served, it may be reasonable to give more weight to members' votes from more populous areas. The drawback of this approach is that it could discourage participation from less populated areas, which could potentially minimize environmental gains from dispersing water supply facilities throughout a region.

2.2 Weighted Voting Based on Customers Served by Member Governments

Many local governments have a larger or smaller potable water customer base than they have residents. Since the wholesale cost of water sold by a water supply authority is ultimately passed along to consumers, it may be reasonable to give representatives of those customers more say in decisions of the authority.

2.3 Ownership and Funding of Facilities and Operations

The WRWSA developed and owns the Charles A. Black Water Supply Facility, which was constructed with a $4.7 million grant from the SWFWMD's Coastal and Withlacoochee River Basin Boards. The facility is operated and maintained by Citrus County under an agreement with the WRWSA that requires the County to purchase bulk water to pay back the cost of the facility over a 30 year period. Annual operations are supported by a 19 cent per capita assessment to each county, revenue from its contract with Citrus County, and carryover reserve funds.

Tampa Bay Water also received funding assistance from the SWFWMD to develop new water supply facilities and construct interconnections, but the bulk of the funding was raised through the sale of bonds backed by its member local governments. The primary source of revenue for Tampa Bay Water is the sale of water to its members. After investing nearly $1 billion in new infrastructure (transmission mains, surface water treatment plant, reservoir, and desalination facility) Tampa Bay Water members serve approximately 2.5 million people in the Tampa Bay region.

The Peace River Authority supplies an average of 25 mgd to its members. Water is skimmed from the Peace River and up to 48 mgd can be treated at a facility owned by the Authority, then injected into the Upper Floridan aquifer to be recovered later as needed. In 2005, the Peace River Authority signed a contract with its member counties and a non-member local government, the City of North Port, to share the costs for building and operating new or expanded water facilities to meet the region's projected water demands. Within the past decade, the Authority increased its water supply capacity by expanding its water treatment facility, constructing a large off-stream reservoir, and interconnecting the water supply facilities of the Authority, the member counties, and other governments. Additional bonds were issued to further fund the expansion program and the regional transmission system.

3.0 Water Rate Structure

The WRWSA's contract with Citrus County is undergoing review at this time. Since Citrus County did not have a customer base to establish payment by water use when the agreement was entered into, the current payment plan is based on an amortization schedule to repay the SWFWMD grant over 30 years.

Tampa Bay Water charges a "Uniform Rate" per 1,000 gallons to its member governments made up of a fixed cost and a variable cost component, with the exception of the rate charged to the City of Tampa for water supplied from the Tampa Bypass Canal. Each member's pro rata share of the estimate of fixed costs is adjusted based on the actual quantity of water delivered. In addition, there is an annual credit for debt service to amortize Tampa Bay Water's purchase of members' water supply facilities, as well as a credit for the actual direct costs of treatment.

The primary funding source for Peace River Authority is also water sales to its member governments. A population based contribution is imposed on its members to defray administrative expenses.

4.0 Dispute Resolution Process

The WRWSA Revised and Restated Interlocal Agreement does not contain specific dispute resolution processes, nor does the interlocal agreement for the Peace River Authority. Section 373.313, Florida Statutes relating to water supply authorities, is silent on the issue. However, providing for a dispute resolution process is specifically stated among the powers that may be exercised through an interlocal agreement authorized by Section 163.01, Florida Statutes. Specifically, Section 163.01(5)(p), indicates that the interlocal agreement may provide for the "adjudication of disputes or disagreements, the effects of failure of participating parties to pay their shares of the costs and expenses, and the rights of the other participants in such cases."

It is also noted that water supply authorities fall within the entities that are covered by the "Florida Governmental Conflict Resolution Act," Section 164.101, et seq, Florida Statutes. If invoked, this statute may require mediation efforts to be attempted prior to litigation, and specifically mentions the "allocation of resources, including water, land or other natural resources," as included within the types of conflicts that are subject to its provisions, Section 164.1051(4), Florida Statutes. Section 186.509, Florida Statutes, also provides for regional planning councils to establish dispute resolution processes that are available to local governments, and regional entities such as a water supply authority.

Tampa Bay Water's Amended and Restated Interlocal Agreement has specific dispute resolution provisions relating to permits. Members are provided with notice of the primary environmental permits, which may then be subject to binding arbitration proceedings. All other disputes are subject to mediation proceedings as a precondition to filing administrative or judicial proceedings.

Chapter 7. Conclusions and Recommendations

The following is a summary of the important conclusions in the report, followed by a series of recommendations to support and enhance the mission of the WRWSA.

Part A. Conclusions

Section 1. Water Demand Projections

1.0 Public Supply

Water demand for public supply utilities in the WRWSA four-county region will increase by approximately 40.9 mgd from 2010 through 2035. Table 7-1 shows the increases by county and by five-year increment.

Table 7-1. Public Water Supply Utility Demand Projections for the WRWSA Four-Country Region 2010-2035).

County	2010 Water Demand (mgd)	Projected Public Supply Demands (mgd)					Total Change in Demand	Percent Increase
		2015	2020	2025	2030	2035		
Citrus	14.7	15.2	16.6	17.8	18.9	20.0	5.3	36.0
Hernando	22.1	22.8	24.4	25.9	27.1	28.1	6.0	27.4
Mar. SWFWMD	11.2	12.3	14.7	16.9	19.6	22.2	11.0	98.2
Mar. SJRWMD	26.8	27.8	29.5	30.7	31.7	32.6	5.8	21.7
Sumter	20.1	24.6	28.5	29.8	31.3	32.9	12.8	53.7
TOTALS	**94.9**	**102.7**	**113.7**	**121.1**	**128.6**	**135.8**	**40.9**	**43.1**

2.0 All Use Categories

Water demand for all use categories in the WRWSA four-county region will increase by approximately 96.7 mgd from 2010 through 2035. Table 7-2 shows the increases by county and by five-year increment.

Section 2. Evaluation of Water Sources and Determination of Deficits/Surpluses

1.0 Evaluation of Demand Management Potential and Water Supply Sources

The potential for demand reduction and the quantity of water that is potentially available from all sources of water within the WRWSA's four-county region to meet water supply demands through 2035 was quantifed. Sources of water that were evaluated included reclaimed water, groundwater, surface water, and seawater desalination.

Table 7-2 . Water Demand Projections for all Use Categories in the WRWSA Four-County Region (2010-2035).

Water Use Type	2010 Base Demand (mgd)		WRWSA Total Incremental Change in Water Demand (mgd)												2035 Total Demand (mgd)	
			2015		2020		2025		2030		2035		Total Increase			
	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10	5-in-10	1-in-10
Agricultural	17.0	20.2	0.7	0.9	0.8	0.8	0.8	0.8	0.0	1.1	0.9	0.8	3.2	4.4	20.2	24.6
Domestic Self-Supply	31.0	32.8	7.2	7.7	6.5	7.0	6.8	7.3	7.0	7.5	6.8	7.2	34.3	36.7	65.3	69.5
Industrial and Commercial	17.7	17.7	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	1.5	1.6	4.8	4.8	22.5	22.6
Public Supply	94.9	100.5	7.8	8.3	11.0	11.7	7.4	7.8	7.5	8.0	7.2	7.6	40.9	43.3	135.8	143.8
Recreational	25.2	31.7	2.6	3.2	2.6	3.3	2.4	3.0	2.5	3.2	3.4	3.9	13.5	16.5	38.7	48.2
Total	**185.8**	**202.9**	**19.1**	**20.9**	**21.7**	**23.6**	**18.2**	**19.7**	**17.9**	**20.6**	**19.8**	**21.1**	**96.7**	**105.7**	**282.5**	**308.7**

1.1 Public Supply Water Conservation Potential

A comprehensive assessment of public supply water conservation potential in the WRWSA four-county region was conducted for the planning period by the University of Florida's Conserve Florida Water Clearinghouse (CFWC). The CFWC completed the analysis using the EZGuide Online water conservation tool, which is a web-based model designed to estimate conservation potential for public supply utilities. Three tiers of water conservation savings targets to achieve 5, 10, and 15 percent savings were developed. To achieve these levels of conservation, a series of BMPs, retrofit programs, and other water savings measures was developed. If the 5, 10, and 15 percent conservation targets were achieved by the year 2035, demand reductions of 6.3, 13.0, and 20.2 mgd, respectively could be achieved in the public supply category. It was decided to utilize the 10 percent savings tier that will be achieved by 2035 for the purposes of this Plan. This will result in a demand reduction by 2035 of 13.0 mgd.

1.2 Reclaimed Water Availability

An analysis of projected reclaimed water availability for the WRWSA region was performed to determine the quantities of reclaimed water that are currently available that have not yet been allocated to planned and funded projects and quantities that will become available by 2035 as the result of increasing population. For both the SWFWMD and SJRWMD portions of the WRWSA region, the reclaimed water that has been allocated to projects that are completed or under development was subtracted from the total quantity projected to be available in 2035. This is the quantity available for future projects in the WRWSA region. Of that quantity, 4.9 mgd of reclaimed water is not yet allocated to projects that are planned, completed, or under development.

1.3 Groundwater Availability

Developing an accurate estimate of the availability of groundwater for water supply is challenging due to the existence of major uncertainties that include the ongoing process to develop MFLs, which could significantly affect groundwater availability, and lack of data in portions of the region to assess the availability of groundwater in the Lower Floridan aquifer. The results of the modeling investigation presented above demonstrate that in the SWFWMD portion of the WRWSA region, 2035 demands for all use categories can be met with groundwater with no exceedances to springs and rivers for which MFLs have been proposed or adopted. However, this result was achieved by reducing demand through water conservation and mitigating aquifer drawdowns to some degree by recharge from the use of reclaimed water. The implication of this is that groundwater from the Upper Floridan aquifer may be limited in certain areas by 2035.

Based on this information, in the SWFWMD portion of the WRWSA region, additional quantities of groundwater available from the Upper Floridan aquifer were set equal to the projected 2035 increase in total water supply demand, which is approximately 76 mgd. Additional groundwater over and above this quantity will be available from the Upper and Lower Floridan aquifers in certain areas, however, an accurate estimate cannot be made at this time.

In the SJRWMD portion of the WRWSA region, MFLs for Silver Springs/Silver River are currently being developed by the SJRWMD and will likely impact resource availability. An analysis by SJRWMD staff indicates that the current draft MFLs would not be met under 2035 projected demands. Therefore the availability of groundwater from the Upper Floridan aquifer to meet projected demands was set equal to a range from zero to 21 mgd. Twenty-one mgd is the projected increase in total water supply demand in the SJRWMD portion of Marion County in the year 2035. While it is likely that some portion of this demand will be met by groundwater from the Upper Floridan aquifer, it is not possible to determine how much at this time. It must also be noted that groundwater from the Lower Floridan aquifer may be available to meet some portion of this demand.

1.4 Surface Water Availability

Withlacoochee River – Available flows are based on the SWFWMD's proposed minimum flows for the river which were developed at the Croom, Wysong, and Holder gages. The Holder gage is furthest downstream, and therefore, the available flow is greatest there; approximately 35.6 mgd on a median annual basis. Much larger quantities could be developed downstream at Lake Rousseau because of its location downstream of the very large inflow of the Rainbow River, fed by Rainbow Springs. The SWFWMD did not establish a minimum flow at this location so there is no estimate of flow potentially available for water supply. The quantities available at Holder will be used for the water supply potential of the Withlacoochee River, with the understanding that significantly larger quantities may be available once flow studies are completed at Lake Rousseau.

Ocklawaha River - The draft SJRWMD District Water Supply Plan states that preliminary estimates indicate that up to 30 mgd may be available from the river in the district's Planning Region 2 (which includes Marion County) depending on how much is withdrawn in the district's other planning regions. This estimate will be refined once MFLs are adopted for the river.

1.5 Potential Supply from Seawater Desalination

The quantity of water that could be available from desalinated seawater was set at 15 mgd. This estimate was developed for the WRWSA's 2010 Water Supply Plan and was based on a long-range forecast of the demands for utilities that could potentially be served by the facility. Although a larger quantity of water could theoretically be produced, the difficulty of disposing of the reject concentrate may make it infeasible even to produce 15 mgd.

1.6 Summary of Demand Reduction Potential and Water Supply Availability

Table 7-3 is a summary of the potential for demand reduction and the additional quantity of water that will potentially be available from all sources of water in each county in the WRWSA region. The table shows that the total quantity available ranges from 174.8 to 195.5 mgd. This is considered a conservative estimate because of the potential for additional fresh and brackish groundwater from the Lower Floridan aquifer and much higher quantities available from the Withlacoochee River if a water supply facility were constructed below the confluence of the Withlacoochee and Rainbow Rivers.

Table 7-3. Demand Reduction Potential and Future Water Availability from all Sources in the WRWSA Four-County Region (mgd).

County	Water Conservation[1]	Reclaimed Water	Groundwater (Upper Floridan Aquifer)		Surface Water		Seawater Desalination[5]	Total
			SW	SJ[2]	Withlacoochee[3]	Ocklawaha[4]		
Citrus	2.8	1.3	10.7	-	17.8		15.0	47.6
Hernando	4.9	1.2	17.2	-				23.3
Marion	3.0	2.3	18.1	0 to 20.7		30		53.4 to 74.1
Sumter	2.3	0.1	30.3		17.8			50.5
Total	**13.0**	**4.9**	**76.3**	**0 to 20.7**	**35.6**	**30**	**15.0**	**174.8 to 195.5**

[1]Potential for demand reduction based on 10 percent conservation savings through 2035 as calculated by the EZGuide model.
[2]The range of potentially available groundwater for the SJRWMD portion of Marion County is due to the uncertainty of how the MFL for Silver Spring/Silver River will affect the availability of groundwater in the Upper Floridan aquifer.
[3]This quantity is the median flow based on SWFWMD's proposed minimum flow at Holder and is evenly divided between Citrus and Sumter in this table because the river separates the counties. It is likely that much larger quantities could be available downstream at Lake Rouseau. A water supply facility could also be constructed on the Withlacoochee River in Hernando County. The table could be altered to reflect a significant quantity available from the river in Hernando, which would result in a reduction in quantities available from the river in Citrus and Sumter counties.
[4]Estimated annual average taken from the draft SJRWMD DWSP. This quantity will be modified upon adoption of MFLs for the river.
[5]This quantity is proposed for a seawater desalination facility at the Crystal River Power Station. Additional quantities are not proposed due to uncertainties with disposal of reject concentrate and the lack of other suitable sites for desalination facilities along the coast of Hernando and Citrus counties.

The projected increase in demand for the planning period for all use categories in the WRWSA region was compared to potentially available supplies. The projected additional water demand in the region for all use categories for the 2010-2035 period is approximately 96.7 mgd.

Table 7-3 shows that the potential of demand management and all other sources to meet demand beyond 2035, even at the low end of the range, is much greater than the projected 2035 demand. What is not included in the table is the potential of the Lower Floridan aquifer to produce additional quantities of fresh and brackish groundwater that could be significant. The water management districts intend to continue their programs to develop the data necessary to accurately assess the water supply potential of the Lower Floridan aquifer during the next decade.

Based on this information, it is concluded that the availability of water supplies, in conjunction with comprehensive demand reduction strategies, is sufficient to meet demands for all use categories at least through 2035 and probably well into the future beyond 2035.

Section 3. Water Supply Project Options

1.0 Water Conservation

The EZGuide water conservation model was used to determine which best management practices and other water conservation measures could be used to accomplish three tiers of water conservation savings targets (5 percent, 10 percent and 15 percent reductions). The EZ

Guide model then estimated the cost of implementation for each utility to meet these targets. On average, the costs to meet the conservation targets will range from $1.03 for a 15 percent reduction to $0.81 per thousand gallons for a 5 percent reduction.

2.0 Reclaimed Water

A list of 17 reclaimed water project options was developed with input from utilities and other interested parties. Capital costs ranged from $250,000 to $6.230,000 and costs/1000 gallons ranged from $0.13 to $1.56.

3.0 Groundwater

Working in close cooperation with Citrus and Marion county utilities and the City of Wildwood Utility, four groundwater supply project options were identified and their feasibility investigated as part of the development of this Water Supply Plan update. These include:

- Option 1 – Increasing the production of the Charles A. Black wellfield in central Citrus County;
- Option 2 - Lower Floridan aquifer well in Sumter County in the City of Wildwood's southern wellfield;
- Option 3 – Upper Floridan aquifer well and treatment plant in the Marion Oaks area of southwest-central Marion County; and
- Option 4 - Lower Floridan aquifer well and treatment plant near Silver Springs in southeast-central Marion County.

It is likely that all four of these options will need to be implemented within the next 10 years. Table 7-4 shows the estimated costs of the options.

4.0 Brackish Groundwater Desalination

The potential of the Lower Floridan aquifer to produce mineralized or brackish groundwater for desalination should be evaluated. The desalination of brackish groundwater for water supply is a common practice in the southern coastal portions of the SWFWMD and is becoming increasingly cost effective as the technology improves. It has the potential to become a major source of supply in certain portions of the WRWSA region when freshwater supplies from the Upper Floridan aquifer become limited in certain areas.

5.0 Surface Water

Three surface water project options were developed for the Withlacoochee River. Costs of the options are shown in Table 7-5. It should be noted that the combined capacity of the three facilities does not represent the quantity of water that could be developed from the river. The most likely scenario is that only one of the facilities will eventually be constructed.

6.0 Seawater Desalination

Cost estimates were developed for a seawater desalination project option with a capacity of 15 mgd at the Crystal River Power Station in northern Citrus County using three different methods of waste concentrate disposal. Table 7-6 is a summary of the cost estimates.

Table 7-4. Summary of the Cost Estimates for Groundwater Project Options.

Description	Total Cost
Expansion of Charles A. Black Wellfield[1]	
Total Capital Cost	N/A
Annual O&M Cost	N/A
Equivalent Annual Cost	N/A
Unit Production Cost	N/A
City of Wildwood Lower Floridan Aquifer Wellfield (4.1 mgd)	
Total Capital Cost	$6,667,680
Annual O&M Cost	$758,000
Equivalent Annual Cost	$1,128,548
Unit Production Cost	**$0.52/1,000 gallons**
Marion County Utilities Marion Oaks Upper Floridan Aquifer Wellfield (5.4 mgd)	
Total Capital Cost	$7,802,160
Annual O&M Cost	$758,000
Equivalent Annual Cost	$1,191,596
Unit Production Cost	**$0.36/1,000 gallons**
Marion County Lower Floridan Aquifer Wellfield Near Silver Springs (8.2 mgd)	
Total Capital Cost	**$7,867,120**
Annual O&M Cost	**$758,000**
Equivalent Annual Cost	$1,360,807
Unit Production Cost	**$0.40/1,000 gallons**

[1]*Charles A. Black option only requires a permit increase with no infrastructure requirements.*

Table 7-5. Summary of the Cost Estimates for Withlacoochee River Surface Water Project Options.

Description	Total Cost
North Sumter (10 mgd)	
Total Capital Cost	$103, 164,000
Annual O&M Cost	$4,500,000
Equivalent Annual Cost	**$10,300,000**
Unit Production Cost	**$2.82/1,000 gallons**
Holder with Reservoir (25 mgd)	
Total Capital Cost	$406,409,000
Annual O&M cost	$11,250,000
Equivalent Annual Cost	**$34,100,000**
Unit Production Cost	**$3.74/1,000 gallons**
Lake Rousseau (25 mgd)	
Total Capital Cost	$306,500,000
Annual O&M Cost	$11,300,000
Equivalent Annual Cost	**$28,500,000**
Unit Production Cost	**$3.12/1,000 gallons**

Table 7-6. Summary of the Cost Estimates for a 15 mgd Seawater Desalination Facility

Description	*Total Cost*
Deep Well Injection for Waste Concentrate Disposal	
Total Capital Cost	*$221,804,000*
Annual O&M Cost	*$18,684,000*
Equivalent Annual Cost	***$31,125,000***
Unit Production Cost	***$5.68/1,000 gallons***
ZLD Technology for Waste Concentrate Disposal	
Total Capital Cost	*$339,511,000*
Annual O&M Cost	*$43,467,000*
Equivalent Annual Cost	***$62,509,000***
Unit Production Cost	***$11.42/1,000 gallons***
Ocean Outfall for Waste Concentrate Disposal	
Total Capital Cost	*$305,588,000*
Annual O&M Cost	*$18,611,000*
Equivalent Annual Cost	***$35,751,000***
Unit Production Cost	***$6.53/1,000 gallons***

Section 4. Regionalization of Water Supplies

1.0 Benefits

The advantages of joining with other local governments to address water supply issues is the opportunity to share common concerns and arrive at solutions that would not otherwise be possible for a single local government because of geographic, resource, or funding constraints. Education, information sharing, and focused research or data-gathering are other benefits of a collective, as opposed to an individual, approach to water supply issues. Having the opportunity to meet and discuss the concerns and positions of the various local governments is beneficial to all the parties. These discussions will lead to a better understanding between the members, thus making it easier to find mutually acceptable solutions to common problems and building trust between the members.

A major advantage to a regional approach to projects is the economy of scale. For example, it is unlikely that an individual local government in the four-county region could develop a water supply from the Withlacoochee River due to the high cost of such an option. However, the WRWSA could develop the water supply and transmission system in cooperation with the SWFWMD and the water could be wholesaled to any local governments needing additional supply. This would reduce the costs that individual governments would otherwise incur.

Additional advantages of regionalization of water supply facilities include:

- ability to take advantage of conjunctive use, wherein both groundwater and alternative sources are available and can be managed to mimic natural hydrologic cycles;
- helping to ensure that adequate water supplies are available to meet growing demands for member governments and participating water supply utilities;
- spreading the cost of developing alternative water supplies, such as the lower Floridan aquifer or surface water projects to achieving economies of scale;
- providing for a diversity of water sources so that availability and reliability during droughts is increased; and
- increasing reliability of water delivery by providing emergency interconnects between utility systems.

Part B.Recommendations

Section 1. Water Conservation

1.0 Regional Water Conservation Program

The WRWSA should continue to assess and modify as appropriate its Regional Water Conservation Program and the projects funded through its grant program to ensure the programs address those conservation activities where the greatest, most cost effective savings can be achieved. These programs assist local governments in improving water conservation within the region to extend the use of groundwater as long as possible. The water conservation activities co-funded by the grant program will help participating utilities meet and sustain the maximum 150 gallons per person per day that is required by the SWFWMD to be achieved no later than 2019. The program should target those utilities that currently exceed the 150 gallons per person per day standard by the greatest margin.

2.0 Reducing Outdoor Irrigation

The WRWSA should work with its member governments to address single family residential outdoor water use, which currently accounts for an average of 33 percent of total public supply water use. In some of the larger utility service areas, between 35 percent and 60 percent of water use is for lawn and landscape irrigation. Converting to drought tolerant landscaping, practicing onsite rainwater harvesting, equipping irrigation systems with soil moisture sensors and ET controllers, and partially or fully replacing highly maintained lawns with more natural landscapes, could greatly reduce or eliminate the need for irrigation at single family residences, potentially saving a significant percentage of the 33 mgd of potable water used for outdoor purposes in the WRWSA region. These savings can directly assist utilities with meeting the projected demands with their current permitted quantities. The WRWSA's Regional Irrigation Audit and Education Project is an excellent example of the type of project that will further this initiative. This project provides an opportunity for single-family residents in certain areas to obtain site-specific irrigation evaluations for optimizing the outdoor residential use of water through Florida-friendly™ landscaping techniques, appropriate rainy season/dry season scheduling, and efficient irrigation application systems.

3.0 EZ Guide Water Conservation Model

The WRWSA should continue to work with the University of Florida's Conserve Florida Water Clearinghouse to refine, enhance, and expand the use of the EZGuide Online water conservation model for determining the potential for public supply water conservation. This could be accomplished in the following ways:

- promote the use of the model in other water supply planning efforts, particularly in the SWFWMD and SJRWMD to ensure consistency;
- modify the model to make it more user friendly and to make the results easier to understand by non-technical staff and decision makers;
- work with member government utilities to use the model for further water conservation planning; and
- work with the water management districts to monitor the implementation of these recommendations.

Section 2. Regional Groundwater Assessment

The WRWSA should continue to actively support efforts to determine the availability of groundwater for water supply. Critical areas for support are listed below.

1.0 Refinement of the Northern District Regional Groundwater Flow Model.

The WRWSA has provided funding to assist the SWFWMD and SJRWMD in the expansion and enhancement of the Northern District Groundwater Flow Model. This has enabled the groundwater system of the entire WRWSA four-county region to be evaluated with a single model. The WRWSA should continue to support the efforts of the districts to refine and enhance the capabilities of this model, especially in regard to its ability to accurately simulate the Lower Floridan aquifer.

2.0 Evaluation of the Water Supply Potential of the Lower Floridan Aquifer

The WRWSA should actively support the efforts of the water management districts to evaluate the water supply potential of the Lower Floridan aquifer through their exploratory well drilling and testing programs. The districts will use the data obtained from these programs to enhance the Northern District Model to more accurately evaluate the water supply potential of the Lower Floridan aquifer. The WRWSA should encourage the districts to not only evaluate the potential of the aquifer to produce additional freshwater, but at some point in the future, as resources become available, focus on the portions of the aquifer that contain more mineralized or brackish groundwater. The desalination of brackish groundwater for water supply is a common practice in the southern coastal portions of the SWFWMD and is becoming increasingly cost effective as the technology improves. It has the potential to become a major source of supply in certain portions of the WRWSA region when freshwater supplies from the Upper Floridan aquifer are no longer available.

Section 3. Minimum Flows and Levels

1.0 Active Role in the MFL Establishment Process

The WRWSA should closely monitor and participate in SWFWMD's and SJRWMD's MFL establishment process. MFLs will determine the limitations on the ground- and surface water resources that the WRWSA and its member governments need to develop for water supply. It is therefore of critical importance that proposed MFLs be based on sound science that allows for a balance between environmental protection and water supply development. The WRWSA should consider contracting with independent experts to review proposed MFLs and provide advisement on how the MFLs will affect the ability of the WRWSA and its member governments to develop water supplies. With this information, the WRWSA can be better prepared to participate in the process and advocate for its interests.

Section 4. Springs Restoration and Protection

1.0 Ensure the Compatibility of WRWSA Water Supply Projects with Springs Protection Efforts

Some of the largest springs in the world are located in the WRWSA four-county region. There is currently a great deal of momentum at the water management districts, FDEP, and legislative levels to fund programs to protect and enhance spring flow and water quality. The WRWSA should ensure that all conservation and water supply projects for which it provides support and funding are compatible with the goal of improving the health of springs in the WRWSA four-county region.

Section 5. Water Supply Project Options

1.0 Fresh Groundwater

Four groundwater supply project options were identified and their feasibility investigated as part of the development of this Water Supply Plan update. It is likely that all four of these options or similar options will need to be implemented within the next 10 years. The WRWSA should support the development of these project options by offering to undertake the projects for the member governments and by providing grant funding and advocacy for cooperative funding from the water management districts.

2.0 Brackish Groundwater

In addition to quantifying the potential of the Lower Floridan aquifer to produce freshwater, the WRWSA should encourage the water management districts to evaluate the potential of the Lower Floridan aquifer to provide brackish groundwater for desalination. The desalination of brackish groundwater for water supply is a common practice in the southern coastal portions of the SWFWMD and is becoming increasingly cost effective as the technology is improves. It has the potential to become a major source of supply in certain portions of the WRWSA region when freshwater supplies from the Upper Floridan aquifer are no longer available.

3.0 Surface Water

The WRWSA should continue to work with the SWFWMD to update feasibility assessments of using the Withlacoochee River for water supply, especially at the Lake Rousseau location where the potential water supply quantities are very large.

The WRWSA should also continue to monitor the efforts of the SJRWMD to quantify the water supply potential of the Ocklawaha River and encourage the district to assess the feasibility of water supply project options that could supply the WRWSA region.

4.0 Seawater Desalination

Due to the closure of the nuclear and coal-fired power generation units at the Crystal River Power Station, the once-through cooling water flow associated with the units will no longer be available to provide dilution of concentrate for a future seawater desalination facility. Although there are other options for disposal of waste concentrate, these are much more technically complex and expensive. In addition, there are no other viable locations for seawater desalination facilities in the coastal portions of Hernando and Citrus counties. As a result, the WRWSA in future water supply planning efforts should de-emphasize the investigation of seawater desalination as a future water supply source.

Section 6. Water Supply Planning

1.0 Monitor and Engage in the Water Supply Planning Process

Continue to monitor and engage where appropriate in the water supply planning processes conducted by other organizations which are within or adjacent to the WRWSA region, including the SJRWMD, SWFWMD, SRWMD and Tampa Bay Water. This includes the Central Florida

Water Initiative being conducted by the FDEP, SWFWMD, SJRWMD, SFWMD, Florida Department of Agriculture and Consumer Services (FDACS) and local governments. These water supply planning and development activities can have direct or indirect implications on water supply availability within the WRWSA region.

Section 7. Statewide Water Policy and Rule Development

1.0 Coordination

Coordinate with FDEP, SJRWMD, SWFWMD and the FDACS on policy and rule development. Provide assistance to WRWSA member governments on FDEP and water management district rule development that may include water use permitting, environmental resource permitting, water conservation and future water supply development, including the statewide consistency initiatives. Monitor water management program and rule development in other parts of the state, including the Central Florida Water Initiative, for implications to the WRWSA and its member governments.

Section 8. Regionalization of Water Supply Projects

1.0 Promotion of Regionalization

Promote the regionalization of water supplies through coordination with member governments to facilitate regional and sub-regional cooperation on water supply development.

2.0 Define Strategic Priorities

Work with the SWFWMDand SJRWMD in defining strategic priorities for the WRWSA four-county region and how these criteria may influence the ranking criteria for the district's Cooperative Funding Initiative, including potential district funding for regional and sub-regional water supply development.

3.0 Foster Support Among Member Governments

The WRWSA is the preferred entity to foster the development of regional water sources, and local governments should work with the WRWSA when developing projects to meet their future water supply needs. Water management district cost share funding places the highest priority on regional projects or projects developed through partnerships with water supply authorities.

4.0 Enhance Governance as Necessary

Near-Term (2015-2025) - The WRWSA's governance structure was recently revised and is considered to be sufficient to continue its support for water conservation and to assist in the development of the small-scale water supply projects and interconnects. However, the WRWSA is in the process of negotiating a new agreement with Citrus County for the operation of the Charles A. Black Wellfield. The original agreement, which was executed in the early 1990s, has become outdated due to the rapid rate of expansion of the quantity of water supplied by the wellfield and it is recommended that it be renegotiated. In addition, the agreement would need to be renegotiated prior to implementing the proposed project option to increase the permitted quantities of the wellfield by over 2 mgd.

Mid-Term (2025-2035) - As the process to develop the first regional water supply projects is initiated during this period, the WRWSA's governance structure will need to be evaluated to determine its suitability to oversee and operate a regional system. Issues that would need to be considered include membership and voting structure, ownership and funding of facilities and operations, authorization to hire staff to operate and maintain facilities and provide administrative and technical support, water rate structures, and a dispute resolution process. It is recommended that a revision of the governance structure be developed proactively to ensure that the appropriate measures are in place to avoid issues that have been experienced by other water supply authorities.

Long-Term (Beyond 2035) - By the beginning of the long-term period, a governance structure should be in place that will allow for the regional sharing of water supplies from a diverse set of water supply facilities. This will become a reality as each phase of the regional transmission system is completed.

5.0 Water Management District Support

Near-Term (2015-2025) - The SWFWMD's 2014-2018 Strategic Plan promotes regional approaches to water supply planning and development and outlines the benefits of regional systems and states that the District is partnering with the WRWSA to promote regional water supply planning and development. In addition, SWFWMD's policy guidelines for cooperative funding place a "highest priority" for alternative water supply projects that are owned, operated and controlled, or perpetually controlled by regional water supply authorities. This policy is intended to incentivize partnerships between local governments and water supply authorities for developing water supply projects.

For the WRWSA to evolve into a truly regional entity that oversees and operates a system to supply water to the four-county region, member governments should utilize the WRWSA as the entity that can foster the development of regional water sources and work with the WRWSA when developing projects to meet their future water supply needs.

Mid-Term (2025-2035) - In the Tampa Bay area, following adoption of the Partnership Agreement and the creation of Tampa Bay Water in the late 1990s, the SWFWMD provided hundreds of millions of dollars in cost share funding to Tampa Bay Water to develop alternative water supply projects. The SWFWMD also provided cost-share funding during the past decade to the Peace River Manasota Regional Water Supply Authority. The SWFWMD provided such large amounts of funding to these Authorities for the express purpose of mitigating some of the negative environmental impacts that had resulted from the over development of fresh groundwater from the Upper Floridan aquifer. Within the WRWSA's four-county region, the water management districts have not yet found it necessary to adopt a prevention or recovery strategy for any of the currently adopted MFLs, unlike other parts of the state where such prevention and recovery strategies exist. The WRWSA members should request funding for regional water projects through the WRWSA to ensure continued compliance with established MFLs and that the environmental impacts that occurred in other parts of the state due to withdrawals will be avoided in the WRWSA area.

Long-Term (Beyond 2035) - During this period the WRWSA should request cost share funding at levels proportionate to what has been provided to Tampa Bay Water and the Peace River Authority during the past 15 years. This funding will be necessary to develop the phases of the regional transmission system and surface water projects on the Withlacoochee and Ocklawaha rivers.

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Appendices

Appendix 4-1 – Water Conservation Analysis for Withlacoochee Regional Water Supply Authority (access at www.wrwsa.org)

Appendix 4-2 – Additional Groundwater Modeling Information (access at www.wrwsa.org)