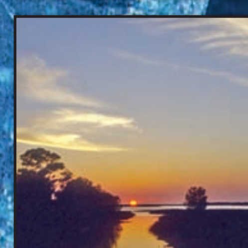
# 2010
# Regional Water Supply Plan
## Northern Planning Region

Southwest Florida
*Water Management District*

# The 2010 Update of the

# Regional Water Supply Plan

## Board Approved
## July 2011

*This document was prepared by the Planning Department with contributions from the Resource Projects, Communications and Finance Departments, and with assistance from Cardno ENTRIX.*

Cardno ENTRIX
Shaping the Future

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## Abbreviations

| | |
|---|---|
| AMO | Atlantic Multi-decadal Oscillation |
| APT | Aquifer Performance Test |
| AR | Aquifer Recharge |
| ARR | Aquifer Recharge and Recovery |
| ASR | Aquifer Storage and Recovery |
| AWT | Advanced Wastewater Treatment |
| BEBR | Bureau of Economic and Business Research |
| BLS | Below Land Surface |
| BMP | Best Management Practices |
| CCI | Construction Cost Index |
| CFCA | Central Florida Coordination Area |
| CFI | Cooperative Funding Initiative |
| CFRSF | Celery Field Regional Storage Facility |
| CFS | Cubic Feet per Second |
| CWCFGWB | Central West-Central Florida Groundwater Basin |
| CWM | Comprehensive Watershed Management Initiative |
| DACS | Department of Agriculture and Consumer Services |
| DOH | Department of Health |
| ENR | Engineering News Record |
| EPA | U.S. Environmental Protection Agency |
| EQIP | Environmental Quality Incentive Program |
| ESWS2 | Enhanced Surface Water System 2 |
| ET | Evapotranspiration |
| ETB | Eastern Tampa Bay |
| F.A.C. | Florida Administrative Code |
| FARMS | Facilitating Agricultural Resource Management Systems |
| FASS | Florida Agricultural Statistics Service |
| FDACS | Florida Department of Agriculture and Consumer Services |
| FDEP | Florida Department of Environmental Protection |
| FFA | Florida Forever Act |
| FIPR | Florida Institute of Phosphate Research |
| FPC | Florida Power Corporation |
| FPL | Florida Power and Light |
| F.S. | Florida Statutes |
| FY | Fiscal Year |
| GIS | Geographic Information System |
| GPCD | Gallons per Capita per Day |
| GPD | Gallons per Day |
| GPDPH | Gallons per Day per Hole |
| GPF | Gallons per Flush |
| GPM | Gallons per Minute |
| HFCAWTP | Howard F. Curren Advanced Wastewater Treatment Plant |
| HR | Highlands Ridge |
| HWA | Heartland Water Alliance |
| I & I | Inflow and Infiltration |
| IAS | Intermediate Aquifer System |
| IC | Industrial, Commercial |

| | |
|---|---|
| ICI | Industrial, Commercial and Institutional |
| IFAS | Institute of Food and Agricultural Sciences |
| IRMWSP | Integrated Regional Master Water Supply Plan |
| LFA | Lower Floridan Aquifer |
| LTPRG | Local Technical Peer Review Group |
| LWPIP | Lowest Wetted Perimeter Inflection Point |
| MARS | Manatee Agricultural Reuse Supply |
| M/D | Mining/Dewatering |
| MFL | Minimum Flow and Level |
| MGD | Million Gallons per Day |
| MG/L | Milligrams per Liter |
| MIA | Most Impacted Area |
| NGF | National Golf Foundation |
| NGVD | National Geodetic Vertical Datum |
| NPDES | National Pollution Discharge Elimination System |
| NRCS | Natural Resources Conservation Service |
| NTB | Northern Tampa Bay |
| NWSI | New Water Sources Initiative |
| O&M | Operation and Maintenance |
| OFW | Outstanding Florida Water |
| OPPAGA | Office of Program Policy Analysis & Governmental Accountability |
| PAC | Powdered Activated Carbon |
| PCU | Polk County Utilities |
| PG | Power Generation |
| PRMRWSA | Peace River Manasota Regional Water Supply Authority |
| PSI | Pounds per Square Inch |
| QWIP | Quality of Water Improvement Program |
| REDI | Rural Economic Development Initiative |
| RFP | Request for Proposal |
| RO | Reverse Osmosis |
| ROMP | Regional Observation Monitoring Program |
| RTS | Regional Transmission System |
| RWSP | Regional Water Supply Plan |
| SA | Surficial Aquifer |
| SCADA | Supervisory Control and Data Acquisition |
| SPJC | Shell, Prairie and Joshua Creek |
| SWCFGWB | Southern West-Central Florida Groundwater Basin |
| SWFWMD | Southwest Florida Water Management District |
| SWTP | Surface Water Treatment Plant |
| SWUCA | Southern Water Use Caution Area |
| TBC | Tampa Bypass Canal |
| TBW | Tampa Bay Water |
| TDS | Total Dissolved Solids |
| TECO | Tampa Electric Company |
| TMDL | Total Maximum Daily Loads |
| TRSIS | Tailwater Recovery and Seepage-Water Interception System |
| UFA | Upper Floridan Aquifer |
| UG/L | Micrograms per Liter |
| ULF | Ultra Low-Flow |
| ULFT | Ultra Low-Flow Toilet |

| | |
|---|---|
| USDA | U.S. Department of Agriculture |
| USF | University of South Florida |
| USGS | United States Geological Survey |
| WEIS | Water-Efficient Landscape and Irrigation System Rebates |
| WMD | Water Management District |
| WMIS | Water Management Information System |
| WPA | Water Planning Alliance |
| WRAP | Water Resource Assessment Project or Water Restoration Action Plan |
| WSRD | Water Supply and Resource Development Program |
| WUCA | Water Use Caution Areas |
| WUP | Water Use Permit |
| WWTF | Wastewater Treatment Facility |
| WWTP | Wastewater Treatment Plant |
| ZLD | Zero Liquid Discharge |

Southwest Florida Water Management District

# Chapter 1: Introduction

*The Green Swamp is the source of the Withlacoochee River; the largest river in the planning region.*

The Regional Water Supply Plan (RWSP) for the Southwest Florida Water Management District (District) is an assessment of projected water demands and potential sources of water to meet these demands for the period from 2005 through 2030. The RWSP has been prepared in accordance with the Florida Department of Environmental Protection's (FDEP) 2009 Format and Guidelines for Regional Water Supply Planning. The RWSP consists of four geographically based volumes that correspond to the District's four designated water supply planning regions: Northern, Tampa Bay, Southern and Heartland (Figure 1-1). This volume is for the Northern Planning Region, which includes Hernando, Citrus and Sumter counties and the portions of Lake, Levy and Marion counties within the District. The purpose of the RWSP is to provide the framework for future water management decisions in the District. The RWSP for the Northern Planning Region shows that demand for water through 2030 can be met with fresh groundwater. However, the need for additional fresh groundwater supplies will be minimized through the use of all available reclaimed water and implementation of comprehensive water conservation measures.

The RWSP also identifies hundreds of potential options and associated costs for developing alternative sources as well as fresh groundwater. The options are not intended to represent the District's most preferable options for water supply development. They are, however, provided as reasonable concepts that water users in the planning region can pursue to meet their water supply planning needs. Water users can select a water supply option as presented in the RWSP or combine elements of different options that suit their water supply needs, provided such options are consistent with the intent and direction of the RWSP. Additionally, the RWSP provides information to assist water users in developing funding strategies to implement water supply projects.

The requirement for regional water supply planning originated from legislation passed in 1997 that significantly amended Chapter 373, Florida Statutes (F.S.). Regional water supply planning requirements are codified in Part VII of Chapter 373 (373.709), F.S., and this RWSP has been prepared pursuant to these provisions. Key components of this legislation included:

- Designation of one or more water supply planning regions within the District
- Preparation of a Districtwide water supply assessment
- Preparation of an RWSP for areas where existing and reasonably anticipated sources of water were determined to be inadequate to meet future demand, based upon the results of the water supply assessment

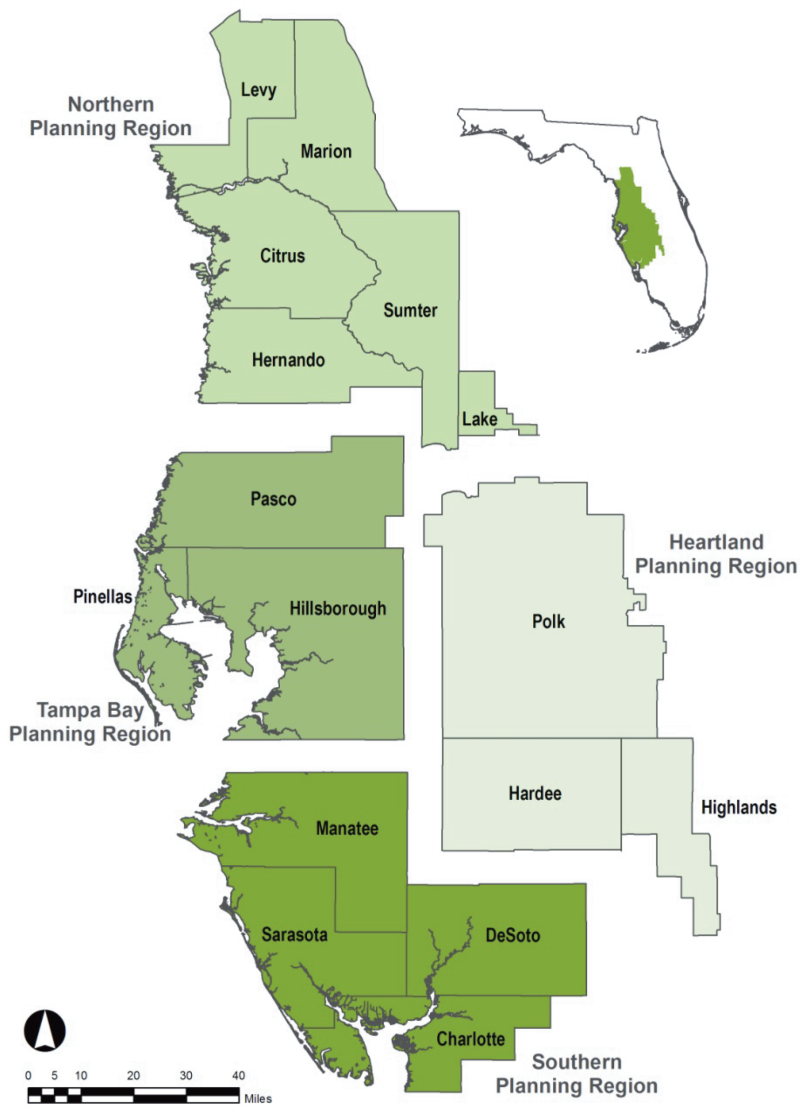



Figure 1-1 *Location of the four water supply planning regions within the District*

Regional water supply planning requirements were amended as a result of the passage of Senate Bill 444 during the 2005 legislative session. The bill substantially strengthened requirements for the identification and listing of water supply development projects. In addition, the legislation was intended to foster better communications among water planners, local government planners and local utilities. Local governments are now allowed to develop their own water supply assessments, which the water management districts (WMDs) are required to consider when developing their RWSPs. Finally, a trust fund was created that provides the WMDs with state matching funds to support the development of alternative water supplies by local governments, water supply authorities and other water users.

In 2001 and 2006, the District completed RWSPs for the 10-county area from Pasco County to Charlotte County. In this area, excessive groundwater withdrawals from the Upper Floridan aquifer had caused very significant environmental impacts. Water supply planning was necessary to determine how the region's future water supply demands could be met and environmental impacts mitigated through the development of alternative sources.

Although an RWSP was not previously developed for the Northern Planning Region due to the lack of regional impacts from groundwater withdrawals, water supply planning and development activities have been ongoing at a high level in the region for at least the past decade. These activities include (1) comprehensive water supply planning conducted cooperatively by Marion County, the Withlacoochee Regional Water Supply Authority (WRWSA), the District and the SJRWMD, (2) extensive resource assessments involving the District, the SJRWMD and the U.S. Geological Survey (USGS), (3) an aggressive program to establish minimum flows and levels (MFLs) and (4) the development of a sophisticated groundwater flow model to assess environmental impacts from groundwater withdrawals. The District has also provided significant financial and technical assistance to make it possible for local governments to develop reclaimed water projects and water conservation initiatives.

During the past several years, a number of factors indicate that the use of groundwater to supply current and future developments throughout the Northern Planning Region has the potential to significantly impact the water resources in some areas. These factors include:

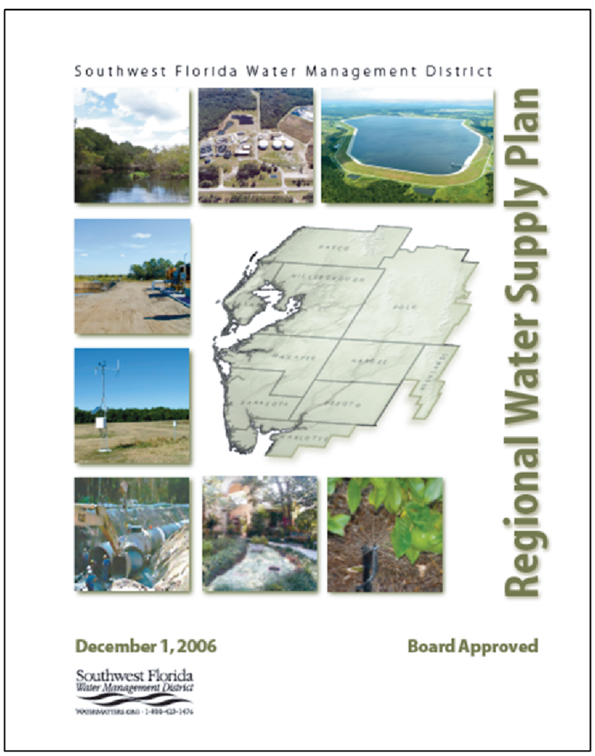
- Historic land platting for thousands of vested lots where residences will be built that will require potable wells and significant supplemental irrigation.
- Negative effects from groundwater withdrawals on water resources that include impacts to spring flow and lake levels that are approaching their minimum levels.
- Areas adjacent to the District in Lake and Marion counties have been placed under focused monitoring and study by the SJRWMD.

In June 2008, the District's Governing Board responded to these concerns by directing staff to include the District's northern six counties in the 2010 RWSP update process to ensure that a proactive, preventive approach is taken to water management in the region. Principal goals of the approach are to develop both short- and long-term measures that can be implemented to optimize the use of available groundwater to meet future demands while preventing unacceptable impacts to the resources. The Northern Planning Region strategy emphasizes three primary courses of action to address the issues of water demand and water supply: resource monitoring, enhanced conservation and regional water supply planning. Each element of this strategy will be discussed in this volume. The goal is to implement the strategy in advance of the significant water resource impacts that have occurred in the Tampa Bay, Heartland and Southern planning regions.

## Part A. Introduction to the Northern Planning Region RWSP

The following describes the content of the RWSP for the Northern Planning Region: Chapter 1 is an introduction to the RWSP, which contains an overview of water supply planning accomplishments in the planning region prior to the development of this RWSP; a description of the land use, population, physical characteristics, hydrology and geology/hydrogeology of the region; and a description of the technical investigations that provide the basis for the District's water resource management strategies. Chapter 2, Resource Protection Criteria, addresses the resource protection strategies that the District has implemented or is considering implementing, including water use caution areas (WUCAs) and the District's MFLs program. Chapter 3, Demand Estimates and Projections, is a quantification of existing and reasonably projected water supply demand through the year 2030 for public supply, agricultural, industrial/commercial, mining/dewatering, power generation and recreational/aesthetic users and environmental restoration. Chapter 4, Evaluation of Water Sources, is an evaluation of the future water supply potential of traditional and alternative sources. Chapter 5 is the water supply development component, which presents a list of water supply development options for local governments and utilities, including surface and stormwater, reclaimed water and water conservation. For each option, the estimated amount of water available for use and the estimated cost of developing the option are provided. Chapter 6 is an overview of water supply development projects that are currently under development and receiving District funding assistance. Chapter 7, the Water Resource Development Component, is an inventory of the District's ongoing data collection and analysis activities and water resource projects that are classified as water resource development. Chapter 8, Overview of Funding Mechanisms, provides an estimate of the capital cost of water supply and water resource development projects proposed by the District and its cooperators to meet the water supply demand projected through 2030 and to restore MFLs to impacted natural systems. An overview of mechanisms available to generate the necessary funds to implement these projects is also provided.

## Part B. Accomplishments Since Completion of the 2006 RWSP




This section is a summary of the water supply planning accomplishments in the planning region prior to the development of this RWSP.

### *Section 1. Conservation and Reclaimed Water Development*

1.0 Water Conservation

The District continues to promote and cooperatively fund water conservation efforts to make more efficient use of existing water supplies. In the public supply sector, this includes cooperatively funded projects for plumbing retrofits, toilet and rain sensor device rebates, water-efficient landscape and irrigation evaluations, and soil moisture sensor device and pre-rinse spray valve rebates. Cumulatively, these projects have saved more than 14 mgd Districtwide as of Oct. 1, 2009. Since 2006, District-funded conservation projects have been undertaken with Hernando and Marion counties. In 2007, the District held a Water Conservation Summit in partnership with the Suwannee River and St. Johns River water management districts. The summit facilitated the exchange of ideas on how local governments and utilities in the District's Northern Planning Region can plan for growth over the next 20 years and avoid the serious water resource impacts experienced in the District's southern 10 counties. Some of the topics covered during the summit included water-conserving rate structures, reclaimed water, alternative water supplies, Florida-Friendly Landscaping™ and conservation resources available to local governments and utilities.

For the agricultural water use category, the District's primary initiative for water conservation is the Facilitating Agricultural Resource Management Systems (FARMS) Program. Established in 2003 in partnership with the Florida Department of Agriculture and Consumer Services, FARMS is a cost-share reimbursement program for production-scale best management practices (BMPs) to reduce groundwater use and improve water quality. To date, more than 40 projects Districtwide have provided a groundwater offset of more than 6 mgd. Additional projects in the planning, design or construction phase are expected to yield another 8 mgd of offset Districtwide. While the FARMS program was initiated primarily to facilitate the recovery of water resources in the District's Southern Water Use Caution Area (SWUCA), the program has been expanded to Citrus, Lake, and Sumter counties in the Northern Planning Region.

2.0 Reclaimed Water

The District has continued its highly successful program to cooperatively fund projects that make reclaimed water available for beneficial reuse. These include design and construction projects for transmission mains and storage facilities, as well as feasibility studies, reuse master plans, metering and research projects. Cumulatively, these projects will result in the offset of more than 147 mgd Districtwide. Since 2006, reclaimed water projects have been jointly undertaken with Citrus, Hernando and Marion counties and the cities of Brooksville and Inverness, as well as with two private utilities.

### *Section 2. Support for Water Supply Planning*

In 2007, the District provided funding to the WRWSA to update its Master Regional Water Supply Plan. This plan is a comprehensive analysis of future water demands and potential supply sources for its four-county region. A follow-up feasibility analysis is nearly complete, providing a more in-depth analysis of water supply options. The District has also been providing office space and administrative support to the WRWSA as it transitions to a full-time agency.

The District partnered with the SJRWMD and Marion County on a water resource assessment and management project, which was completed in 2007. The project inventoried, evaluated and assessed the water resource base and long-range water requirements of the county. The District has been involved in providing technical support to local governments as they prepare statutorily required Water Supply Facilities Work Plans as part of their comprehensive plans. District staff worked with the Community Affairs Department, the FDEP and the other WMDs to develop a guidance document for preparing the plans. Staff has provided ad hoc assistance to local governments and has recently instituted a utility outreach program to assist utilities with planning, permitting and information/data needs.

### *Section 3. Minimum Flows and Levels Establishment*

1.0 Established MFLs

MFLs established in the planning region since 2006 include minimum flows in 2008 for the Weeki Wachee River System and five springs in Hernando County, including Weeki Wachee Spring. In 2010, minimum flows are scheduled to be established for the upper and middle

Withlacoochee River System, the Chassahowitzka River System and Springs, the Homosassa River System and Springs, the Gum Springs Group and Rainbow Springs.

2.0 MFLs Recovery Initiatives

MFLs established in the planning region to date are currently being met and, therefore, recovery strategies are not required. The reduction in groundwater withdrawals from Tampa Bay Water's wellfields in Pasco County associated with the recovery strategy for the Northern Tampa Bay Water Use Caution Area (NTBWUCA) has probably had some beneficial effect on groundwater levels and surface waters in Hernando County.

### *Section 4. Regulatory and Other Initiatives*

The District approved enhancements to the water conservation provisions of its water use permitting rules in 2009. Some of these enhancements involved extending certain per capita conservation standards, reporting requirements and other rule provisions to the Northern Planning Region that previously applied only in the District's WUCAs. The District has developed new modeling tools for projecting permanent and functional population for any selected area, such as a utility service area, municipal boundary, watershed or region. This will help District staff, local governments, utilities and other users better estimate and project population and future water demand. As part of this effort, a new demographics web page has been created to assist users (*www.WaterMatters.org/demo*). The District has partnered with the WRWSA, The Villages of Sumter County and the City of Wildwood to expand groundwater monitoring and data collection in northern Sumter County. This is a high-growth area that is hydrogeologically complex. Information gained in these studies will be incorporated into regional groundwater models for use in assessing impacts of groundwater withdrawals on lake levels, spring flows and the Withlacoochee River.

## Part C. Description of the Planning Region

### *Section 1. Land Use and Population*

The Northern Planning Region is characterized by a diversity of land use types (Table 1-1). The area encompasses extensive tracts of federal, state and District-owned conservation lands that include the Withlacoochee State Forest, the Annutteliga Hammock, the Chassahowitzka Wildlife Management Area, the Weekiwachee Preserve, the Flying Eagle Preserve, Potts Preserve and the Lake Panasoffkee tract. These protected public lands are used and maintained for timber

Southwest Florida Water Management District

Table 1-1. *Land use/land cover in the Northern Planning Region (2007*

| Land Use/Land Cover Types (2007) | Percent | Acres |
|---|---|---|
| Urban and Built-up | 22.03 | 376,061.632 |
| Agriculture | 24.09 | 411,300.969 |
| Rangeland | 1.81 | 30,869.111 |
| Upland Forest | 28.26 | 482,443.268 |
| Water | 1.25 | 21,387.312 |
| Wetlands | 19.89 | 339,467.438 |
| Barren Land | 0.23 | 3,841.605 |
| Transportation, Communication and Utilities | 1.10 | 18,800.249 |
| Industrial and Mining | 1.34 | 22,915.877 |
| **Total** | **100** | **1,707,087.460** |

Source: SWFWMD 2007 LULC GIS layer (SWFWMD, 2007).

management; ecological restoration; public recreation; and conservation of hardwood swamps, fresh and saltwater marshes, river frontage, sandhill-dwelling plants and prime black bear habitat. Limestone mining activities occur primarily in Hernando, Sumter and Levy counties and numerous inactive mines are scattered throughout the northern counties. 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, with Levy County leading the region. Other crops farmed at a much smaller scale include sweet peppers, squash, cucumbers, cantaloupes and sweet corn.

The population of the planning region is projected to grow from approximately 470,347 in 2005 to 792,666 in 2030. This is an increase of approximately 322,319 new residents; a 59 percent increase over the planning period. Marion, Lake and Sumter counties include sections of The Villages retirement communities, with approximately 43,957 single-family homes projected by 2019 (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 and Levy counties. 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.

## *Section 2. Physical Characteristics*

The planning region is divided along the Brooksville Ridge physiographic region into two distinct watersheds. The Springs Coast watershed consists 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 (the second largest in the District) encompasses parts of Marion, Levy, Citrus, Hernando, all of Sumter County, and portions of Pasco and Polk counties outside of the Northern Planning Region.

The Brooksville Ridge trends northwest-southeast across the planning 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

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 in the planning region including rivers, lakes and springs.

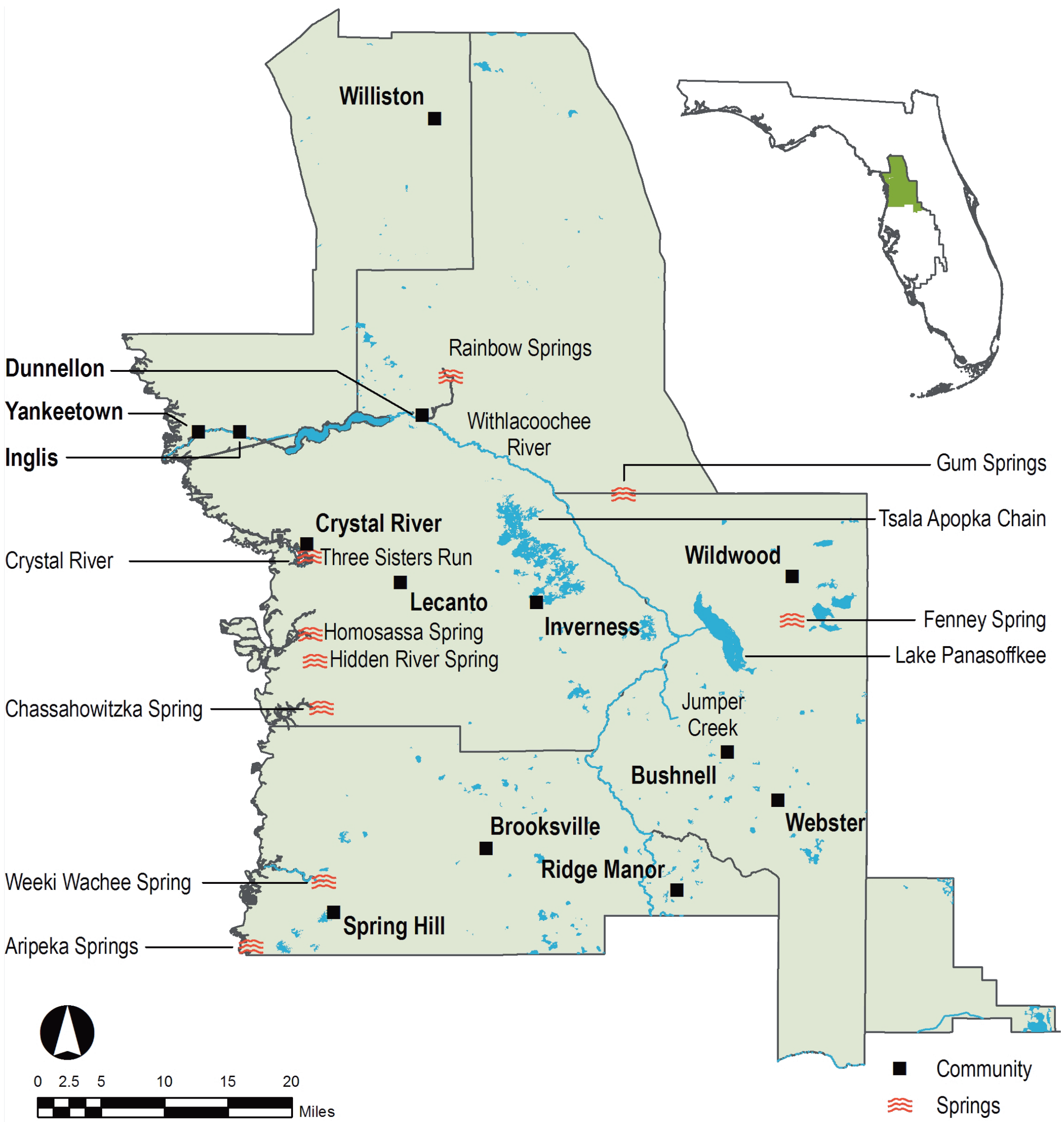



Figure 1-2. *Major hydrologic features in the Northern Planning Region*

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.

2.0 Lakes

Lakes in the planning region 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). Figure 1-2 depicts the locations of lakes in the planning 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 planning region. These include the Rainbow Springs Group 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. The river flows for approximately 5.9 miles before merging with the Withlacoochee River upstream of Lake Rousseau. Combined discharge of the Rainbow Springs Group averages 493 mgd, which makes it the fourth largest among Florida's 33 first-magnitude springs (SWFWMD, 2004).

*Rainbow Springs in Marion County is one of the largest springs in Florida, discharging an average of 493 mgd.*

The Crystal River Group and the Chassahowitzka and Homosassa springs groups are located on Citrus County's gulf coast. The Crystal River springs discharging into the tidally influenced Kings Bay (600 acres) are the headwaters of the Crystal River Group and are part of a complex network of more than 30 springs. These springs are Florida's second largest spring system, with an average discharge of 975 cfs (630 mgd) (SWFWMD, 2004). Because the springs are located within the saltwater interface (the boundary between fresh water and salt water in the Upper

Floridan aquifer), most of the springs discharge water that is brackish to varying degrees. The Homosassa Springs Group discharges approximately 92 cfs (60 mgd) 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 consists of a group of springs with a combined average discharge of 268 cfs (173 mgd). 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 172 cfs (111 mgd). 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 planning region, but many are unnamed and difficult to locate. Springs in the Lake Panasoffkee area are good examples. 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.

## 4.0 Wetlands

*Hardwood cypress wetlands are common throughout the planning region.*

Wetlands in the planning region can be grouped into saltwater and freshwater types. Saltwater wetlands are found bordering estuaries that are coastal wetlands influenced by the mixing of fresh water and seawater. Salt grasses and mangroves are common estuarine plants. The Withlacoochee Gulf Preserve is a large estuary located west of Yankeetown in Levy County. 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. Nearly half of Levy County is designated as freshwater wetlands that extend from the forested systems of the Goethe State Forest into Alachua County. The hardwood-cypress swamps in the Hálpata Tastanaki tract are a major freshwater system in southeastern Marion County.

5.0 Karst Hydrology

Intensive karst development characterizes much of the planning 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 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 (Jones et al., 1997).

## *Section 4. Geology/Hydrogeology*

The Upper Floridan aquifer system is the principal storage and water conveying aquifer in the planning region. Figure 1-3 is a generalized north-south cross section of the hydrogeology of the District. As seen in this figure, the Central West-Central Florida Groundwater Basin (CWCFGWB) constitutes a hydrogeologic transition between the southern and northern parts of the District. From the Southern Planning Region to the Tampa Bay Planning Region, the intermediate aquifer system and its associated clay confining units decrease in thickness and eventually become a single confining unit in the central portion of the Tampa Bay Planning Region (the intermediate confining unit). The unit becomes discontinuous and disappears entirely in the Northern Planning Region. As a result, the Upper Floridan aquifer is not under confined conditions as it is throughout much of the remainder of the District (SWFWMD, 1987).

The Upper Floridan aquifer consists of a thick sequence of marine carbonate deposits and is the main source for water supply within the planning region. A relatively thin sequence of sands, silts and clays 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 the Suwannee and Ocala limestones.

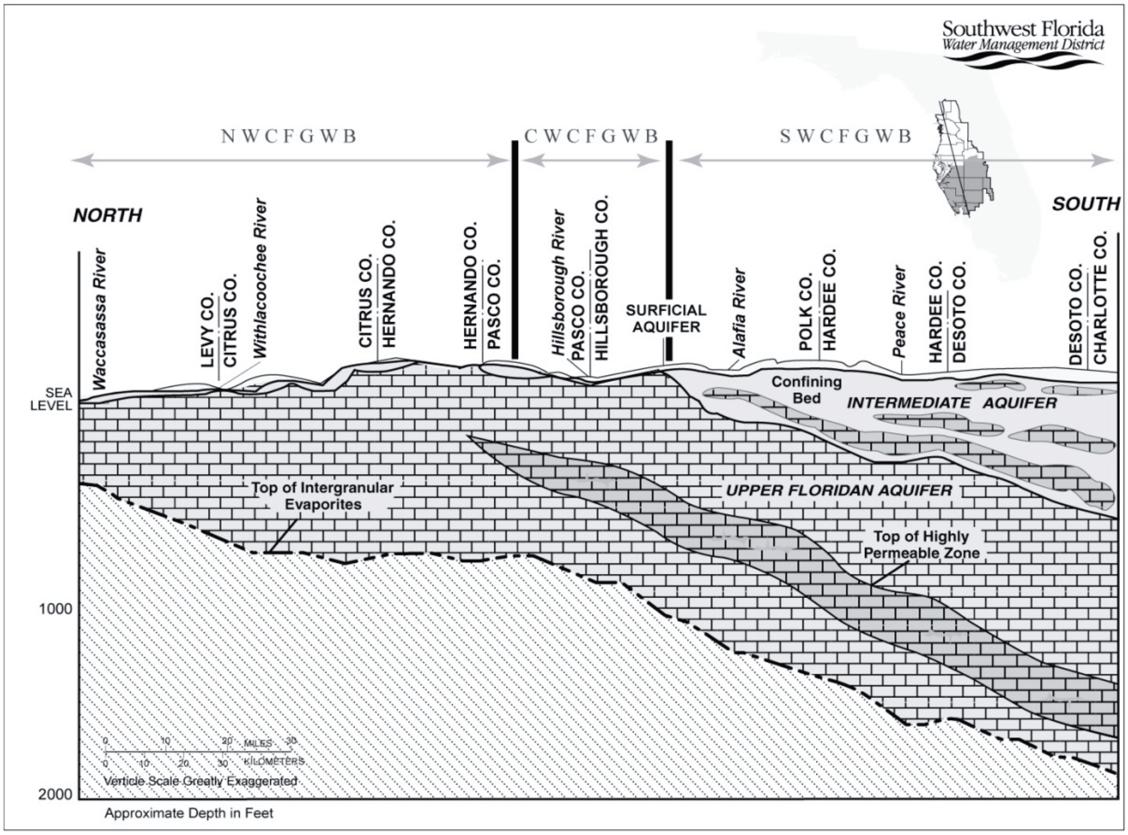



Figure 1-3. *Generalized north-south geologic cross section through the District*

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 planning region and outcrops in several areas of limited extent, mainly within Levy and Citrus counties. The Avon Park Formation is the deepest potable water-bearing formation in the planning region and forms the lower flow zone for the Upper Floridan aquifer.

## Part D. Previous Technical Investigations

The 2010 RWSP builds on a series of cornerstone technical investigations that were undertaken by the District and the USGS beginning in the 1970s. These investigations have provided the District with an understanding of the complex relationships between human activities (i.e., surface water and groundwater usage and large-scale land-use alterations), climactic cycles, aquifer/surface water interactions, aquifer and surface hydrology, and water quality. Investigations conducted in the planning region and in areas adjacent to it are listed by categories and briefly outlined below.

### *Section 1. Water Resource Investigations*

During the past 30 years, various water resource investigations have been initiated by the District to collect critical information about the condition of Districtwide water resources and the impacts of human activities on them. Following the Florida Water Resources Act of 1972, the District began to invest in enhancing its understanding of the effects of water use, drainage and development on the water resources and ecology of west-central Florida. A major result was the creation of the District's Regional Observation and Monitor-well Program (ROMP), which involved the construction of monitor wells and aquifer testing to better characterize groundwater resources and surface and groundwater interactions. About a dozen wells were drilled annually, and in the 1980s, data collected from these wells began to be used in a number of hydrologic assessments that clearly identified regional resource concerns.

During the 1980s, hydrologic and biologic monitoring from the District's expanded data collection networks began to reveal water resource impacts in other areas of the District. In the late 1980s, the District initiated a detailed water resource assessment project (WRAP) in the Northern Tampa Bay (NTB) area to determine causes of water level declines and to address water supply availability. Resource concerns in this area included lowered lake and wetland levels.

In 1989, based on the findings of the WRAP study and continued concern about water resource impacts, the District established the NTBWUCA and implemented a strategy to address the resource concerns, which included comprehensive studies to determine long-term water supply availability. From May 1989 through March 1990, there were extensive public work group meetings to develop management plans for the NTBWUCA. These meetings are summarized in the Northern Tampa Bay Work Group Report (SWFWMD, 1990a) and Management Plan (SWFWMD, 1990b). These deliberations led to major revisions to the District's water use permitting rules as special conditions were added that applied to the NTB and other WUCAs.

A WRAP is currently being conducted for the Northern Planning Region to gain a better understanding of the water resource issues from Pasco County north to Levy County. Data is being collected to enhance understanding of the groundwater system, characterize the saline water interface, identify areas of poor groundwater quality, determine the nature of flow to major springs and provide information for regional flow models. This effort will also assist in the evaluation of future water supply planning assessments and MFL establishment. The WRAP is expected to be completed in 2014.

### *Section 2. USGS Hydrologic Investigations*

The District has a long-term cooperative program with the USGS to conduct hydrogeologic investigations that are intended to supplement work conducted by District staff. The projects are focused on improving the understanding of cause-and-effect relationships and developing analytical tools for resource evaluations. Funding for this program is generally on a 50/50 cost-share basis with the USGS. However, this varies based on whether other cooperators are involved in the project and if requests for non-routine data collection or special project assignments are implemented. The District's cooperative investigations with the USGS have typically been focused on regional hydrogeology, water quality and data collection. Over the years, several groundwater and surface water cooperative projects have been completed in and around the planning region. In addition, a number of projects and data collection activities are in progress. Completed and ongoing cooperative District/USGS investigations and data collection activities are listed in Table 1-2.

Table 1-2. *District/USGS cooperative hydrologic investigations and data collection activities applicable to the Northern Planning Region*

| Investigation Type | Description |
|---|---|
| **Completed Investigations** | |
| Groundwater | Regional Groundwater Flow System Models of the SWFWMD; Cypress Creek, Cross Bar and Morris Bridge Wellfields; and the St. Petersburg Aquifer Storage and Recovery (ASR) Site. |
| Surface Water | Statistical Characterization of Lake Level Fluctuations |
| | Lake Stage Statistics Assessment to Enhance Lake Minimum Level Establishment |
| | Lake Augmentation Impacts |
| Groundwater and Surface Water | Occurrence and Distribution of Nitrate in the Silver Springs Basin |
| | Effects of Using Groundwater for Supplemental Hydration of Lakes and Wetlands |
| | Use of Groundwater Isotopes to Estimate Lake Seepage in the NTB and Highlands Ridge Lakes |
| | Effects of Recharge on Interaction Between Lakes and the Surficial Aquifer |
| | Surface and Groundwater Interaction in the Upper Hillsborough River Basin |
| | Relationship Between Groundwater Levels, Spring Flow, Tidal Stage and Water Quality for Selected Springs in Coastal Pasco, Hernando and Citrus Counties |
| | Surface and Groundwater Interaction in the Upper Hillsborough River Basin |
| **Ongoing Investigations/Data Collection Activities** | |
| Surface Water | Primer on Hydrogeology and Ecology of Freshwater Wetlands in Central Florida |
| | Factors Influencing Water Levels in Selected Impaired Wetlands in the NTB Area |
| | Methods to Define Storm Flow and Base Flow Components of Total Stream Flow in Florida Watersheds |
| Groundwater and Surface Water | Interaction Between the Upper Floridan Aquifer and the Withlacoochee River |
| | Interaction Between the Upper Floridan Aquifer and Lake Panasoffkee |
| Data Collection | Minimum Flows and Levels Data Collection |
| | Surface Water Flow, Level and Water Quality Data Collection |

## *Section 3. Water Supply Investigations*

As part of the U.S. Army Corps of Engineers' Four River Basins Area project, an assessment of water resources in the region was prepared to determine ways in which excess surface water or groundwater could be used to help solve regional water supply problems. Objectives of the study were to evaluate current and anticipated water resource problems in the study area, determine sites suitable for alleviating the identified problems and describe preliminary design elements and costs associated with developing these sites. The study projected where problem areas were anticipated through the year 2035 and identified possible solutions to those problems.

Since the 1970s, the District has conducted numerous hydrologic assessments designed to assess the effects of groundwater withdrawals and determine the availability of groundwater in the region. In the late 1980s, the Florida Legislature directed each of the WMDs to conduct a Groundwater Basin Resource Availability Inventory covering areas deemed appropriate by the WMD's Governing Boards. The District completed inventory reports for 13 of the 16 counties within its jurisdiction. The three remaining counties, which were only partially contained within the District's boundaries, were to be completed by adjacent WMDs. These reports described the groundwater resources of the individual counties and respective groundwater basins.

Based on the District's hydrologic and biologic monitoring programs and results of the hydrologic assessments that had been conducted, the District established three WUCAs in the late 1980s because of observed impacts of groundwater withdrawals. Recognizing that the future supply of groundwater was limited in some areas, the District prepared the *Water Supply Needs & Sources: 1990–2020* study (SWFWMD, 1992). One of the more important objectives of the study was to provide a foundation from which the District could provide appropriate water resources management in the future. Key to the management approach was to optimize resources to provide for all reasonable and beneficial uses without causing unacceptable impacts to the resources, natural systems and existing legal users. The document assessed future water demands and sources through the year 2020. Major recommendations of the study included the need for users to rely on local sources to the greatest extent practicable to meet their needs before pursuing more distant sources, requiring users to increase their water use efficiency, and pursuing a regional approach to water supply planning and development.

In response to legislation in 1997 that clarified the role of WMDs in water supply planning, the District completed a water supply assessment in 1998 (SWFWMD, 1998). The assessment quantified water supply needs through the year 2020 and identified areas where future demand could not be met with traditional groundwater sources. As required by the legislation and based on the water supply assessment, the District initiated an RWSP for its southern 10 counties. This area encompassed the NTBWUCA and SWUCA. In 2001, the District published its first RWSP, which quantified water supply demands through the year 2020 and identified water supply options for developing alternative sources (sources other than fresh groundwater). The RWSP was updated in 2006 for the period from 2000 through 2025. The 2006 RWSP concluded that fresh groundwater from the Upper Floridan aquifer would be available to meet future demands in the District’s southern 10 counties on a limited basis only and that sufficient alternative sources existed in the region to meet projected demands through 2025. It also concluded that a regional approach to meeting future water demands was required because some areas have limited access to alternative water supplies.

The Northern Planning Region has recently experienced accelerated population growth, development and the accompanying cumulative effects of many small- and large-scale groundwater withdrawals. The District decided to initiate water supply planning for the Northern Planning Region for the 2010 RWSP update to help plan for future water supply needs and to prevent negative impacts. The WRWSA, which serves Citrus, Hernando, Marion and Sumter counties, has implemented a comprehensive water supply planning, design and construction program in cooperation with the District to plan for sustainable, future water supplies. Groundwater modeling was completed as part of this project to analyze anticipated changes in the surficial and Upper Floridan aquifers associated with proposed water supply projects. The study includes an analysis of the impacts of 2030 water demands on the surficial and Upper Floridan aquifers and identifies proxy MFLs to assist in the identification of areas of potential surplus or deficit groundwater availability. A feasibility analysis will be completed, local member government coordination will be implemented and projects will be constructed to meet the growing water supply demand in the planning region.

### Section 4. MFL Investigations

In addition to the actual measurement of water levels and flows, extensive field data is often required in support of MFL development. Studies done in support of MFL development are both ecologic and hydrologic in nature and include basic biologic assessments such as the determination of the frequency, abundance and distribution of plant and animal species and their habitats. Ultimately this ecologic information is related to hydrology based on relationships to elevation or flow. Ecologic and hydrologic relationships are developed using either statistical or mechanistic models, or a combination of the two. In estuaries for example, two- or three-dimensional salinity models may be developed to assess how changes in flow affect the spatial and temporal distribution of various salinity zones. In certain circumstances, depending on the resources of concern, thermal or water quality models might be required as well. Elevation data is also collected for generating bathymetric maps or coverages used for modeling purposes to determine when important features such as roads, floor slabs and docks become inundated or when flows or levels drop sufficiently low to affect recreation and aesthetics.

### *Section 5. Modeling Investigations*

Since the 1970s, the District has developed numerous computer models to support resource evaluations and water supply investigations. These models have been subdivided into groundwater flow models for general resource assessments and solute transport models to assess past and future saltwater intrusion. In recent years, the District has begun to support the use of integrated hydrologic models that simulate the entire hydrologic cycle and include information on both the surface water and groundwater flow systems. These models are being used to address issues where the interaction between groundwater and surface water is significant. Many of the early groundwater flow models were developed by the USGS through the cooperative studies program with the District. Over time, as more data were collected and computers became more sophisticated, the models developed by the District have included more detail about the hydrologic system. The end result of the modeling process is a tool that can be used to assess effects of current and future withdrawals and better understand hydrologic relationships

1.0 Groundwater Flow Models

Beginning in the late 1970s, the USGS, with cooperative funding from the District, created several models of the Hernando, Pasco, Pinellas and Hillsborough counties area that were generally used to evaluate effects of withdrawals for specific wellfield areas. Using information from these models, the District (Bengtsson, 1987) developed a transient groundwater model of this area with an active water table to assess effects of withdrawals on surficial aquifer water levels. In 1993, the District completed development of the NTB model, which covered approximately 1,500 square miles from Hernando to Pinellas counties (Hancock and Basso, 1993). Together with monitoring data, the NTB model was used to characterize and quantify the magnitude of groundwater withdrawal impacts occurring in the region. In addition to the models developed by the District and USGS, models have been developed by Tampa Bay Water (TBW) to support requests for surface water and groundwater withdrawals.

The Northern Planning Region groundwater flow model covers the northern half of the District and portions of the St. Johns River and Suwannee River water management districts. (HydroGeoLogic, Inc., 2008). This model, completed in May 2008, is unique for west-central Florida in that it is the first regional flow model that represents the groundwater system as fully three-dimensional. The model contains seven active layers, which include the surficial aquifer or unsaturated zone, the Intermediate Confining Unit (ICU), Suwannee Limestone, Ocala Limestone, Avon Park Formation, Middle Confining Unit (MCU) and the Lower Floridan aquifer. The Northern Planning Region model serves as an important tool to examine potential impacts to wetlands, lakes, springs and the Withlacoochee River from regional groundwater withdrawals. The results of these predictions have been used by the District to support water supply planning assessments and establishment of MFLs.

2.0 Saltwater Intrusion Models

Although regional saltwater intrusion in the NTB area is not a major resource concern as it is in the SWUCA, local and sub-regional saltwater intrusion has been observed. Saltwater intrusion models completed for the area include Dames and Moore, Inc. (1988), GeoTrans, Inc. (1991), HydroGeoLogic, Inc. (1992) and Tihansky (2005). These models have generally confirmed the localized nature of saltwater intrusion in the NTB area. HydroGeoLogic, Inc., completed a regional saltwater intrusion model in May 2008 that covered the coastal region of Pasco, Hernando, Citrus and Levy counties. This work was completed in conjunction with the development of the Northern Planning Region groundwater flow model.

3.0 Integrated Groundwater/Surface Water Models

In 1997, SDI-Environmental developed the first fully integrated model of the area that covered an area larger than that of the NTB model. The District worked with TBW to develop a new generation of integrated model, the Integrated Northern Tampa Bay (INTB) model, which was completed in April 2009 and covers a 4,000-square-mile area that extends from southern Citrus and Sumter counties to northern Manatee County. This advanced tool combines a traditional groundwater flow model with a surface water model and contains an interprocessor code that links both systems, which allows for simulation of the entire hydrologic system. It can be used to assess changes in rainfall, land use and groundwater withdrawals. The model has been used in MFL investigations of the Anclote River and Crystal and Weeki Wachee springs. In the future, the INTB model will be used in water supply planning to determine future groundwater availability, evaluate MFLs, and evaluate recovery in the NTB area resulting from the phased reductions in groundwater withdrawals from TBW’s 11 central-system wellfields as required by the Partnership Agreement.

4.0 Districtwide Regulation Model

The development and implementation of a Districtwide regulation model (DWRM) was undertaken in an effort to produce a regulatory modeling platform that is technically sound, efficient and reliable and has the capability to address cumulative impacts. The DWRM was initially developed for the District in 2003 by Environmental Simulations, Inc. (Environmental Simulations, Inc., 2004). It is mainly used to evaluate whether requested groundwater quantities in water use permit applications have the potential to cause unacceptable impacts to existing legal users, off-site land uses, environmental systems, the saltwater interface and movement of documented groundwater contamination on an individual and cumulative basis. The DWRM simulates the surficial, intermediate, Upper Floridan and Lower Floridan aquifer systems. It covers the entire area of the District and an appropriate buffer area surrounding the boundaries of the District. The DWRM Version 2 (Environmental Simulations, Inc., 2007) incorporates the Focused Telescopic Mesh Refinement (FTMR), which was initially developed to enable the regional DWRM to be used as a base model for efficient development of smaller scale sub-models (FTMR models). The FTMR uses a fine grid around a well or group of wells and increasing grid spacing out to the edge of the model. It was specifically designed to enhance water use permit analysis; however, the DWRM and the FTMR are increasingly being used for water resource evaluations.

# Chapter 2: Resource Protection Criteria

This chapter addresses the primary strategies the District employs to protect water resources, which include water use caution areas (WUCAs), minimum flows and levels (MFLs), prevention and recovery strategies, and reservations.

*Many lakes in the planning region have experienced low levels during the past decade, resulting primarily from two severe droughts.*

## Part A. Water Use Caution Areas

### Section 1. Definitions and History

Figure 2-1 depicts the location of the District's WUCAs. WUCAs are areas that require regional action to address cumulative water withdrawals that are causing or may cause adverse impacts to the water and related land resources or the public interest (Chapter 40D-2.801 F.A.C.). In order to determine whether an area should be declared a WUCA, the Governing Board must consider the following factors:

- Quantity of water available for use from groundwater sources, surface water sources, or both.
- Quality of water available for use from groundwater sources, surface water sources, or both, including impacts such as saline water intrusion, mineralized water upconing or pollution.
- Environmental systems, such as wetlands, lakes, streams, estuaries, fish and wildlife, or other natural resources.
- Lake stages or surface water rates of flow.
- Off-site land uses.
- Other resources as deemed appropriate.

In the late 1980s, the District determined that certain interim resource management initiatives could be implemented to help prevent existing problems in the water resource assessment project (WRAP) areas from getting worse prior to the completion of each WRAP. As a result, in 1989, the District established three WUCAs: Northern Tampa Bay (NTB), Eastern Tampa Bay (ETB) and Highlands Ridge (HR). For each of the initial WUCAs, a three-phased approach to water resource management was implemented, including: (1) short-term actions that could be put into place immediately, (2) mid-term actions that could be implemented concurrent with the ongoing WRAPs and (3) long-term actions that would be based upon the results of the WRAPs. In addition to the development of conservation plans, cumulative impact analysis-based permitting and requiring withdrawals from stressed lakes to cease within three years, the District developed management plans for each WUCA to stabilize and restore the water resources in each area through a combination of regulatory and non-regulatory efforts. In 1992, the District established an additional WUCA: the Southern Water Use Caution Area (SWUCA), which

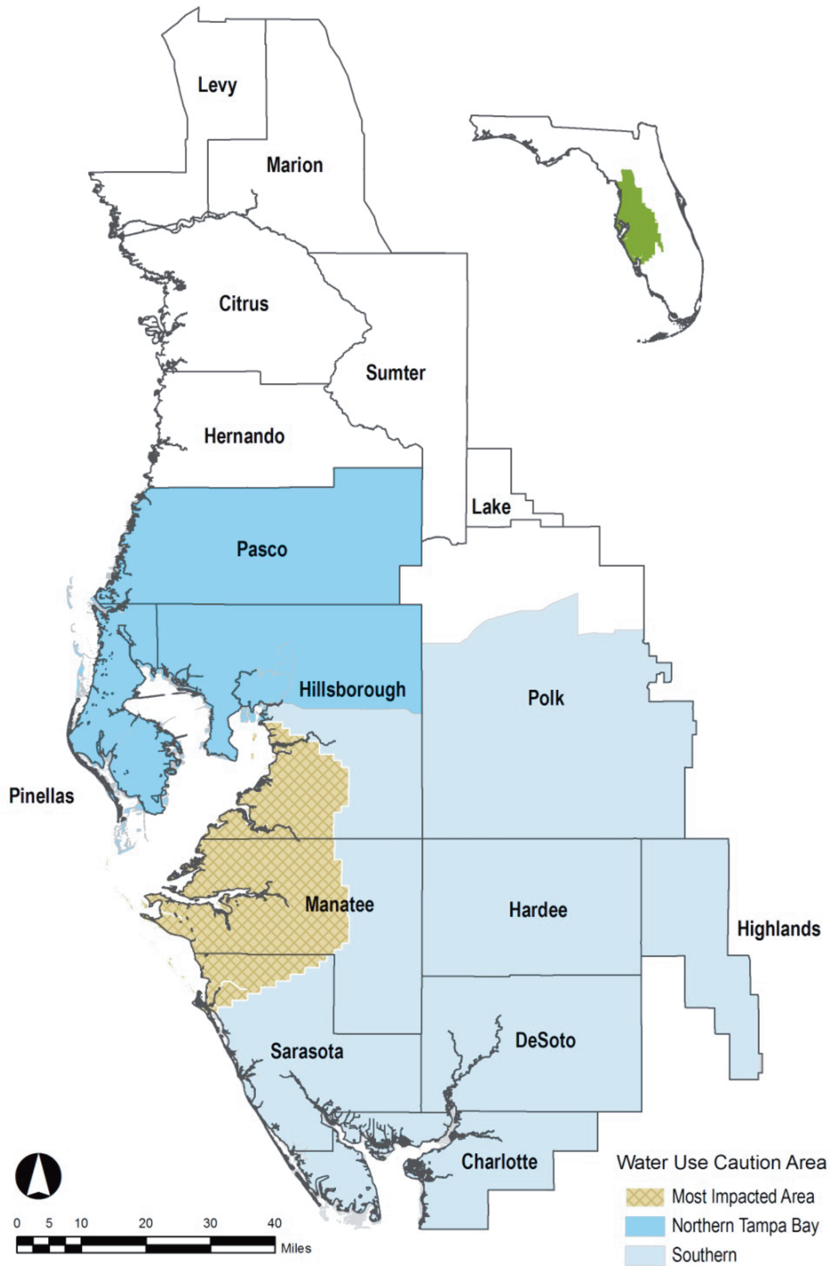



Figure 2-1 *Location of the District's water use caution areas*

encompasses the entire southern portion of the District, including the areas that were previously part of the ETB and HR WUCAs. In 2007, the NTBWUCA was expanded to include an additional portion of northeastern Hillsborough County and the remainder of Pasco County. The District has not declared a WUCA in the Northern Planning Region; however, the SJRWMD has declared a priority water resource caution area adjacent to Lake and Marion counties in the planning region.

## Part B. Minimum Flows and Levels

### Section 1. Definitions and History

An MFL is the level or flow below which significant harm occurs to the water resources or ecology of the area. Since the early 1970s, the District has been engaged in an effort to develop MFLs for water resources. The District implements established MFLs primarily through its water supply planning, water use permitting and environmental resource permitting programs, and funding of 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, the District has enhanced its program for the development of MFLs. The District's MFL program addresses all the requirements expressed in the Florida Water Resources Act and the Water Resource Implementation Rule.

*The Withlacoochee River ceases to flow in certain reaches during severe droughts.*

1.0 Statutory and Regulatory Framework

The Florida Water Resources Act (Chapter 373, F.S.) and the Water Resource Implementation Rule (Chapter 62-40, F.A.C., formerly the State Water Policy) provide the basis for establishing MFLs and explicitly include provisions for setting them. The Water Resources Act requires the WMDs to establish minimum levels for both groundwater and surface waters and minimum flows for surface watercourses below which significant harm to the area's water resources or ecology would result. In 1996, the Florida Legislature mandated that the District submit a priority list and schedule for establishing MFLs by Oct. 1, 1997, for surface watercourses, aquifers and surface waters in the counties of Hillsborough, Pasco, and Pinellas in the NTB area (Section 373.042[2]). Chapter 373 now requires the WMDs to update and submit for approval by the FDEP a priority list and schedule for the establishment of MFLs throughout their respective jurisdictions. The priority list and schedule is published annually in *Florida Administrative Weekly* and is posted on the District's web site at www.*WaterMatters.org*.

### Section 2. Priority Setting Process

In accordance with the requirements of Section 373.042, F.S., the District has established and annually updates a list of priority groundwaters and surface waters for which MFLs will be set. As part of determining the priority list and schedule, the factors listed below are considered.

- Importance of the water bodies to the state or region
- Existence of or potential for significant harm to the water resources or ecology of the state or region
- Required inclusion of all first-magnitude springs and all second-magnitude springs within state or federally owned lands purchased for conservation purposes
- 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
- Proximity of MFLs already established for nearby water resources
- Possibility that the water resource may be developed as a potential water supply in the foreseeable future
- Value of developing an MFL for regulatory purposes or permit evaluation

The District's Priority List and Schedule for the Establishment of MFLs is contained in the Chapter 2 Appendix.

### *Section 3. Technical Approach to the Establishment of MFLs*

The District'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 groundwater 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.

1.0 Ongoing Work, Reassessment and Future Development

The District continues to conduct the necessary activities to support the establishment of MFLs according to the District's Priority List and Schedule. Refinement and development of new methodologies is also ongoing. In accordance with state law, MFLs are established based upon the best available information. The District plans to conduct periodic reassessment of the adopted MFLs based on consideration of the significance of particular MFLs in water supply planning and the relevance of new data that may become available.

2.0 Scientific Peer Review

Chapter 373.042(4), F.S., permits affected parties to request independent scientific peer review of the scientific and technical data and methodologies used to determine MFLs. As part of the adopted MFLs' rules, the District has committed to pursuing independent scientific peer review as part of future efforts. The District voluntarily seeks independent scientific peer review of MFL methodologies that are developed for all priority water bodies. Since the RWSP was last updated in 2006, the District has sought and obtained the review of methodologies for water resources in the planning region that include the Weeki Wachee River System and springs and proposed methodological revisions for methods used to establish minimum lake levels.

3.0 Methodology

The District's methodology for MFL establishment for wetlands, lakes, rivers, springs and aquifers is explained in detail in the Chapter 2 Appendix.

### *Section 4. MFLs Established to Date*

Figure 2-2 depicts MFL priority water resources that are located within the planning region. A complete list of water resources with established MFLs throughout the District is provided in the Chapter 2 Appendix. MFLs established for water resources in the planning region include:

- Eighteen lakes in Citrus, Hernando, Levy and Sumter counties
- Weeki Wachee River System, including Weeki Wachee, Twin Dees, Mud, Salt and Jenkins Creek springs

Priority water resources within the planning region for which MFLs have not yet been established include:

- Chassahowitzka River System and Springs (Chassahowitzka #1, Crab Creek, Potter and Ruth springs)
- Blind Spring
- Homosassa River System and Springs
- Upper and Middle Withlacoochee River System (Green Swamp)
- Lower Withlacoochee River System
- Rainbow Springs (Bubbling and Waterfall springs)
- Crystal River System
- Kings Bay Springs
- Gum Springs Group
- Hidden River Springs 1 and 2

## Part C. Prevention and Recovery Strategies

### *Section 1. Prevention Activities*

A three-point prevention strategy has been developed 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 use does not cause violation of established MFLs. In addition to the development of an 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 ensure that future water supply demands will be met without adversely impacting proposed or established MFLs. These activities are discussed below.

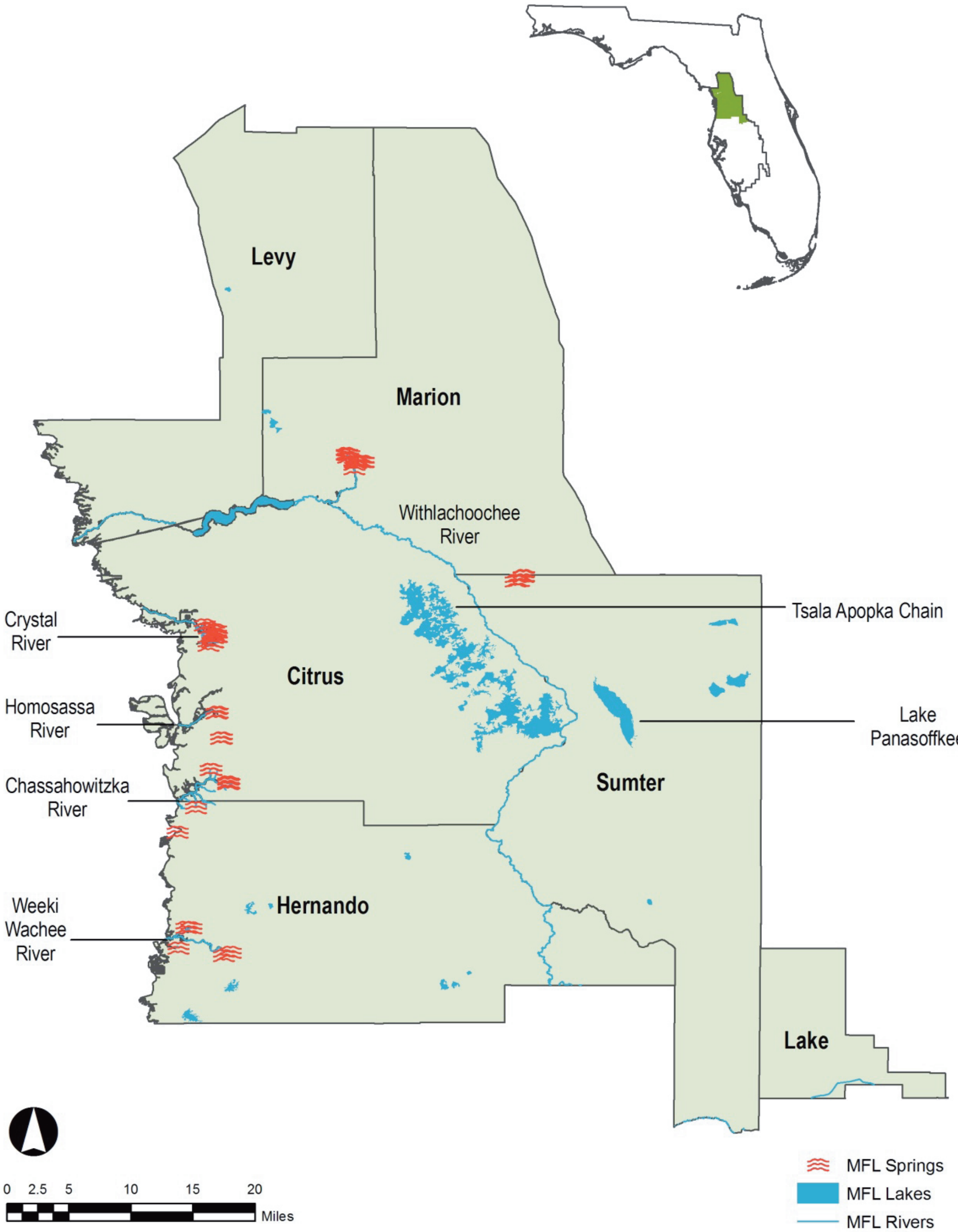



Figure 2-2 *MFL priority water resources in the Northern Planning Region*

## 1.0 Northern Planning Region Strategy

In response to rapidly increasing development pressure in the planning region, the District developed a process in 2006 to evaluate options for long-term water resource management. The strategy focuses on minimizing current and future water use through best management and conservation practices so that use of groundwater as a source of supply can be extended as long as possible prior to introduction of alternative water sources. The strategy will be implemented prior to completion of the District's technical efforts, but in advance of the significant water resource impacts that have occurred in the Tampa Bay, Heartland and Southern planning regions.

Principal goals of the strategy are to develop short-term measures that can be implemented to optimize the use of available groundwater to meet future demands while preventing unacceptable impacts to the resources. The Northern Planning Region strategy emphasizes three primary courses of action to address the issues of water demand and water supply in the planning region: resource monitoring, enhanced conservation and collaborative regional water supply planning.

The District has authorized rule making to expand the public supply permittee per capita water use requirements that exist in the WUCAs to those areas of the District not currently subject to them. The requirements include the calculation of per capita water use according to adopted SWUCA rules and service area population estimation methodology, the submission of an annual per capita water use report and associated data via the annual public supply survey, refined service area delineation requirements and reporting, calculation of reclaimed and stormwater credits, and a utility per capita compliance of 150 gallons per person per day.

The District has also authorized rule making to expand water conservation efforts in the planning region. Enhanced conservation standards may include the promotion of reclaimed water, water-conserving rate structures, water audits, the adoption and enforcement of landscape ordinances, and the setting of specific percentages for components of water loss. At a minimum, the same standards of efficiency for all public supply permittees will apply throughout the District, regardless of the availability of groundwater supplies. Finally, the District has conducted a public outreach campaign to engage stakeholders, decision-makers, residents and regulated communities. Efforts have included a conservation summit for local governments and utilities, individual meetings with local government staff, and joint coordination meetings with the Withlacoochee Regional Water Supply Authority (WRWSA), the Withlacoochee Regional Planning Council, editorial boards and other agencies.

2.0 WRWSA Master Regional Water Supply Planning and Implementation Program

The District is cooperating with the WRWSA on the adoption of the Master Regional Water Supply Planning and Implementation Program (Program). The Program is designed to analyze regional water demands and determine alternatives to meet them. It employs a multiphased approach which includes: (1) updating and maintaining the WRWSA 2005 Regional Water Supply Plan, (2) a feasibility analysis of proposed water supply projects, (3) reclaimed water optimization and enhanced water conservation efforts, (4) a detailed design of selected water supply, reclaimed water and conservation projects, (5) the construction and implementation of recommended projects, and (6) Northern Planning Region modeling and technical support for local communities.

The WRWSA first developed their Master Regional Water Supply Plan in 1995, and the 2005 Regional Water Supply Master Plan Update was completed in March 2007. The update included population projections, the associated water demand and water supply options that could be developed to meet this demand. Options included fresh groundwater and alternative water sources such as seawater desalination and surface water, reclaimed water and water conservation. A Marion County Compendium to the Master Plan Update was completed in November 2009 to include the county in the planning efforts, since the county rejoined the WRWSA shortly after the completion of the plan update.

The feasibility analysis of proposed water supply options, reclaimed water optimization and water conservation within the WRWSA was completed in June 2010. The feasibility analysis includes the development of conceptual designs and feasibility analyses of options, prioritization of options and selection and coordination with local partners to implement the options. Demand evaluations were included to account for recent changes in economic conditions. Potential water sources were evaluated to assess environmental impacts, ability to permit, public perception, long-term viability, relative cost and time required to implement, conflicts with existing sources, ability to serve multiple users and compatibility with current utility systems. Feasibility analyses of water supply options will progress to higher levels in areas having the highest water supply demand and will include sizing, cost-estimation, cost-benefit analyses, timing/scheduling and optimization.

Northern Planning Region modeling and technical support for local communities is being conducted simultaneously with other phases of the Program. In addition to joint groundwater modeling efforts between the District and the SJRWMD, the WRWSA provides qualified expertise and technical support to local member communities to help them prepare and interpret technical modeling data.

3.0 Marion County Water Resource Assessment and Management Project (WRAMP)

In response to increasing demands for groundwater and the designation of areas within and adjacent to Marion County in the SJRWMD as priority water resource caution areas, Marion County initiated development of the WRAMP in 2004. The WRAMP is a cooperative effort among the District, the SJRWMD and Marion County to define the future water demands in the county and identify how these demands can be met in an environmentally sustainable manner. Through the WRAMP, the District and the SJRWMD assisted the county in inventorying, evaluating and assessing the water resources and long-term water requirements of the county and determining the effects of using groundwater to meet projected water demands. The WRAMP also involved analyzing and modifying as necessary, comprehensive plan policies and land development regulations aimed at protecting, developing and managing the county's water resources. Major tasks included in the WRAMP were the projection of water demands to 2025 and 2055, using a regional model to simulate the effects of meeting future demands exclusively with groundwater, and evaluating whether projected demands can be met without adverse impacts to environmental systems.

4.0 North Central Florida Coordination Area

The North Central Water Supply Planning Area (NCFCA) includes parts of Lake, Sumter and Marion counties. The District is coordinating its water supply planning efforts with the SJRWMD in this area. Specific objectives include developing a consistent understanding of the area hydrogeology, the degree to which groundwater can meet growing water supply need and the roles of conservation, reuse and alternative water supplies in the region. Within those larger programs, specific areas of coordination include resource assessment, water supply rule application and outreach messaging. Both water management districts are implementing prevention strategies focused on avoiding critical water levels in both aquifer and wetland systems. Like the inland areas of the Northern Planning Region, the geology of western Marion County is largely a thin layer of sands and silts topping a sequence of marine carbonate deposits underscored by thick layers of limestone. Moving east through the county, this karst geology transitions into a more confined aquifer system. This transition of aquifer systems is evidenced by differing surface features such as large lakes (Kerr, Halfmoon and Weir) along with contiguous wetland systems, present in eastern Marion County but largely absent in the western county. The Districts' continued work to reconcile how differences in hydrogeologic characteristics and surface features impact their approaches to groundwater modeling and groundwater availability assessment is an example of the technical issues being collaboratively resolved by the two water management districts. The SWFWMD and SJRWMD are committed to sharing groundwater monitoring data, exchange groundwater modeling methodologies and collaboratively discuss the findings of these activities with the end goal of preserving the region's water resources while providing ample, economically viable water supplies for its residents.

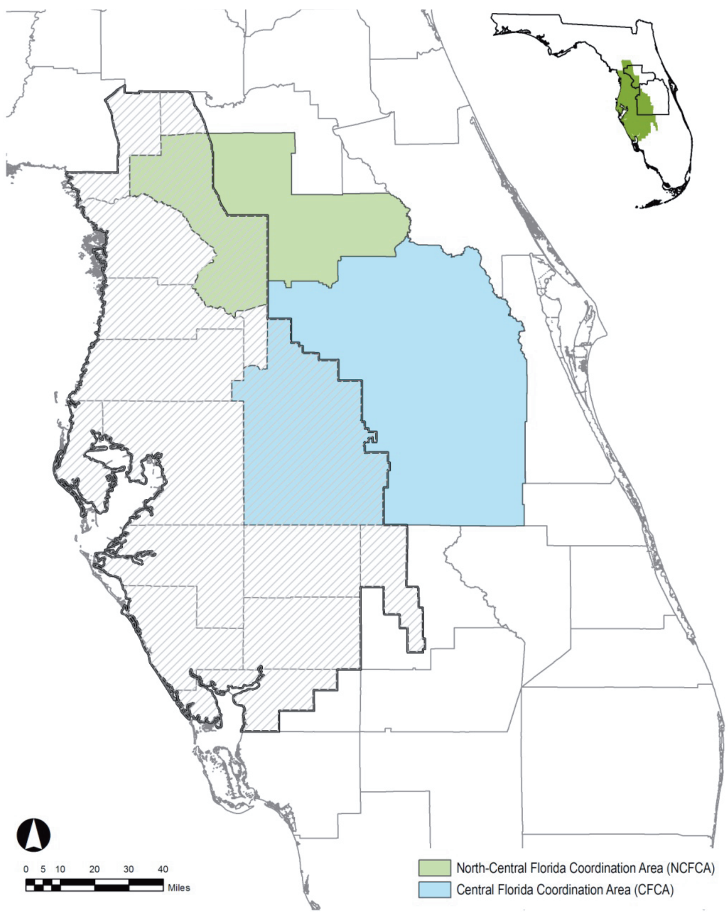



Figure 2-3 *Location of the North-Central Florida Coordination Area and the Central Florida Coordination Area*

5.0 Central Florida Coordination Area (CFCA)

The CFCA encompasses Orange, Osceola, Polk, Seminole and southern Lake counties (Figure 2-3). In this region, the District, the SJRWMD and the South Florida Water Management District have each concluded through detailed water supply planning and individual permit actions that the development of additional groundwater from the Upper Floridan aquifer to meet the projected growth in public water supply demand over the next 20 years would cause harm to the water resources of the region. Because the CFCA is located within three WMDs, an action plan was developed by the WMDs in the fall of 2006 to ensure a coordinated and consistent approach to managing the area's water resources. Portions of the regulatory component of the action plan were put in place through adoption of amendments to existing water use permitting rules in December 2007. Key provisions of the rules require that additional fresh groundwater withdrawals for all uses be limited to what is necessary to meet 2013 demands and permit durations may be limited to 2013, or a longer duration permit will be limited to those fresh groundwater withdrawals documented as the applicant's demonstrated 2013 demand, unless there is a commitment to develop alternative water supplies. This first set of rules is considered to be temporary in nature and will sunset in December 2012. Development of long-term rules began in 2008 and the WMDs are continuing to pursue the action plan. Although the entirety of Polk County is included in the CFCA for water supply planning purposes, the first set of rules only apply to the portion of the county not within the SWUCA, in recognition that the SWUCA rules are as protective of the resource as those for the CFCA and to avoid confusion as to which rules apply.

As part of the implementation of the action plan, field investigations to assess the current status of environmental systems in the area are being conducted and analyses to determine whether existing levels of groundwater withdrawals are causing adverse impacts are being prepared. The WMDs are also preparing groundwater modeling assessments to determine whether projected levels of future withdrawals are sustainable. Results of these analyses will provide the technical basis for development of a water resource management plan for the region. The three WMDs are currently collaborating on water supply planning and water resource assessments for the region.

## Section 2. Recovery Strategies

Section 373.0421(2), F.S., requires that a recovery strategy be developed if the existing flow or level in a water resource is below, or within 20 years is projected to fall below, established MFLs. The District established recovery strategies by rule in Chapter 40D-80, F.A.C. When MFLs for a water resource are not being met or, as part of a recovery strategy, are not expected to be met for some time in the future, the District will first examine the established MFLs in light of any newly obtained scientific data or other relevant information to determine whether the MFLs should be reassessed. If no reassessment is necessary, the management tools listed below are available to restore the water resource to meet its MFL.

- Developing additional supplies
- Implementing structural controls and/or augmentation systems to raise levels or increase flows in water bodies
- Reducing water use permitting allocations
- Requiring the use of alternative water supply sources

District water resource assessments and MFL investigations have so far concluded that recovery strategies are not required in the Northern Planning Region.

## Part D. Reservations

Subsection 373.223(4), F.S., authorizes reservations of water by providing as follows:
"The governing board or the department, by regulation, may reserve from use by permit applicants, water in such locations and quantities, and for such seasons of the year, as in its judgment may be required for the protection of fish and wildlife or the public health and safety…"

The District will consider establishing a reservation of water when a District water resource development project will produce water needed to achieve compliance with established MFLs. Reservations of water will be established by rule. The rule-making process allows for public input to the Governing Board in its deliberations about establishing a reservation including, among other matters, the amount of water to be reserved and the time of year the reservation would be effective. There are currently no plans to establish a reservation in the Northern Planning Region.

## Part E. Climate Change

### *Section 1. Overview*

Climate change has been a growing global concern for several decades. According to the United States Environmental Protection Agency (EPA), a global warming trend of about 1.0°F to 1.7°F has occurred from 1906–2005. This warming trend is believed to be the result of increased levels of greenhouse gases (GHG) such as carbon dioxide ($CO_2$) in the earth's atmosphere. Climate change is a global issue that will require international coordination and planning but local, regional and statewide strategies will be extremely important in alleviating the potential impacts.

In the state of Florida, regional and statewide models indicate the potential for increased rates of sea level rise, precipitation fluctuations, flooding of low-lying areas, erosion of beaches, loss of coastal wetlands, intrusion of salt water into water supplies and increased vulnerability of coastal areas to storms and hurricanes. As a result, Governor Crist has acknowledged the need to reduce statewide GHG emissions and develop recommendations for long-term policies that address the potential impacts of climate change. The Governor has issued Executive Orders that lay out a set of immediate actions to address climate change issues, and he has convened two Florida Summits on Global Climate Change. In response, the Florida Legislature has reorganized Florida's Energy Office Program and created a new Energy and Climate Commission.

Florida now has partnership agreements with Germany and the United Kingdom outlining climate policies and mutual economic benefits, a state climate change web site, and an Action Team on Energy and Climate Change, which was established to identify the policy areas likely to require adaptive management. One of the primary policy areas identified was water resource management, including several goals relating to the effect of climate change on water supply planning efforts. In addition, the Century Commission's 2008 Water Congress recommended support for Florida-specific research on climate change and water management interrelationships to better understand the state's water vulnerabilities and adaptation potential. The Water Congress recommended this research include the following: protection of drinking water and wastewater infrastructure against the threat of rising sea level; increased water use efficiencies to reduce carbon footprints; and consideration of energy and greenhouse emission consequences of water supply activities (Century Commission 2009). These research needs and potential risks associated with climate change mandate that they be addressed in water supply planning.

Climate change is one water supply challenge among many such as drought, deterioration in groundwater and surface water quality, and limitations on the availability of water sources. This section of the RWSP will address the potential issues of concern for water supply planning as a result of climate change, identify current management strategies in place to address these concerns and consider future strategies necessary to adaptively manage water supply resources in the face of a changing climate.

Sources of climate change information include: the US Global Change Research Program (www.globalchange.gov/), the EPA's climate change web site, and the Florida State University Beaches and Shores Resource Center and the Center for Economic Forecasting and Analysis' report on sea level rise in Florida (based on the work of the Intergovernmental Panel on Climate Change).

### *Section 2. Possible Effects*

Although the nature, magnitude and timing of the effects of climate change are not well understood, current data suggest that water supply planning may be affected in three primary ways: sea level rise, air temperature rise and changes in precipitation regimes.

1.0 Sea Level Rise

According to the EPA's climate change web site, sea levels along the Mid-Atlantic and Gulf coasts have already risen 5 to 6 inches more than the global average in the last century due to the subsidence of coastal lands in this region. In late 2008, the Florida State University Beaches and Shores Resource Center and the Center for Economic Forecasting and Analysis published a report on sea level rise in Florida. The report presented low-end and high-end scenarios based on the work of the Intergovernmental Panel on Climate Change (IPCC) and the center's own analysis of trends. They estimated that by 2080, sea level will rise between 0.82 feet and 2.13 feet (Harrington et al., 2008). Such changes would stress southwest Florida's water resources in a variety of ways. Rising sea levels would cause salt water to encroach further up coastal rivers into freshwater intakes of water treatment plants. Saltwater intrusion would also threaten coastal aquifers that supply urban, agricultural and industrial water users. Most of Florida's population, and the water infrastructure to serve them, reside within 50 miles of the coast, and population is projected to increase in these areas. New and existing water supply infrastructure that will be needed to serve this population would be impacted by higher storm surges. The cost of constructing, repairing and retrofitting infrastructure to meet the threat of sea level rise and higher storm surges will be very high.

2.0 Air Temperature Rise

The IPCC predicts that by 2100 the average temperature at the earth's surface could increase anywhere from 2.5 to 10.4°F (IPCC 2007). Evaporation is likely to increase with a warmer climate, which could result in lower river flows, lower lake levels and greater challenges balancing the needs of humans with the needs of the environment during drier periods. Increased evaporation is likely to have an impact upon runoff, soil moisture and groundwater recharge, in addition to adversely affecting water supply availability from surface water sources and reservoirs (IPCC 2008). Additionally, higher air temperatures may cause declines in water quality that could raise the cost of treatment to meet potable water-quality standards. This uncertainty may significantly decrease the reliability and increase the cost of surface water supply sources.

3.0 Precipitation Regimes and Storm Frequency

Current models suggest that overall precipitation will generally decrease in sub-tropical areas (IPCC 2008). However, due to warming sea surface temperatures, tropical storms and hurricanes are likely to become more intense, produce stronger peak winds and increased rainfall over some areas. Studies show that in humid regions, higher summer temperatures are related to an increased probability of severe convective weather and the frequency of heavy and very heavy rain events resulting in higher peak flows and increased flooding in some areas (Groisman, et al., 2005). In addition, very heavy rain events have increased over most of the contiguous United States and evidence is growing that the observed historical trend of increased very heavy rain events is linked to climate change (Groisman et al., 2005).

### *Section 3. Current Management Strategies*

The District has taken several steps to address the management of water resources in light of a changing climate. First, the District's data collection and monitoring activities are likely to provide information critical to monitoring and responding to local climate change. Long-established networks of rainfall and streamflow gage stations, many with real-time electronic reporting, provide continuous streams of data that will enable the District to monitor changes in local hydrology. In addition to monitoring rivers, lakes, springs and wetlands to ensure adequate water to sustain natural systems and provide for human use, the District has an extensive network of coastal and inland surface and groundwater monitoring sites to collect and analyze water quality data, including information about saltwater intrusion. In those places where water quantity and quality issues become evident, the District implements programs, projects and regulations to address them. The District also participates in local, state and national discussions on these issues in order to accommodate timely and effective responses to climate changes as they become evident.

The District also encourages maximizing the use of diverse water supply sources and establishing system redundancies to ensure a resilient water supply. For example, the District promotes water conservation across all use sectors, from agriculture and industrial to residential and commercial uses, which not only saves supplies for the future, but also reduces chemical and energy use. The District continues to increase the availability and use of reclaimed water through partnerships, the development of wet-weather storage facilities and requirements for efficiency enhancements. Additionally, the District supports and co-funds projects to interconnect water supply systems, either potable or nonpotable, to ensure adequate supplies from dispersed sources and redundancy for emergencies. The District also emphasizes the need for diversified water supply sources and helps to fund environmentally sustainable and drought-resistant water supply options such as reclaimed water, stormwater reuse, brackish groundwater, surface water reservoirs, aquifer storage and recovery and the country's largest seawater desalination plant.

Efforts like these are possible by leveraging partnerships through programs such as the District's Cooperative Funding Initiative (CFI). The CFI is an important cost-share program that can be used to accomplish a variety of objectives relating to water supply and climate change. For example, through cooperative funding, the District can improve water use efficiency and demand management, both of which are effective options to cope with climate change (Bates et al., 2008). Collectively, these efforts will be very important in ensuring an adequate and resilient water supply in the face of various water supply challenges and will play an important role in meeting demands in a changing climate. Through these and other measures, the District is well positioned to address and adapt to changes that may result from the alteration of historic climate regimes.

### *Section 4. Future Adaptive Management Strategies*

Meeting the new challenges to water supply planning posed by climate change will require new tools. More region-specific modeling and forecasts are needed to better understand the nature of these changes. While many District efforts provide ongoing and critical information and allow the flexibility to accommodate future changes, effective adaptation to climate change will require an estimate of the likely magnitude and timing of change. Any such projections will have some uncertainty and the planning response must recognize that uncertainty. An important means of reducing uncertainty is assessing the most plausible scenarios for climate variability and change in Florida. Florida's Energy and Climate Change Action Plan (2008) points out the need to identify and quantify the potential effects of differing scenarios on the vulnerabilities and reliability of existing water supplies. The development of risk assessments can help determine adaptation needs and potential program changes in a variety of areas.

While GHGs are generally recognized as the primary source of human-induced climate changes, the National Center for Atmospheric Research in Boulder, Colorado, notes changes in historical land cover may also play an important role. Over the past 100 years, a large percentage of Florida's wetlands have been drained and converted for other uses. This large-scale transformation has potentially modified the regional climate, making the days warmer in summer and the nights colder in winter, as well as causing decreased inland rainfall. By comparing differences in rainfall between 1993 and pre-1900, average state precipitation may have been reduced as much as 12 percent (Lindsey 2005). Regardless of the reason for hydrologic changes, planning and acting sooner rather than later can significantly lessen impacts and reduce the costs needed to adapt to these changes as they occur. The District has a statutory responsibility to review land-use changes and provide technical assistance to local governments, such as quantifiable conservation data and strategies, to protect current water sources and limit demands. As other adaptive strategies are developed, it will be the District's role to promote their adoption by the 98 local governments within its boundaries through planning, communication and regulatory activities.

Climate change may have significant potential to affect water supply sources and should be factored into evaluations of the adequacy of supplies to meet future demand. It also has potential to dramatically change patterns of demand, and could, therefore, be an important consideration in demand projections. Changes in the nature of supply and demand would necessitate infrastructure adaptation. High cost and relative uncertainty can make these adaptations problematic; however, as related information is generated, existing and proposed water sources and projects will be evaluated to determine their feasibility and desirability in light of a changing environment. For these reasons, the District is maintaining a "monitor and adapt" approach toward climate change. The District will actively monitor research projects, both locally and nationally, interpret the results and initiate appropriate actions necessary to protect the water resources in the region as the effects of climate change become evident.

Changes to the environment may ultimately result from climate change. At present, Florida's water managers do not have a clear understanding of what those changes will be. The WMDs are important players in maintaining Florida's unique quality of life, water resources, environmental sustainability and economic vitality. The District will play an influential role in quantifying, proactively planning for and implementing actions that address the uncertainties and risks associated with climate change in the region.

Southwest Florida Water Management District

# Chapter 3: Demand Estimates and Projections

Water for golf course irrigation and other recreational and aesthetic uses is a significant component of projected water supply demand.

This chapter is a comprehensive analysis of the demand for water for all use categories in the Northern Planning Region for the 2005–2030 planning period. The chapter includes the District's methods and assumptions used in projecting water demand for each county, the demand projections in five-year increments and an analysis and discussion of important trends in the data. Water demand has been projected for the public supply, agricultural, industrial, commercial, mining, dewatering, power generation and recreational aesthetic categories for each county in the planning region. An additional water use category, environmental restoration, comprises quantities of water that need to be developed and/or existing quantities that need to be retired to meet established MFLs. The environmental restoration demand could increase during the planning period based on the recovery requirements of MFLs established in future years. The methodologies used to project demand for each category are briefly summarized in this chapter and presented in greater detail in the Chapter 3 Appendix.

The demand projections represent those reasonable and beneficial uses of water that are anticipated to occur through the year 2030. Five-in-10 (average condition) and 1-in-10 (drought condition) demands have been determined for each five-year increment from 2005 to 2030 for each category. The demand projections for counties located partially in other WMDs (Lake, Levy and Marion) reflect only the anticipated demands in those portions located within the District's boundaries. Decreases in demand are reductions in the use of groundwater for the agricultural and industrial/commercial, mining/dewatering and power generation use categories. Decreases in demand are not subtracted from increases in demand but are tracked in separate tables. This is because increases in demand may be met with alternative sources and/or conservation and the retired groundwater quantities may be reallocated for mitigation of new groundwater permits for other use categories and/or permanently retired to help meet future environmental restoration requirements.

General reporting conventions for the RWSP were guided by the document developed by the Water Planning Coordination Group: *Final Report: Development and Reporting of Water Demand Projections in Florida's Water Supply Planning Process,* (WPCG, 2005). This document was produced by the Water Demand Projection Subcommittee of the Water Planning Coordination Group, a subcommittee consisting of representatives from the WMDs and the FDEP, formed in 1997 as a means to reach consensus on the methods and parameters used in developing RWSPs. Some of the key guidance parameters include:

- Establishment of a base year: The year 2005 was agreed upon as a base year to develop and report water demand projections. This is consistent with the methodology agreed upon by the Water Planning Coordination Group. The data for the base year consist of reported and estimated usage for 2005, whereas data for the years 2010 through 2030 are projected demands.
- Water use reporting thresholds: Minimum thresholds of water use within each water use category were agreed upon as the basis for projection.
- 5-in-10 versus 1-in-10: For reporting demand in average versus drought conditions, specific parameters were prescribed for at least a portion of the demand related to all water supply categories except industrial, commercial, mining, dewatering and power generation. In general, demand is reported for a 5-in-10 average annual effective rainfall condition and a 1-in-10 drought year condition (an increase in water demand having a 10 percent probability of occurring during any given year).

The projected demand represents the total amount of water required to meet reasonable and beneficial water needs through 2030. Total demand does not account for reductions that could be achieved by additional demand management measures. Water conservation and other sources are accounted for separately in Chapter 4 as a means by which demand can be met.

## Part A. Water Demand Projections

The following is a brief summary of the methods used to project water demand. Demand projections were developed for five categories: (1) public supply, (2) agriculture, (3) industrial/commercial, mining/dewatering and power generation, (4) recreational/aesthetic and (5) environmental restoration. The categorization provides for the projection of demand for similar water uses under similar assumptions, methods and reporting conditions.

*The increase in demand for public supply water use in the planning region in 2030 is projected to be much larger than the increases for all other uses combined.*

### *Section 1. Public Supply*

1.0 Definition of the Public Supply Water Use Category

The public supply category consists of four subcategories: (1) large utilities (permitted for 0.1 mgd or greater), (2) small utilities (permitted for less than 0.1 mgd), (3) domestic self-supply (individual private homes or businesses that are not utility customers that receive their water from small wells that do not require a water use permit, and (4) additional irrigation demand (water from domestic wells that do not require a water use permit and used for irrigation by residences that rely on a utility for indoor and other non-irrigation water needs).

## 2.0 Population Projections

### 2.1 Base Year Population

All WMDs agreed that 2005 would be the base year from which projections would be determined. The 2005 base year population for each county was derived from the *Estimated Water Use Report* (SWFWMD, 2005a). Population and per capita water use was obtained from historical data previously collected and analyzed by the District or from data provided as part of the District's water supply planning process.

### 2.2 Methodology for Projecting Population

The population projections developed by the Bureau of Economic and Business Research (BEBR) are generally accepted as the standard throughout Florida. However, these projections are made at the county level only and accurate projections of future water demand require more spatially precise data. The District achieved this by developing a model that projects future permanent population growth at the census block level, distributes that growth to parcels within each block and normalizes those projections to BEBR county projections. The model is comprehensively described in the Chapter 3 Appendix.

## 3.0 2005 Base Year Water Use and Per Capita Rate

### 3.1 Base Year Water Use

The 2005 public supply base year water use for each large utility is derived by multiplying the average 2003–2007 unadjusted gross per capita rate by the 2005 estimated population for each individual utility. Base year water use for small utilities is derived by multiplying the average 2003–2007 unadjusted gross countywide per capita rate by the 2005 estimated population for the additional estimated population associated with those non-reporting utilities, contained in Table 1 of the *Estimated Water Use Report* (SWFWMD, 2005a).

## 4.0 Water Demand Projection Methodology

### 4.1 Public Supply

Water demand is projected in five-year increments from 2010 to 2030. To develop the projections, the District used the 2003–2007 average per capita rate multiplied by the projected population for that increment. An additional component of public water supply demand is water derived from domestic wells for irrigation. These wells have a diameter of less than 6", do not require a water use permit and are used for irrigation at residences that receive potable water for indoor use from a utility. These wells are addressed in a separate report entitled *Southwest Florida Water Management District Irrigation Well Inventory* (D.L. Smith and Associates, 2004). This report provides the estimated number of domestic irrigation wells within the District and their associated water demand. The District estimates that approximately 300 gpd are used for each well.

4.2 Domestic Self-Supply

Domestic self-supply population is as any current and future functional population parcel projections developed using the District's GIS population projection model (GIS Associates, Inc., 2008, 2009) that are not within a water utility retail service area.

5.0 Water Demand Projections

Table 3-1 shows the projected public supply demand for the planning period. The table shows that demand will increase by 72 mgd for the 5-in-10 condition. The projections are generally consistent with those of the District's 2006 RWSP with the exception of Sumter County where there is a 37 percent difference between the current projection of 22 mgd and the projection documented in the 2006 RWSP of 17 mgd. This is primarily due to the significant and recent growth in The Villages and the City of Wildwood. Other differences in the projections from those in the 2006 RWSP can be attributed to changes in methodology for the per capita rate used, the change in methodology and threshold for the large utility category and the general trend of decreases in per capita water use reported by permittees.

6.0 Stakeholder Review

Population and water demand projection methodologies, results and analyses were provided to the District's water use regulation staff and public water use stakeholders for review. Changes suggested by stakeholders were incorporated only if they were based on historical regression data and long-term trends and supported by complete documentation.

*The washing of laundry accounts for 15 to 40 percent of the overall water consumption in a typical household of four persons.*

Table 3-1 *Projected increase in public supply demand including public supply, domestic self-supply and private irrigation wells in the Northern Planning Region (mgd)*

| County | 2005 Base | | 2005–2010 | | 2010–2015 | | 2015–2020 | | 2020–2025 | | 2025–2030 | | Total Increase | | % Increase | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 |
| **Citrus** | **22.0** | **23.3** | 5.5 | 5.9 | 2.9 | 3.0 | 2.5 | 2.7 | 2.4 | 2.5 | 2.2 | 2.3 | **15.5** | **16.4** | **70.4%** | **70.4%** |
| **Hernando** | **28.1** | **29.8** | 3.5 | 3.7 | 3.3 | 3.5 | 3.0 | 3.2 | 2.7 | 2.8 | 2.8 | 3.0 | **15.3** | **16.2** | **54.4%** | **54.4%** |
| **Lake** | **0.1** | **0.1** | - | - | - | - | - | - | - | - | - | - | **0.0** | **0.0** | **0.0%** | **0.0%** |
| **Levy** | **2.5** | **2.7** | 0.6 | 0.6 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 | 0.3 | 0.3 | 0.2 | **1.7** | **1.7** | **68.0%** | **62.9%** |
| **Marion** | **15.1** | **16.0** | 5.6 | 5.9 | 3.2 | 3.4 | 2.7 | 2.9 | 3.0 | 3.2 | 3.0 | 3.2 | **17.5** | **18.6** | **115.9%** | **116.2%** |
| **Sumter** | **14.6** | **15.4** | 8.8 | 9.4 | 3.5 | 3.7 | 5.2 | 5.5 | 1.7 | 1.8 | 2.9 | 3.1 | **22.1** | **23.5** | **151.4%** | **152.5%** |
| **Incremental Increase** | **n/a** | **n/a** | **24.0** | **25.5** | **13.2** | **13.9** | **13.7** | **14.6** | **10.0** | **10.6** | **11.2** | **11.8** | **72.1** | **76.4** | **87.5%** | **87.4%** |

*Water used for outdoor irrigation in the planning region is a large component of current public supply use and future demand.*

### Section 2. Agriculture

1.0 Description of the Agricultural Water Use Category

*The demand for water for agricultural purposes in the planning region is projected to increase by nearly 3 mgd during the planning period.*

Agriculture is the second largest category of water use in the District. Included in this category are irrigated crops and other miscellaneous water uses associated with agricultural commodity production. Irrigated acreage was determined for the following commodities: (1) citrus, (2) vegetables, melons and berries (cucumbers, melons, potatoes, strawberries, tomatoes, other vegetables and row crops), (3) field crops, (4) greenhouse/nursery, (5) sod and (6) pasture. Projected water demand associated with aquaculture, dairy, poultry, swine, etc., are reported as "Miscellaneous."

2.0 Water Demand Projection Methodology

Demand projections for irrigated commodities were determined by multiplying projected irrigated acreage by the irrigation requirements of each commodity. Acreage projections were formulated based on a cumulative review of the information through GIS/permitting analysis, analysis of historical Florida Agricultural Statistics Service (FASS) data, and other sources using a base year of 2005. The District's GIS resources were used to compare the agricultural water use permitting information and land-use/land cover property appraiser parcel data for each county and to record the future land use for each parcel and permitted area. The acreage increases were limited by the total available remaining land and total permitted quantity of water. This method attempted to account for land-use transition between agriculture and residential, commercial, or industrial use, and a land-use conversion trend was determined. Aerial photography provided another layer of information for land-use/land cover analysis and commodity category determination.

3.0 Water Demand Projections

Trends indicate that agricultural activities are expected to remain at or near their current levels Districtwide during the planning period. These trends include declining or stable land costs, a reduced pace of urban development and enhanced focus by the agricultural industry on solutions to destructive insect and disease outbreaks. Agriculture in the planning region has historically been practiced at a considerably smaller scale than in the District's planning regions to the south. In 2010, more than 19 mgd will be used to irrigate 15,600 acres of agricultural commodities.

Table 3-2a is the projected increase in agricultural water demand for the 5-in-10 and 2-in-10 conditions for the planning period. For the 5-in-10 condition, agricultural water demand is projected to increase from 18.9 mgd in 2005 to 22.2 mgd in 2030, an increase of 3.2 mgd, or 17 percent. The majority of the increase will be for field crops and nurseries. Other crop categories, such as vegetables/row crops and pasture, will also experience increases in water use. Table 3-2b is the projected decrease in agricultural irrigation demand for the 5-in-10 and 2-in-10 conditions for the planning period. For the 5-in-10 condition, a decrease in demand of 0.8 mgd is projected. This reduction in demand represents a reduction in the use of groundwater, which is tracked separately and not subtracted from the increase in demand. This is because increases in agricultural demand may be met with alternative sources or conservation. The retired groundwater quantities may be reallocated for mitigation of new groundwater permits for other use categories and/or permanently retired to help meet future environmental restoration requirements.

4.0 Stakeholder Review

The agricultural water demand projection methodology, results and analyses were provided to the District's water use regulation staff and agricultural stakeholders for review. Changes suggested by stakeholders were incorporated only if they were based on historical regression data and long-term trends and supported by complete documentation. Review of the commodity acreages by agricultural experts was varied: some believed that for some commodities in some counties the projections were too high; others, too low. The District reviewed these comments, compared them to the methods used to produce the irrigated acreage projections for the 2006 RWSP (SWFWMD, 2006), and made revisions where appropriate. The general consensus after public comment was that citrus acreage projections were unrealistically low and should be revisited. As a result, the citrus projections were revised based on a combination of historical FASS data and knowledge of emerging trends.

## *Section 3. Industrial/Commercial, Mining/Dewatering and Power Generation (I/C,M/D,PG)*

*Numerous limerock mines are located in the planning region. The demand for water for mining and other industrial uses is projected to decrease by more than 6 mgd during the planning period.*

1.0 Description of the I/C,M/D,PG Water Use Category

I/C,M/D,PG uses within the District include chemical manufacturing, food processing and miscellaneous industrial and commercial uses. Much of the water used in food processing is for citrus and other agricultural commodities. Chemical manufacturing is associated with phosphate mining and consists mainly of phosphate processing. Water for thermoelectric power generation is used for cooling or other purposes associated with the generation of electricity.

Table 3-2a. *Projected increase in agricultural irrigation demand in the Northern Planning Region (5-in-10 and 2-in-10) (mgd)*

| County | 2005 Base | | 2005–2010 | | 2010–2015 | | 2015–2020 | | 2020–2025 | | 2025–2030 | | Total Increase | | % Increase | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5-10 | 2-10 | 5-10 | 2-10 | 5-10 | 2-10 | 5-10 | 2-10 | 5-10 | 2-10 | 5-10 | 2-10 | 5-10 | 2-10 | 5-10 | 2-10 |
| Citrus | 0.45 | 0.62 | - | - | - | - | - | - | - | - | - | - | 0.00 | 0.00 | 0.0% | 0.0% |
| Hernando | 2.31 | 2.84 | - | - | 0.05 | 0.09 | 0.03 | 0.05 | 0.04 | 0.05 | 0.02 | 0.05 | 0.14 | 0.24 | 6.1% | 8.4% |
| Lake | 1.86 | 2.56 | - | - | - | - | - | - | - | - | - | - | 0.00 | 0.00 | 0.0% | 0.0% |
| Levy | 4.79 | 8.09 | 0.11 | 0.17 | - | - | 0.04 | 0.08 | - | - | 0.01 | 0.01 | 0.16 | 0.26 | 3.3% | 3.2% |
| Marion | 2.98 | 5.08 | - | | 0.06 | 0.11 | 0.06 | 0.11 | 0.07 | 0.11 | 0.09 | 0.14 | 0.28 | 0.47 | 9.4% | 9.2% |
| Sumter | 6.55 | 6.91 | 0.64 | 0.70 | 0.67 | 0.73 | 0.67 | 0.73 | 0.67 | 0.73 | - | 1.0 | 2.65 | 3.89 | 40.4% | 56.3% |
| Incremental Increase | n/a | n/a | 0.75 | 0.87 | 0.78 | 0.93 | 0.80 | 0.97 | 0.78 | 0.89 | 0.12 | 1.20 | 3.23 | 4.86 | 17.0% | 18.6% |

Table 3-2b. *Projected decrease in agricultural irrigation demand in the Northern Planning Region (5-in-10 & 2-in-10) (mgd)*

| County | 2005 Base | | 2005–2010 | | 2010–2015 | | 2015–2020 | | 2020–2025 | | 2025–2030 | | Total Decrease | | % Decrease | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5-10 | 2-10 | 5-10 | 2-10 | 5-10 | 2-10 | 5-10 | 2-10 | 5-10 | 2-10 | 5-10 | 2-10 | 5-10 | 2-10 | 5-10 | 2-10 |
| Citrus | 0.45 | 0.62 | -0.05 | -0.05 | - | -0.01 | -0.01 | -0.01 | - | - | -0.01 | -0.01 | -0.07 | -0.08 | 15.6% | 12.9% |
| Hernando | 2.31 | 2.84 | -0.01 | -0.03 | - | | - | - | - | - | - | - | -0.01 | -0.03 | 0.4% | 13.1% |
| Lake | 1.86 | 2.56 | -0.18 | -0.26 | -0.13 | -0.15 | -0.13 | -0.15 | -0.13 | -0.16 | -0.13 | -0.15 | -0.70 | -0.87 | 37.6% | 34.0% |
| Levy | 4.79 | 8.09 | - | - | -0.01 | -0.01 | - | - | - | - | - | - | -0.01 | -0.01 | 0.2% | 0.1% |
| Marion | 2.98 | 5.08 | - | -0.01 | - | - | - | - | - | - | - | - | 0.00 | -0.01 | 0.0% | 0.2% |
| Sumter | 6.55 | 6.91 | - | - | - | - | - | - | - | - | - | - | 0.00 | 0.00 | 0.0% | 0.0% |
| Incremental Decrease | n/a | n/a | -0.24 | -0.35 | -0.14 | -0.17 | -0.14 | -0.16 | -0.13 | -0.16 | -0.14 | -0.16 | -0.80 | 1.0 | 4.2% | 3.8% |

M/D water use is associated with a number of products mined in the planning region, including limestone and sand.

## 2.0 Demand Projection Methodology

Demand projections were developed by multiplying the amount of water permitted to each I/C,M/D,PG facility by the percentage of permitted quantities historically used in the category in each county. The permitted quantity for each facility was the value contained in the District's Water Management Information System (WMIS) in October 2008 (SWFWMD, 2008a). The percentage of the permitted quantity historically used in each county was calculated by dividing total estimated county use by the county's permitted quantity in each category for the years 2001 through 2006, using data from the District's estimated water use reports. During this six-year period, 38.2 percent of M/D permitted quantities and 42.1 percent of I/C permitted quantities were actually reported as used Districtwide. However, the percentage of permitted quantity actually used in the I/C and M/D categories varies significantly from county to county. When data was available, the percentage of the permitted quantity actually used by each PG water use permittee was used to project water demand on a permit-by-permit basis. When individual power station data was not available, the Districtwide average use for PG was used. While not considered in these demand projections, Progress Energy has proposed the development of a nuclear power facility in southern Levy County. While the construction schedule is uncertain, preliminary estimates indicate the facility will require approximately 110 mgd of seawater and 3 to 5 mgd of fresh groundwater for cooling purposes. More refined demand numbers, for the facility and surrounding development, will be factored in the 2015 update to this plan.

When the 2001 RWSP was completed, it was noted that the District had experienced a tremendous amount of turnover in the number of I/C and M/D water use permits in a short period of time. A comparison of currently existing water use permits with those that existed when the demand projections were compiled for the 2006 RWSP indicates that permit volatility remains a significant factor. There were 426 I/C and M/D water use permits as of October 2008. This number includes 90 newly issued permits not in existence in 2005, 63 that were not captured in 2005 and 90 that existed in 2005 but have since been deleted. This equates to a net change of 57 percent in total permits since data for the 2006 RWSP was compiled. Therefore, permit volatility must be considered when attempting to project water demand over a 20-year period. Because of permit volatility, it is conceivable, even probable, that new permits have been issued and others have been deleted or expired since October 2008. Thus, the 2010 projections are based on a "snapshot in time."

## 3.0 Water Demand Projections

Table 3-3a is the projected I/C,M/D,PG water demand for the planning period. The table shows an increase in demand from 23.3 mgd in 2005 to 27.0 mgd in 2030, an increase of 3.7 mgd, or nearly 16 percent. Although the Northern Planning Region was not included in the 2006 RWSP, permitted quantities are 41.7 mgd lower than when the demand projections were formulated for the 2006 RWSP. The planned construction of a nuclear power station in Levy County will increase PG demand in the region, but there are several limestone mining operations with water use permits that have been revised downward since 2005. Due to the projection method used, the quantity permitted is a key factor in calculating future demand. For several years, the

Table 3-3a. *Projected increase in industrial/commercial, mining/dewatering, power generation demand in the Northern Planning Region (mgd) (5-in-10)*[1]

| County | 2005 Base | 2005–2010 | 2010–2015 | 2015–2020 | 2020–2025 | 2025–2030 | Total Increase | % Increase |
|---|---|---|---|---|---|---|---|---|
| **Citrus** | **1.7** | 1.1 | 0.1 | 0.1 | 0.1 | 0.1 | **1.5** | **88.2%** |
| **Hernando** | **17.3** | - | 0.3 | 0.4 | 0.3 | 0.4 | **1.4** | **8.1%** |
| **Lake** | **0.0** | - | - | - | - | - | **0.0** | **0.0%** |
| **Levy** | **0.0** | - | 0.6 | - | - | - | **0.6** | **n/a**[2] |
| **Marion** | **0.1** | - | - | - | 0.1 | - | **0.1** | **100%** |
| **Sumter** | **4.1** | - | - | - | 0.1 | - | **0.1** | **2.4%** |
| **Incremental Increase** | **n/a** | **1.1** | **1.0** | **0.5** | **0.6** | **0.5** | **3.7** | **15.9%** |

[1]For the I/C,M/D,PG category, water use for the 5-in-10 and 1-in-10 condition is the same.
[2]Because the base quantity is zero, the percent change is extremely high. The absolute change is only 0.6 mgd.

permitted quantity in the I/C and M/D sectors has been declining, mostly due to revisions in the way permitted quantities are allocated by the District's regulation division. Non-consumptive dewatering uses are no longer included in permitted quantities. For the 2006 RWSP, demand was calculated based on a Districtwide permitted quantity of 396.8 mgd, while 2010 RWSP demand was calculated based on a permitted quantity of 273.2 mgd, a reduction of 123.6 mgd, or 31 percent. As a result, projected 2010 RWSP demand is lower than that for the 2006 RWSP, even though the 2010 projections include all 16 counties. The 2005 projections only included the 10 southern counties. Additionally, quantities permitted for product entrainment were not included in the 2010 projections because the District no longer considers them part of actual water demand, i.e., quantities necessary to conduct mining operations. Eliminating entrainment quantities reduced projected demand for the planning period by 1.4 mgd Districtwide.

Table 3-3b, the projected decrease in I/C,M/D,PG demand for the planning period, shows a decrease of 9.8 mgd. This is a reduction in the use of groundwater, which is tracked separately and not subtracted from the increase in demand. This is because increases in I/C,M/D,PG demand may be met with alternative sources or conservation. The retired groundwater quantities may be reallocated for mitigation of new groundwater permits for other use categories and/or permanently retired to help meet future environmental restoration requirements.

Table 3-3b. *Projected decrease in industrial/commercial, mining/dewatering, power generation demand in the Northern Planning Region (mgd) (5-in-10)*[1]

| County | 2005 Base | 2005–2010 | 2010–2015 | 2015–2020 | 2020–2025 | 2025–2030 | Total Decrease | % Decrease |
|---|---|---|---|---|---|---|---|---|
| **Citrus** | **1.7** | - | - | - | - | - | **0.0** | **0.0%** |
| **Hernando** | **17.3** | -6.4 | - | - | - | - | **-6.4** | **37.0%** |
| **Lake** | **0.0** | - | - | - | - | - | **0.0** | **0.0%** |
| **Levy** | **0.0** | - | - | - | - | - | **0.0** | **0.0%** |
| **Marion** | **0.1** | - | - | - | - | - | **0.0** | **0.0%** |
| **Sumter** | **4.1** | -3.4 | - | - | - | - | **-3.4** | **82.9%** |
| **Incremental Decrease** | **n/a** | **-9.8** | **-** | - | - | - | **-9.8** | **42.0%** |

[1]For the I/C,M/D,PG category, water use for the 5-in-10 and 1-in-10 condition is the same.

4.0 Stakeholder Review

The demand projection methodology, results and analyses were provided to the District's water use permitting staff and I/C,M/D,PG sector stakeholders for review and comment. The projections were reviewed by the District's Industrial Advisory Committee, which concurred with the projection methodologies and outcome. Upon receiving stakeholder comments, the District reviewed suggested changes and, if appropriate, included updates. Suggested changes were only taken into consideration if they were based on historical regression data and long-term trends and supported by complete documentation.

## *Section 4. Recreational Aesthetic*

1.0 Description of the Recreational Aesthetic Water-Use Category

The recreational/aesthetic category includes the self-supplied water use associated with the irrigation of golf courses, cemeteries, parks, medians, attractions and other large self-supplied green areas. Golf courses are the major users within this category. Recreational aesthetic water use projections are based largely on historical trends.

***The demand for water for the recreational/aesthetic water use category in the planning region is projected to increase by more than 11 mgd during the planning period.***

2.0 Demand Projection Methodology

2.1 Golf Courses

Golf course demands are based on the average water use per golf course hole by county and a projection of golf course growth. The average golf course water use from 2003 through 2007 for permitted golf courses in the District was used to calculate the average gallons per day per hole. Growth in golf course holes was projected for each county from 2005 to 2030 using a linear extrapolation from a linear regression. The number of golf course holes for each county was statistically significant at more than a 90 percent confidence level when compared to a straight-line trend to 2030. That confidence level, together with the historical trend, provided the basis for the assumption that the trend could continue through 2030. The average annual water use per hole by county was multiplied by the future growth in golf course holes to project demand.

2.2 Landscapes

Landscape water use includes irrigation for parks, medians, attractions, cemeteries and other large self-supplied green areas. For each county, per capita water use, expressed in gallons per day per person, was obtained from a five year average (2003–2007) of the published estimated landscape water use from the District's *Estimated Water Use Report*.

Estimates of population growth from 2005 to 2030 were obtained from the District's public supply demand projections. The population projections were multiplied by the per capita landscape water use to estimate aesthetic demand by county. The District's average per capita water use for green space irrigation is 6.7 gallons per day per person.

3.0 Water Demand Projections

Table 3-4 is the projected recreational/aesthetic demand for the planning period. The table shows an increase in demand of 11.3 mgd for the 5-in-10 condition. The recreational/aesthetic irrigation demand in the planning region is significantly affected by The Villages, a large development in Sumter County that provides golf courses as its prime attraction to buyers. The Villages has more than 350 golf course holes in the District's portion of Sumter County. Water used to irrigate these golf courses represents 25 percent of recreational demand in the region. However, extensive use of reclaimed water significantly reduces The Villages' demand for potable water. Due to the extensive use of reclaimed water, Sumter County's average gallons of potable water used per day per hole (gpdph) is just over 6,000, while the remaining four counties in the planning region use an average 13,000 gpdph. This favorable ratio will be reduced in the future since The Villages is likely to be built out between 2015 and 2020. Aesthetic water demand does not show a similar trend and is most likely influenced primarily by weather and soils.

4.0 Stakeholder Review

The demand projection methodology, results and analyses were provided to the District's water use permitting staff and recreational/aesthetic use sector stakeholders for review and comment. Comments and suggested changes were only taken into consideration if they were based on historical regression data and long-term trends and supported by complete documentation.

### *Section 5. Environmental Restoration*

1.0 Description of the Environmental Restoration Water Use Category

Environmental restoration comprises quantities of water that may need to be developed and/or existing quantities that need to be retired to facilitate recovery of natural systems to meet their MFLs. Unlike the District's other three planning regions, there are no water resources in recovery in the Northern Planning Region. As a result, there is no need to project demand for environmental restoration. However, this could change if water resources are identified as impacted as the District continues to establish MFLs in the region.

Table 3-4. *Projected increase in recreational/aesthetic demand in the Northern Planning Region (5-in-10 and 1-in-10) (mgd)*

| County | 2005 Base | | 2010 | | 2015 | | 2020 | | 2025 | | 2030 | | Total Increase | | % Increase | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 |
| **Citrus** | **5.4** | **7.0** | 0.8 | 1.1 | 0.7 | 0.8 | 0.6 | 0.8 | 0.6 | 0.7 | 0.6 | 0.8 | **3.3** | **4.2** | **61.1%** | **60.0%** |
| **Hernando** | **6.0** | **7.8** | 0.5 | 0.6 | 0.7 | 0.9 | 0.7 | 0.9 | 0.6 | 0.8 | 0.7 | 0.9 | **3.2** | **4.1** | **53.3%** | **68.3%** |
| **Lake** | **0.0** | **0.0** | - | - | - | - | - | - | - | - | - | - | **0.0** | **0.0** | **0.0%** | **0.0%** |
| **Levy** | **0.3** | **0.4** | - | - | - | - | - | - | - | - | - | - | **0.0** | **0.0** | **0.0%** | **0.0%** |
| **Marion** | **3.8** | **5.0** | 0.5 | 0.6 | 0.6 | 0.7 | 0.6 | 0.7 | 0.5 | 0.8 | 0.6 | 0.7 | **2.8** | **3.5** | **73.7%** | **92.1%** |
| **Sumter** | **3.1** | **3.9** | 0.8 | 1.1 | 0.3 | 0.3 | 0.4 | 0.5 | 0.2 | 0.3 | 0.3 | 0.4 | **2.0** | **2.6** | **64.5%** | **66.7%** |
| **Incremental Increase** | **n/a** | **n/a** | **2.6** | **3.4** | **2.3** | **2.7** | **2.3** | **2.9** | **1.9** | **2.6** | **2.2** | **2.8** | **11.3** | **14.4** | **60.8%** | **60.0%** |

***Water used for irrigation of common areas in residential subdivisions is included in the recreational/aesthetic water use category.***

### Section 6. Summary of Projected Increases and Decreases in Demand

Table 3-5a and 3-5b summarize the increases and decreases in demand respectively for the 5-in-10 and 1-in-10 conditions for all use categories. Increases and decreases in demand are tracked separately. Decreases in demand represent a reduction in the use of groundwater, which can be available for mitigation of new groundwater permits and/or permanently retired to help meet future environmental restoration requirements.

Table 3-5a shows that 90.4 mgd of additional water supply will need to be developed to meet demand in the planning region through 2030. Public supply water use will increase by 72 mgd over the planning period, which accounts for nearly 80 percent of the projected increase. Recreational/aesthetic is next at 11.3 mgd, or 12.5 percent of the projected increase.

Table 3-5b shows a reduction of 0.8 mgd of agricultural use and 9.8 mgd of I/C,M/D,PG use, the majority of which is groundwater. Table 3-6 summarizes the projected increase in demand for each county in the planning region for the 5-in-10 condition.

### Section 7. Comparison of Demands Between the 2006 RWSP and the 2010 RWSP

Because the District is including its Northern Planning Region in the RWSP for the first time in 2010, there are no demand projections from 2006 to compare to those developed for 2010. The comparison of Northern Planning Region demand projections between five-year planning cycles will be undertaken in the future as each new RWSP update is completed.

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Table 3-5a. *Summary of the projected increase in demand in the Northern Planning Region (5-in-10 and 1-in-10)[1] (mgd)*

| Water Use Category | 2005 Base | | 2005–2010 | | 2010–2015 | | 2015–2020 | | 2020–2025 | | 2025–`2030 | | Total Increase | | % Increase | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 |
| **Public Supply** | **82.4** | **87.4** | 24.0 | 25.5 | 13.2 | 13.9 | 13.7 | 13.7 | 10.0 | 10.6 | 11.2 | 11.8 | **72.1** | **75.5** | **87.5%** | **87.4%** |
| **Agriculture** | **18.9** | **26.1** | 0.8 | 0.9 | 0.8 | 0.9 | 0.8 | 1.0 | 0.8 | 0.9 | 0.1 | 1.2 | **3.2** | **4.9** | **17.0%** | **18.6%** |
| **I/C,M/D,PG** | **23.3** | **23.3** | 1.1 | 1.1 | 1.0 | 1.0 | 0.5 | 0.5 | 0.6 | 0.6 | 0.5 | 0.5 | **3.7** | **3.7** | **15.9%** | **15.9%** |
| **Recreation** | **18.6** | **24.0** | 2.6 | 3.4 | 2.3 | 2.7 | 2.3 | 2.9 | 1.9 | 2.6 | 2.2 | 2.8 | **11.3** | **14.4** | **60.8%** | **60.0%** |
| **Incremental Increase** | **n/a** | **n/a** | **28.5** | **30.9** | **17.3** | **18.5** | **17.3** | **18.1** | **13.3** | **14.7** | **14.0** | **16.3** | **90.4** | **98.5** | **n/a** | **n/a** |
| **Cumulative Increase** | **143.2** | **160.8** | **171.7** | **191.7** | **189.0** | **210.2** | **206.3** | **228.3** | **219.6** | **243.0** | **233.6** | **259.3** | **90.4** | **98.5** | **63.1%** | **61.2%** |

[1]Agriculture quantities in the 1-in-10 column are actually 2-in-10.

Table 3-5b. *Summary of the projected decrease in demand in the Northern Planning Region (5-in-10 and 1-in-10)[1] (mgd)*

| Water Use Category | 2005 Base | | 2005–2010 | | 2010–2015 | | 2015–2020 | | 2020–2025 | | 2025–2030 | | Total Decrease | | % Decrease | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 | 5-10 | 1-10 |
| **Public Supply** | **82.4** | **87.4** | - | - | - | - | - | - | - | - | - | - | **0.0** | **0.0** | **0.0%** | **0.0%** |
| **Agriculture** | **18.9** | **26.1** | -0.25 | -0.35 | -0.14 | -0.17 | -0.14 | -0.16 | -0.13 | -0.16 | -0.14 | -0.16 | **-0.80** | **1.0** | **4.2%** | **3.8%** |
| **I/C,M/D,PG** | **23.3** | **23.3** | -9.8 | -9.8 | - | - | - | - | - | - | - | - | **-9.8** | **-9.8** | **42.0%** | **42.0%** |
| **Recreation** | **18.6** | **24.0** | - | - | - | - | - | - | - | - | - | - | **0.0** | **0.0** | **0.0%** | **0.0%** |
| **Incremental Decrease** | **n/a** | **n/a** | **-10.0** | **-10.1** | **-0.14** | **-0.17** | **-0.14** | **-0.16** | **-0.13** | **-0.16** | **-0.14** | **-0.16** | **-10.6** | **-10.8** | **7.3%** | **6.8%** |

[1]Agriculture quantities in the 1-in10 column are actually 2-in-10.

Table 3-6. *Summary of the projected increases in demand for counties in the Northern Planning Region (mgd) (5-in-10)*

| Water Use Categories | Planning Period | | | | | | Total Increase | |
|---|---|---|---|---|---|---|---|---|
| | 2005 Base | 2005–2010 | 2010–2015 | 2015–2020 | 2020–2025 | 2025–2030 | mgd | % |
| **Citrus** | | | | | | | | |
| **Public Supply** | **22.0** | 5.5 | 2.9 | 2.5 | 2.4 | 2.2 | **15.5** | **70.4%** |
| **Agriculture** | **0.45** | - | - | - | - | - | **0.0** | **0.0%** |
| **I/C,M/D,PG** | **1.7** | 1.1 | 0.1 | 0.1 | 0.1 | 0.1 | **1.5** | **88.2%** |
| **Rec/Aesthetic** | **5.4** | 0.8 | 0.7 | 0.6 | 0.6 | 0.6 | **3.3** | **61.1%** |
| **Incremental Increase** | **n/a** | **7.4** | **3.7** | **3.2** | **3.1** | **2.9** | **20.3** | **n/a** |
| **Cumulative Increase** | **29.5** | **36.9** | **40.6** | **43.8** | **46.9** | **49.8** | **20.3** | **68.8%** |
| **Hernando** | | | | | | | | |
| **Public Supply** | **28.1** | 3.5 | 3.3 | 3.0 | 2.7 | 2.8 | **15.3** | **54.4%** |
| **Agriculture** | **2.3** | - | 0.05 | 0.03 | 0.04 | 0.02 | **0.14** | **6.1%** |
| **I/C,M/D,PG** | **17.3** | - | 0.3 | 0.4 | 0.3 | 0.4 | **1.4** | **8.1%** |
| **Rec/Aesthetic** | **6.0** | 0.5 | 0.7 | 0.7 | 0.6 | 0.7 | **3.2** | **53.3%** |
| **Incremental Increase** | **n/a** | **4.0** | **4.3** | **4.1** | **3.6** | **3.9** | **19.9** | **n/a** |
| **Cumulative Increase** | **53.7** | **57.7** | **62.0** | **66.1** | **69.7** | **73.6** | **19.9** | **37.0%** |
| **Lake** | | | | | | | | |
| **Public Supply** | **0.1** | - | - | - | - | - | **0.0** | **0.0%** |
| **Agriculture** | **1.9** | - | - | - | - | - | **0.0** | **0.0%** |
| **I/C,M/D,PG** | **0.0** | - | - | - | - | - | **0.0** | **0.0%** |
| **Rec/Aesthetic** | **0.0** | - | - | - | - | - | **0.0** | **0.0%** |
| **Incremental Increase** | **n/a** | **-** | **-** | **-** | **-** | **-** | **0.0** | **n/a** |
| **Cumulative Increase** | **2.0** | **2.0** | **2.0** | **2.0** | **2.0** | **2.0** | **0.0** | **0.0%** |
| **Levy** | | | | | | | | |
| **Public Supply** | **2.5** | 0.6 | 0.3 | 0.3 | 0.2 | 0.3 | **1.7** | **68.0%** |
| **Agriculture** | **4.8** | 0.11 | - | 0.04 | - | 0.01 | **0.16** | **3.3%** |
| **I/C,M/D,PG** | **0.0** | - | 0.6 | - | - | - | **0.6** | **n/a**[1] |
| **Rec/Aesthetic** | **0.3** | - | - | - | - | - | **0.0** | **0.0%** |
| **Incremental Increase** | **n/a** | **0.71** | **0.9** | **0.34** | **0.2** | **0.31** | **2.5** | **n/a** |
| **Cumulative Increase** | **7.6** | **8.31** | **9.21** | **9.55** | **9.75** | **10.06** | **2.5** | **32.9%** |
| **Marion** | | | | | | | | |
| **Public Supply** | **15.1** | 5.6 | 3.2 | 2.7 | 3.0 | 3.0 | **17.5** | **115.9%** |
| **Agriculture** | **3.0** | - | 0.06 | 0.06 | 0.07 | 0.09 | **0.3** | **10.0%** |
| **I/C,M/D,PG** | **0.1** | - | - | - | 0.1 | - | **0.1** | **100%** |
| **Rec/Aesthetic** | **3.8** | 0.5 | 0.6 | 0.6 | 0.5 | 0.6 | **2.8** | **73.7%** |
| **Incremental Increase** | **n/a** | **6.1** | **3.9** | **3.4** | **3.7** | **3.7** | **20.8** | **n/a** |
| **Cumulative Increase** | **22.0** | **28.1** | **32.0** | **35.4** | **39.1** | **42.8** | **20.8** | **94.1%** |
| **Sumter** | | | | | | | | |
| **Public Supply** | **14.6** | 8.8 | 3.5 | 5.2 | 1.7 | 2.9 | **22.1** | **151.4%** |
| **Agriculture** | **6.6** | 0.64 | 0.67 | 0.67 | 0.67 | - | **2.6** | **40.1%** |
| **I/C,M/D,PG** | **4.1** | - | - | - | 0.1 | - | **0.1** | **2.4%** |
| **Rec/Aesthetic** | **3.1** | 0.8 | 0.3 | 0.4 | 0.2 | 0.3 | **2.0** | **64.5%** |
| **Incremental Increase** | **n/a** | **10.2** | **4.5** | **6.3** | **2.7** | **3.2** | **26.9** | **n/a** |
| **Cumulative Increase** | **28.4** | **38.6** | **43.1** | **49.4** | **52.1** | **55.3** | **26.9** | **94.4%** |

[1]Because the base quantity is zero, the percent change is extremely high. The absolute change is only 0.6 mgd.

# Chapter 4: Evaluation of Water Sources

This chapter presents the results of the District's investigations to quantify the amount of water that is potentially available from all sources of water within the planning region to meet demands through 2030. Sources of water that were evaluated include surface water stormwater, reclaimed water, seawater desalination, brackish groundwater desalination, fresh groundwater and conservation. The amount of water that is potentially available from these sources is compared to the demand projections for the planning region presented in Chapter 3 and a determination is made as to the sufficiency of the sources to meet demand through 2030.

*The construction of a groundwater production well. A large portion of 2030 water supply demand in the planning region is projected to be met with fresh groundwater.*

## Part A. Evaluation of Water Sources

Fresh groundwater from the Upper Floridan aquifer currently is by far the major source of supply for all use categories in the planning region. In addition, the principal source of water to meet the projected 2030 demand is likely to be new quantities of fresh groundwater. However, impacts resulting from groundwater withdrawals in southern Hernando County and northern Sumter County will limit future availability of groundwater in these areas. Establishment of minimum flows for the coastal springs may also limit the availability of groundwater in certain areas. To ensure that low-cost groundwater supplies are available in the future, water users throughout the region are increasingly developing reclaimed water systems and implementing conservation measures. These measures will enable water supply systems to support more users with the same quantity of water and hydrologic stress. Although it may be beyond the 2030 planning period, the region's continued growth will eventually require the development of alternative sources such as brackish groundwater, seawater and surface water with off-stream storage reservoirs. The following discussion summarizes the evaluation of all water supply sources and the potential for those sources to be used to produce new water supplies in the planning region.

### Section 1. Surface Water/Stormwater

The Withlacoochee River is the only major river system in the planning region. The potential yield of the Withlacoochee River for water supply will ultimately be constrained by its established minimum flows.

1.0 Criteria for Determining Potential Water Availability

Since the minimum flow for the Withlacoochee River has not yet been established, the available yield was calculated using a planning-level minimum flow criteria. The five-step process used to estimate potential surface water availability includes: (1) estimation of unimpacted flow, (2) selection of the analysis period, (3) application of minimum flow or planning level criteria, (4) consideration of existing legal users and (5) application of engineering limitations. The amount of water that can be developed in the future will depend on adopted minimum flows and the permitting process. A complete description of this process is included in the Chapter 4 Appendix.

2.0 Overview of the Withlacoochee River System

The Withlacoochee River.

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, Florida. In 1989, the river and its connected lakes and tributaries were designated an Outstanding Florida Water. 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 river 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.

The Withlacoochee Regional Water Supply Authority (WRWSA), in cooperation with the District, completed a study to determine the availability of surface water from the Withlacoochee River by applying a “proxy minimum flow” (Water Resource Associates, Inc., 2007). A proxy was used because the District had not yet established a minimum flow for the river. The proxy minimum flow was developed using data from minimum flow studies of rivers located in relatively close proximity to the Withlacoochee River. This study did not include development of a proxy threshold for the lower Withlacoochee River, since it has been significantly altered by construction of the Inglis Dam and the Cross Florida Barge Canal. The most downstream point included in this study was Holder, which excludes flow from the Rainbow River located further downstream. Because the Rainbow River was not included in the WRWSA study, it was not used to calculate surface water availability. Instead, the planning level minimum flow criteria were applied to flow data obtained from the USGS gage near Holder to make the calculation. Flows from the Rainbow River at Dunnellon were added to the flows near Holder to account for the Rainbow River’s contribution to the Withlacoochee River. Once minimum flows are established for the Withlacoochee River, water supply availability estimates will be refined. The average annual discharge at the gage near Holder plus the discharge from the Rainbow River at the Dunnellon gage is 1,003 mgd (1,552 cfs) for the period 1965–2003. Annual average withdrawals of 0.495 mgd and 0.005 are permitted from the Withlacoochee and Rainbow rivers, respectively. Average annual diversions from 2003 to 2007 for the Withlacoochee and Rainbow rivers were 0.01 mgd. Based on the planning level minimum flow criteria, an additional 93 mgd of water supply is potentially available from the Withlacoochee River.

### 3.0 Potential for Water Supply from Surface Water/Stormwater

Table 4-1 summarizes potential surface water availability from the Withlacoochee River. The estimated additional surface water that could potentially be obtained from the Withlacoochee River in the planning region ranges from approximately 0.49 mgd to 93.7 mgd. The lower end of the range is the amount of surface water that has been permitted but is currently unused, and the upper end includes permitted but unused quantities plus the estimated remaining available surface water (93.2 mgd). Additional factors that could affect the quantities of water that are ultimately developed for water supply include the future establishment of minimum flows, variation in discharges to the river from outside sources and the ability to develop sufficient storage capacity.

Table 4-1 *Summary of current withdrawals and potential availability of water from the Withlacoochee River in the Northern Planning Region (mgd) based on planning level minimum flow criteria*

| Water Body | In-stream Impoundment | Adjusted Annual Average Flow[1] | Potentially Available Flow Prior to Withdrawal[2] | Permitted Average Withdrawal Limits[3] | Current Withdrawal[4] | Unpermitted Potentially Available Withdrawals[5] | Days/Year New Water Available[6] | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Avg | Min | Max |
| Withlacoochee River near Holder plus Rainbow River at Dunnellon[7] | Yes | 1002.0 | 100.2 | 0.50 | 0.01 | 93.2 | 310 | 0 | 366 |
| **Total** | | | **100.2** | **0.50** | **0.01** | **93.2** | | | |

[1]Mean flow based on recorded USGS flow plus reported water use permit (WUP) withdrawals added back in when applicable. Maximum period of record used for rivers in the region is 1965–2003.
[2]Based on 10 percent of mean flow.
[3]Based on individual WUP permit conditions, which may or may not follow current 10 percent diversion limitation guidelines.
[4]Based on average reported withdrawals from 2003–2007.
[5]Equal to remainder of 10 percent of total flow after permitted uses allocated, with minimum flow cutoff for new withdrawals of P85 and maximum system diversion capacity of twice median flow (P50).
[6]Based on estimated number of days that any additional withdrawal is available considering current permitted quantities and withdrawal restrictions. The minimum and maximum are the estimated range of days that additional withdrawals would have been available in any particular year.
[7]Unpermitted potentially available withdrawals from the Withlacoochee Regional Water Supply Authority study (Water Resource Associates, Inc., 2007) were not used because the analysis did not include flows available from the Rainbow River tributary.

*Headwaters of the Withlacoochee River in the Green Swamp.*

### Section 2. Reclaimed Water

*The District strongly promotes the use of reclaimed water including providing matching funds to utilities to develop infrastructure such as this reclaimed water pump station.*

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 domestic wastewater treatment plant (WWTP). 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 Villages development in Sumter County has one of the largest reclaimed water systems in the planning region. In 2005, customers within The Villages utilized an average daily flow of more than 1.7 mgd of reclaimed water for golf course and other public access irrigation use. Since 1987, the District has provided nearly $15 million in grant funding for 16 reclaimed water projects in the planning region.

The benefit that can be obtained from the use of reclaimed water is governed by the concepts of utilization and offset. Utilization is the percent of treated waste water from a WWTP that is utilized in a reclaimed water system. The utilization rate of a reclaimed water system varies by utility. Typically, only 50 to 70 percent of treated wastewater flows go to reclaimed water customers. The highest utilization rates occur in utilities in urban areas where large industries and numerous residential customers can be supplied. Utilization is also limited by seasonal supply and storage. A utility cannot expand its reuse system beyond peak flow demand, which occurs during dry periods when demand is highest, without experiencing shortages. For example, a reclaimed water system with a one mgd flow normally is limited to supplying 0.5 mgd (50 percent utilization) on a yearly basis. This is because during the dry season, demand for reclaimed water for irrigation can more than double.

The four main options to increase utilization beyond 50 percent include seasonal storage, system interconnects, an interruptible customer base and supplementing reclaimed water supplies with other sources. Seasonal storage is the storage of excess reclaimed water in surface reservoirs or aquifer storage and recovery systems during the wet season when demand is low. This stored reclaimed water can be used to augment daily reclaimed water flows to meet peak demand in the dry season. System interconnects involve the transfer of reclaimed water from areas of excess supply to areas of high demand. This transferred reclaimed water can be used to augment daily reclaimed water flows to meet peak demand in the dry season. An interruptible customer base is where a utility has golf course, recreational, commercial, agricultural, industrial and other bulk customers that have multiple sources of irrigation or process water. Reclaimed water is supplied to these customers during certain times of the day and during certain seasons, but they may be requested to go "off line" and switch to backup sources during peak demand times or seasons. This enables a utility to develop a much larger customer base and maximize the utilization of reclaimed water, while avoiding the negative consequences of running out of reclaimed water during peak irrigation times/seasons. Supplementing reclaimed water supplies with other water sources such as stormwater and groundwater for short periods to meet peak demand enables systems to serve a larger customer base.

Offset is the amount of potable-quality groundwater or surface water that is replaced by reclaimed water usage. Customers tend to use more reclaimed water than potable water because reclaimed water is generally less expensive and not as restricted as potable water. For example, a single-family residence with an inground irrigation system connected to potable water uses about 300 gpd for irrigation. However, if the same single-family residence converts to an unmetered, flat-rate, reclaimed water irrigation supply without day-of-week restrictions, it will use approximately two and one-half times (804 gpd) this amount. In this example, the offset rate would be 37 percent (300 gpd offset for 804 gpd reclaimed water utilization). Different types of reclaimed water uses have different offset potentials. For example, a power station or industry using one mgd of potable water for cooling or process water will, after converting to reclaimed water, normally use about the same quantity. In this example, the offset rate would be 100 percent. Most reclaimed water utilities provide service to a wide variety of customers and, as a result, the average reclaimed water offset rate is estimated to be 65 percent. The District is actively cooperating with utilities to help identify ways to increase reclaimed water utilization and offset. For example, efficiency can be further enhanced with practices such as individual metering coupled with water-conserving rates, efficient irrigation design and irrigation restrictions.

The District's goal is to achieve 75 percent utilization of all wastewater treatment plant flows and 75 percent offset efficiency of all reclaimed water used by 2030. This goal is intended to reduce the overuse of reclaimed water and increase potable and groundwater offsets. Opportunities may exist for utilization and offset to be even greater in some cases by utilizing methods such as customer base selection (i.e., large industrial), project type selection (i.e., recharge) and implementation of developing technologies.

## 1.0 Potential for Water Supply From Reclaimed Water

Table 4-2 provides information on the current and future availability of reclaimed water in the planning region and the potential to achieve potable-quality water offsets through 2030. In 2005, there were 31 WWTPs in Levy, Citrus, Sumter, Marion, Hernando and Lake counties, collectively producing 15.0 mgd of wastewater. Of that quantity, 6.9 mgd was beneficially used to offset 4.5 mgd of traditional water supplies. Therefore, only about 46 percent of the available reclaimed water produced in the region was provided to customers for irrigation, industrial cooling or other beneficial purposes. By 2030, it is expected that more than 75 percent of reclaimed water available in the planning region will be used. It is further expected that efficiency of use will increase from 65 percent to 75 percent through a combination of measures such as development of a customer base with significant numbers of high-volume high-efficiency users, metering, volume-based rate structures and education. As a result, by 2030 it is estimated that 28.1 (approximately 75 percent) of the 36.2 mgd of reclaimed water produced will be reused for beneficial purposes and 22.4 mgd of traditional water supplies will be offset (more than 75 percent efficiency). The quantity of reclaimed water that will be available from 2005 to 2030 that was not allocated to projects as of 2005 is 29.2 mgd. Based on an overall 75 percent utilization and offset, 22.4 mgd will be used and 16.8 mgd of potable-quality water supplies will be offset by this quantity from 2005 to 2030. Utilization and offset could potentially be greater than 75 percent because of industrial operations that use large quantities of water and achieve virtually 100 percent offset rates.

Table 4-2. *2005 actual versus 2030 potential reclaimed water availability, utilization and offset (mgd) in the Northern Planning Region*

| County | 2005 Availability, Utilization and Offset[1] | | | | 2005–2030 Potential Availability, Utilization and Offset[2] | | | |
|---|---|---|---|---|---|---|---|---|
| | Number of WWTPs in 2005 | WWTP Flow in 2005 | Utilization in 2005 | Potable-Quality Water Offset (65%) | 2030 Total WWTP Flow | 2030 Availability (Increase in WWTP Flow From 2005–2030 Plus Unused 2005 WWTP Flow) | Utilization (75%)[3] | Potable-Quality Water Offset (75%)[4] |
| Levy | 1 | 0.18 | 0.00 | 0.00 | 0.23 | 0.23 | 0.17 | 0.13 |
| Citrus | 8 | 3.43 | 0.03 | 0.02 | 9.57 | 9.54 | 7.15 | 5.36 |
| Sumter | 6 | 3.90 | 3.23 | 2.10 | 10.43 | 7.20 | 4.59 | 3.44 |
| Marion | 7 | 2.61 | 1.49 | 0.97 | 6.75 | 5.26 | 5.40 | 4.05 |
| Hernando | 9 | 4.91 | 2.18 | 1.42 | 9.20 | 7.02 | 5.10 | 3.82 |
| Lake | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 31 | 15.03 | 6.93 | 4.51 | 36.17 | 29.25 | 22.41 | 16.81 |

[1] Estimated at 65% Districtwide average.
[2] See Table 4-1 in Appendix 4.
[3] Unless otherwise noted, equals 2030 WWTP flow at 75 percent utilization minus 2005 actual utilization.
[4] Unless otherwise noted.

## Section 3. Seawater Desalination

*Desalinated seawater could eventually be a source of large quantities of potable water in the Northern Planning Region.*

Seawater is defined as water in any sea, gulf, bay or ocean having a total dissolved solids concentration greater than or equal to 35,000 mg/L (SWFWMD, 2001). Seawater can provide a stable, droughtproof 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 (permeate) and a mineralized concentrate byproduct. There are five principal elements to an RO desalination system that require extensive design consideration: an intake structure to acquire the source water, pretreatment to remove organic matter and suspended solids, desalination to remove dissolved minerals and other constituents, post-treatment to stabilize product water and prepare it for transmission, and concentrate management (National Research Council, 2008). Each of these elements is briefly discussed below.

The intake structure is utilized to withdraw large amounts of source water for the treatment process. The intake design and operation must address environmental impacts because much of the District's near-shore areas have been designated as either Outstanding Florida Waters (OFW) or aquatic preserves. Ecological concerns include the risk of impingement and entrainment of aquatic life at the intake, entrainment of sediments and perturbation to seagrasses and hard-bottom communities.

The pretreatment of source water is imperative to protect RO membranes from fouling prematurely, and this may be the most critical design element in an RO system treating seawater. A pretreatment system may require coagulation and/or microfiltration technology similar to the treatment of fresh surface water. Extensive pilot testing is recommended to determine the most appropriate pretreatment system. There are a variety of methods to desalinate water, however RO is the most accepted and rapidly advancing technology. The RO system pressurizes saline water above the osmotic pressure of the solutes and passes the water through a network of semi-permeable membranes. Fresh water passes through the membranes, while a constant flow of raw water prevents dissolved minerals from fouling the membrane's surface. The membranes are susceptible to fouling or damage from dissolved organic matter and other fine suspended particles, which is why an effective pretreatment method is necessary. The pressurization step can be energy-intensive, although the latest membrane technology has reduced the required pressure levels. Technical advancements have also been made with energy recovery systems, which use the high-pressure concentrate flow exiting the RO membranes to drive turbines. In return, the turbines direct energy back to the pumps feeding the source water. Research indicates that energy recovery rates between 30 and 40 percent are possible. Energy recovery systems reduce electrical demands, alleviate redundant pumping capacities and lower costs. The post-treatment element is necessary to protect the facility's infrastructure and distribution piping. The RO product water has a very low hardness and alkalinity, which can cause corrosion to piping and addition of unwanted metals into the water. Chemical post-treatment such as lime or caustic soda addition is often used for buffering and pH adjustment. A settling system may be necessary to reduce turbidity generated by chemical treatment. A degassing system may also be necessary, as dissolved gasses such as hydrogen sulfide can pass through RO membranes and create a noticeable odor in the finished water.

Nearly all seawater desalination facilities worldwide dispose of RO concentrate by surface water discharge, which entails significant environmental considerations. The salinity of the concentrate can be 50 percent higher than that of the source water, and the increased density of the concentrate may cause it to sink and impact benthic communities (National Research Council, 2008). A National Pollution Discharge Elimination System (NPDES) permit from the Environmental Protection Agency (EPA) and other local permits may be required to discharge the concentrate into surface waters. To obtain the NPDES permit, a variety of factors must be demonstrated to not impose harm to aquatic organisms. There are several technological approaches to alleviating these issues including diffusion of the discharge using widely dispersed multiple outlets and pumping large volumes of additional water to dilute the concentrate to safe levels prior to discharge. An additional consideration in the development of desalination facilities that can significantly enhance their financial feasibility is co-location with electric power stations. Co-location produces cost and environmental compliance benefits by blending waste concentrate with the power station's high-volume cooling water discharge. The complex infrastructure for the intake and outflow is already in place and source water heated by the power station's boilers can be more efficiently desalinated.

Additional information on seawater desalination can be found in a recent FDEP report entitled *Desalination in Florida: Technology, Implementation, and Environmental Issues* (www.dep.state.fl.us/water/default.htm).

## 1.0 Potential for Water Supply from Seawater Desalination

One option for a large-scale seawater desalination facility in the planning region has been developed as part of the water supply planning efforts of the District and the WRWSA. The option is for a 15 mgd facility co-located with Progress Energy's Crystal River power station near the Gulf of Mexico in Citrus County. Additional information on this option is presented in Chapter 5. The proposed location of this option, along with other existing and proposed seawater and brackish groundwater desalination facilities in the District, is shown in Figure 4-1.

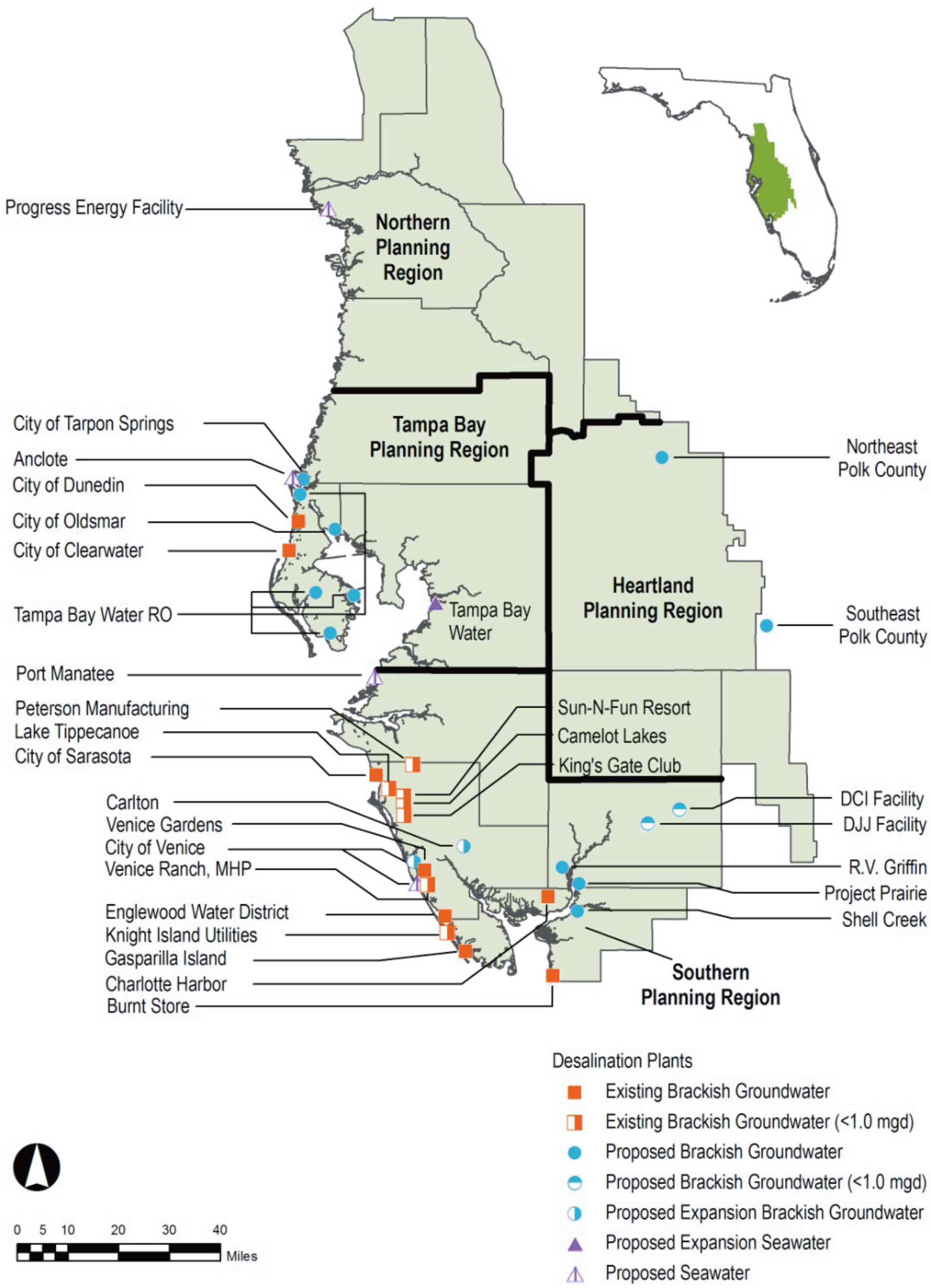



Figure 4-1 *Locations of existing and potential seawater and brackish groundwater desalination facilities in the District*

## Section 4. Brackish Groundwater Desalination

*Reverse osmosis membranes in a brackish groundwater treatment facility.*

Brackish groundwater is found in coastal areas in the Upper Floridan as a depth-variable transition between fresh and saline waters. Figure 4-2 depicts the generalized location of the freshwater/saltwater interface (as defined by the 1,000 mg/L isochlor) in the Avon Park high production zone of the Upper Floridan aquifer in the southern and central portions of the District. Brackish groundwater is also found in the Lower Floridan aquifer. Data collected by the District's exploratory well drilling program indicates that brackish groundwater from the Lower Floridan aquifer could be a viable water supply for inland counties. Additional data collection is planned by the District to assess the water supply potential of the Lower Floridan aquifer in greater detail.

Brackish groundwater is defined as having a chloride concentration greater than 250 mg/L or a total dissolved solids (TDS) concentration greater than 500 mg/L. Seawater has a TDS concentration of 35,000 mg/L. Utilities that utilize brackish groundwater for water supply typically use source water that slightly or moderately exceeds potable water standards. Water with TDS values greater than 10,000 mg/L is more expensive to treat due to increased energy and membrane costs. Brackish groundwater desalination has been a more expensive source of water than traditional sources, and utilities and industries have used brackish groundwater only when less expensive sources are unavailable. However, improvements in technology have substantially reduced operating costs for newer systems.

The predominant treatment technology for brackish groundwater is medium or low-pressure RO membranes. TDS concentrations greater than about 10,000 mg/L typically require high-pressure RO membranes. This water quality threshold generally distinguishes the upper limit of brackish groundwater source feasibility. As membrane efficiencies have increased, the operating pressures and energy needed to drive the process have declined, thus significantly reducing costs. Additionally, most treatment facilities reduce operating costs by blending RO permeate with lower quality raw water. Some utilities may supplement their conventional treatment with a smaller portion of high quality RO treated water to reduce the TDS levels of finished water. Having the option to blend RO permeate with other existing sources improves the overall quality and reliability of the facility.

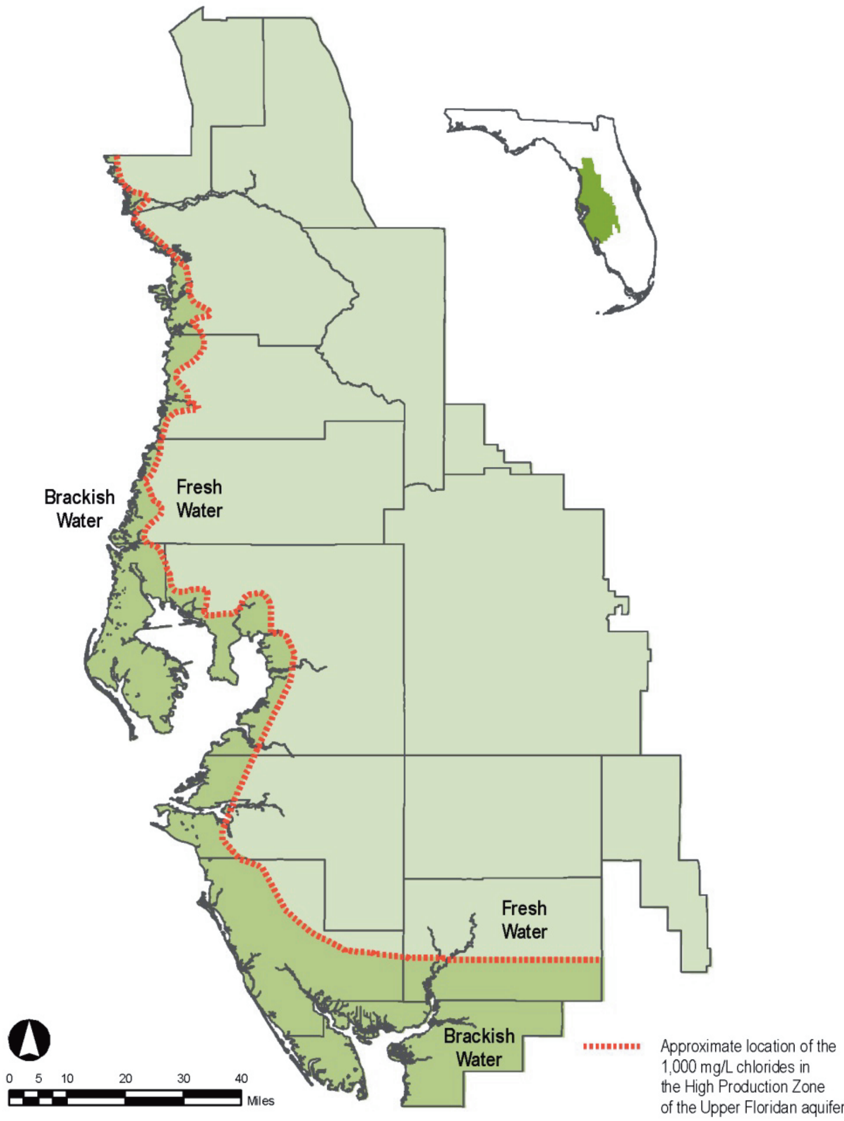



Figure 4-2 *Generalized location of the freshwater/saltwater interface in the District*

Depending on the TDS concentration of raw water, 15 to 50 percent of the water used in the RO process becomes concentrate that must be disposed of through methods that include surface water discharge, deep-well injection or dilution at a WWTP. Surface water discharge has been the preferable disposal method due to its lower cost. Surface water discharges require a NPDES permit and may be restrained by total maximum daily loads (TMDL) limitations. In some cases, RO facilities have been required to run below their potential efficiencies to reduce the strength of the concentrate. Because of these environmental considerations, deep-well injection and dilution at municipal WWTPs are becoming more prevalent. The use of deep-well injection may not be permittable in some areas, due to unsuitable geologic conditions. An additional disposal option that may be viable in the future is zero liquid discharge (ZLD). ZLD is the treatment of concentrate for a second round of high-recovery desalination, then crystallization or dehydration of the remaining brine. The resulting solid may have economic value since there is potential to use it in various industrial processes. This technology addresses the issue of concentrate disposal for situations where traditional methods are not feasible. The District is participating in a research study to apply this technology in Florida.

Technological advancements continue to be made in the areas of energy recovery. Energy recovery systems use the high-pressure concentrate flow exiting the RO membranes to drive turbines. Energy produced from the turbines helps feed raw water into the membrane system. Energy efficiency may be increased by 30 to 40 percent, which can reduce overall operating costs. Energy recovery systems may not be viable at facilities where concentrate is disposed by deep-well injection because it may be more desirable to maintain system pressure of the concentrate stream for the injection process.

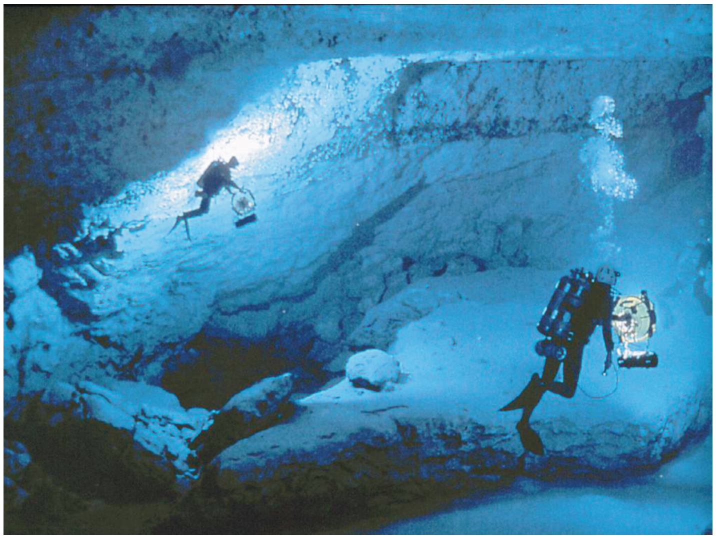
Though the Florida Legislature declared brackish groundwater an alternative water source in 2005 (Senate Bill 444), it remains a groundwater withdrawal and must occur in a manner that is consistent with applicable rules and water use management strategies for the areas in which the withdrawals will occur. Factors affecting the development of supplies include the hydraulic properties and water quality of the aquifer, rates of groundwater withdrawal, and well configurations. The District revised its Cooperative Funding Initiative Policy in December 2007, which previously restricted any funding for the construction of projects that develop groundwater. Prior to the update, the District only funded the feasibility of developing brackish groundwater sources. The construction of brackish groundwater production facilities will only be considered for funding where advanced membrane treatment is required.

### 1.0 Potential for Water Supply From Brackish Groundwater

In the coastal portions of the planning region, salt water is close to the surface and exists as a wedge beneath a relatively thin freshwater lens in the Upper Floridan aquifer. This, combined with the fact that the Upper Floridan aquifer in these areas is unconfined and highly transmissive, results in a very significant potential for induced saltwater intrusion from brackish groundwater withdrawals. Extensive analysis and modeling will be required to permit a sustainable withdrawal of brackish groundwater in coastal areas. In some inland areas, the freshwater zone in the Upper Floridan aquifer may only be a few hundred feet thick. Below this level, water becomes increasingly more mineralized, mainly due to the presence of sulfate. However, the variability of sulfate concentrations with depth across the planning region is significant. For example, sulfate concentrations in groundwater pumped from depths of 600 to 1,000 feet at The Villages development in northeast Sumter County varied from 10 to 50 mg/L, which is well within potable water standards. The District is conducting extensive tests through exploratory drilling in northern Sumter and western Marion counties to determine and map water quality within the Lower Floridan aquifer.

Because fresh groundwater from the Upper Floridan aquifer continues to be available in much of the planning region, the potential to develop brackish groundwater as a source of supply has not been investigated to any significant degree. As a result, it is not possible to determine the availability of brackish groundwater from the Upper and Lower Floridan aquifers. In the near term, the availability of brackish groundwater in the planning region for water supply must be determined on a case-by-case basis through the permitting process. An advantage of the electrodialysis reversal (EDR) membrane process is that it requires less energy than RO. (Florida Department of Environmental Protection, 2010). Alternately charged layers of membranes pull salt ions from the source water. Sarasota County has effectively applied this technology at the 12-mgd T. Mabry Carlton, Jr. Water Treatment Plant.

## Section 5. Fresh Groundwater



*This large water-filled cavern in Hernando County illustrates why the Upper Floridan aquifer is one of the most productive aquifers in the world.*

Fresh groundwater from the Upper Floridan aquifer is the principal source of water supply for all use categories in the planning region. Although there is a surficial aquifer in the planning region, the lack of a confinement between the Upper Floridan and surficial aquifers in most places causes the aquifers to function as a single unit. In 2006, approximately 98 percent (160 mgd) of the 163 mgd of water used in the planning region was from groundwater sources. Approximately 42 percent (67 mgd) of the fresh groundwater used was for public supply. The following is an assessment of the availability of fresh groundwater in the Upper Floridan aquifer in the planning region.

### 1.0 Upper Floridan Aquifer

Modeling simulations using the Northern District Groundwater Flow Model indicate that fresh groundwater from the Upper Floridan aquifer is sufficient to meet the projected demands for all use categories in the planning region through 2030, based on predicted impacts to wetlands, lakes, springs and the Withlacoochee River. The simulations analyzed the change in surficial and Upper Floridan aquifer water levels from pre-pumping conditions to 2030 using projections of future demand. In this model scenario, changes to spring flow and Withlacoochee River base flow, due to groundwater withdrawals from pre-pumping conditions to 2030, were 10 percent or less. In most of the planning region, predicted drawdown within the surficial or Upper Floridan aquifer (where it is unconfined) is less than one foot, except in localized areas where concentrated groundwater withdrawals for public supply occur in northeast Sumter and western Hernando counties. In these areas, management strategies such as increased monitoring, conservation and use of reclaimed water are being promoted to offset potential impacts due to withdrawals. In addition, the WRWSA has proposed additional groundwater sources well outside these immediate areas to provide future water supply in the event that local impacts occur.

MFLs have been established for Weeki Wachee Spring, Lake Tsala-Apopka, Lake Panasoffkee, Lake Marion, Lake Miona, Lake Okahumpka, Lake Deaton, Fort Cooper Lake, Hunters Lake, Lake Theresa (Weeki Wachee Prairie) and Lake Gant in the planning region. Currently, all established MFLs are in compliance. For 2030, there is the possibility that the Weeki Wachee Springs minimum flow and the Lake Theresa and Hunters Lake minimum levels in western Hernando County could be exceeded if the projected public supply demand is met with groundwater from existing facilities. In addition, minimum levels for Miona, Okahumpka and Deaton lakes in northeast Sumter County may be exceeded by 2030 if public supply demand is met with groundwater from this area. In both cases, reductions in demand through the use of reclaimed water, the implementation of strict demand management measures and the development of groundwater sources outside of these areas can prevent these MFLs from being exceeded. Over the next five years, MFLs are proposed for Rainbow Springs, Gum Springs, Homosassa Springs and the Withlacoochee River. Future groundwater availability will be governed by compliance with these MFLs once they are established.

As stated above, it is likely that fresh groundwater is available in quantities sufficient to meet projected demands through 2030. Therefore, for water supply planning purposes, the availability of fresh groundwater has been set equal to the 2030 projected demand for all users in the planning region (88.7 mgd). Of this quantity, 22.0 mgd is already permitted but is currently unused (see discussion below). However, to ensure that environmental impacts from groundwater withdrawals are minimized, it is the District's intent that the 2030 demand that will be met by groundwater will be significantly reduced by maximizing the efficient use of reclaimed water and implementing conservation measures.

1.1 Upper Floridan Aquifer Permitted/Unused Quantities

A number of public supply utilities in the planning region currently are not using their entire permitted allocation of groundwater. The District anticipates that these utilities will eventually grow into these unused quantities to meet future demand. Based on a review of the unused quantities of water associated with public supply water use permits, approximately 22.0 mgd of additional groundwater quantities are available to public supply utilities from the Upper Floridan aquifer.

## *Section 6. Water Conservation*

1.0 Non-Agricultural Water Conservation

Water conservation is defined as the beneficial reduction of water use through mandatory or voluntary actions resulting in the modification of water use practices, the reduction of water distribution system and customer losses and/or the installation and maintenance of low-volume water use systems, processes, fixtures and devices. The implementation of a portfolio of conservation measures creates the benefits listed below.

*The District assists utilities with the development of incentive programs that encourage their customers to install water saving fixtures such as low-flow shower heads.*

- Infrastructure and Operating Costs. The conservation of water allows utilities to defer expensive expansions of the potable water and wastewater systems and limit operation and maintenance (O&M) costs at existing treatment plants, such as the use of expensive water treatment chemicals.
- Fiscal Responsibility. Most water conservation measures have a cost-effectiveness that is much greater than that of other alternative water supply sources. The cost-effectiveness is defined as the cost of each measure compared to the amount of water expected to be conserved over the lifetime of the measure.

- Environmental Stewardship. Proper irrigation techniques including promotion of Florida-Friendly Landscaping™ and irrigation practices achieved through outdoor water conservation measures can reduce unnecessary runoff from properties into water bodies. This can reduce nonpoint-source pollution, particularly from agricultural operations that use chemicals, which in turn may contribute to a local government's overall strategy of dealing with TMDL restrictions within their local water bodies.

Since the 1990s, the District has provided financial and technical assistance for the implementation of local and regional water conservation efforts to water users and suppliers in the planning region. Water users are encouraged to seek assistance by working with the District when implementing water-saving and water conservation education programs. Community social-based marketing, discussed later in this section, can be an important component to successfully implement water conservation programs.

Water savings have been achieved in the planning region through a combination of regulatory, economic, incentive-based and outreach measures, as well as technical assistance. Regulatory measures include water restrictions and codes and ordinances that require water-efficiency standards for new development and existing areas. For example, the National Energy Policy Act of 1992 requires all new construction built after 1994 to be equipped with low-flow plumbing fixtures. In Florida, Senate Bill 494, which took effect in July 2009, requires all automatic irrigation systems to use an automatic shutoff device. Senate Bill 2080 prohibits contractual and/or local government ordinance restrictions on the implementation of Florida-Friendly Landscaping™. Periodically, WMDs in Florida issue water shortage orders that require short-term mandatory water conservation through best management practices (BMPs) and other practices.

Economic measures, such as an inclining block rate structures, provide price signals to customers of public water supply systems. Incentive programs include rebates, utility bill credits or giveaways of devices and fixtures that will replace older, less water-efficient models. Such equipment includes, but is not limited to, low-flow toilets, low-flow faucet aerators, low-flow showerheads and irrigation controllers. Recognition programs such as the District's Florida Water Star℠, WaterCHAMP℠ and WaterPRO℠ are also incentive programs that recognize homeowners and businesses for their environmental stewardship.

Education is an important element of a successful conservation program. While the actual quantity of water saved as a result of customer education is not always measurable, the effort greatly increases the success of all other facets of the conservation program by raising customer awareness and changing attitudes regarding water use. Educating the public is a necessary facet of every water conservation program, and education programs accompanied with other effective conservation measures can be an effective long-term water conservation strategy.

The District has incorporated community-based social marketing as a part of its educational strategy. Community-based social marketing is a method to change behavior at the community level. The key goals of the District's education efforts are to change the attitudes and behavior of water users regarding the need for water conservation, benefits of conserving water, consequences of not conserving water, and actions needed to achieve water conservation goals. Community-based social marketing can be a useful tool to drive behavior changes in times of water shortages, such as drought or water supply interruptions.

## 1.1 Planned Conservation Measures

Based on the success of existing conservation measures, new measures, technologies and BMPs, the District has identified the following incentive-based and outreach conservation measures that can contribute to an overall water supply management strategy. The four targeted water use categories include public supply, domestic self-supply, recreational/aesthetic, and industrial/commercial, mining, power generation (I/C,M,PG).

Regulatory, economic and community-based social marketing measures are not addressed due to the wide variance in the feasibility of implementation at the local level and the difference in costs for implementation. Three such measures that have significant potential to generate water savings but are not addressed in this document include water-conserving rate structures, water-efficiency building codes/ordinances and the dissemination of conservation education materials. Water-conserving rate structures and some education programs primarily have the impact of increasing participation in conservation measures. Therefore, to include savings from these measures would likely constitute double counting of actual water savings. Other measures that have acknowledged water savings potential and continue to be encouraged by the District include sub-metering of master-metered complexes (both multifamily and commercial) and supply-side water conservation (leak detection, system audits, etc.).

The District evaluated potential conservation measures that met established criteria for each of the four water use categories. The primary selection criterion was the cost-to-benefit ratio (cost-effectiveness). The cost-effectiveness is defined as the cost of each measure compared to the amount of water expected to be conserved over the lifetime of the measure. Water conservation measures with a cost-effectiveness greater than $3 per thousand gallons saved ($3/1,000 gal) are not being recommended for implementation at this time (SWFWMD, 2006).

The cost of a conservation measure is made up of “variable” costs (the individual cost per measure) and “non-variable” costs (the fixed cost of implementing a program regardless of the number of measures actually implemented). For this RWSP, the costs were assumed to be the same for all utilities and non-variable costs were not included. The total costs per utility, however, will vary based on size of the utility and, thus, the number of measures implemented. The District also considered secondary criteria such as (1) applicable water use categories and the potential number of participants, (2) potential acceptability of the measure to participants and the implementing utility, (3) compatibility with existing programs or those that may be implemented concurrently, (4) functional life of the measure, (5) short-term and long-term effectiveness of a measure, (6) level of ease with which a measure can be implemented and (7) possibility of implementation on a regional basis.

After giving consideration to the above criteria, the measures listed below were selected for further evaluation by each utility in the planning region. An asterisk indicates those measures that have not previously been implemented or financially supported by the District. A complete description of the above measures, including applicable water use sectors, is provided in Chapter 5.

Residential
- Clothes Washer Rebates*
- Plumbing Retrofit Kit
- Ultra Low-Flow Toilet (ULFT) Rebate
- Water-Efficient Landscape and Irrigation Evaluation
- Rain Sensor Device Rebate
- Water Budgeting

Commercial/Industrial, Mining, Power Generation
- Pre-Rinse Spray Valve Rebate
- Ultra Low-Flow Toilet (ULFT) Rebate
- Industrial, Commercial and Institutional (ICI) Facility Assessment
- Water-Efficient Landscape/Irrigation Evaluation (for parcels less than one acre)
- Rain Sensor Device Rebate

Recreational /Aesthetic
- Water-Efficient Landscape/Irrigation Evaluation (for parcels less than one acre)
- Large Landscape Survey (for parcels more than one acre)*
- Rain Sensor Device Rebate
- Water Budgeting*

The cost of each program was calculated based on the variable cost per measure (the actual incremental cost of providing rebates, evaluations and surveys, including administrative costs). The non-variable costs (fixed program costs including promotion/educational materials, marketing, outreach, etc.) are not included. Program costs were expressed in real dollars (i.e., neither escalated for future costs nor discounted to present-day value). The cost-to-benefit ratio (or “cost-effectiveness”, expressed in cost per thousand gallons saved) was discounted at a rate of 6 percent. The complete list of measures and associated costs, savings and life expectancy is provided in the Chapter 4 Appendix.

1.2 Planning Model for Water Conservation Measures

A spreadsheet-based planning model was developed to estimate the potential for future water savings and the cost of the identified conservation measures for all utilities and non-public supply categories, including domestic self-supply, I/C,PG and recreational/ aesthetic within the planning region. A complete description of the model is located in the Chapter 4 Appendix.

1.3 Basis of Water Conservation Goals

The water savings potential stated in this RWSP is based on the implementation of the above conservation measures, provided the current and projected population, which equates to the number of accounts and estimated level of participation for the conservation programs, is accurate. Parameters considered in the conservation planning model as the basis for predicting the water savings that could be obtained from various conservation programs included (1) the number and type of accounts, (2) projected population and water demands and (3) conservation measures completed to date. These parameters are explained in greater detail as part of the description of the planning model in the Chapter 4 Appendix.

1.4 Potential for Non-Agricultural Water Conservation Savings

Water users are organized into four categories based on the source and intended use of the water. The categories, as described below, include public supply, domestic self-supply, I/C,M/D,PG, and recreational/aesthetic.

1.4.1 Public Supply

*Easily installed faucet aerators are one of a number of water conservation measures that have the potential to save nearly 19 mgd for the public supply and domestic self-supply water use categories in the planning region through 2030.*

The public supply category includes all water users that receive water from public water systems and private water utilities. The public supply category may include non-residential customers such as hospitals and restaurants. Water conservation in the public supply sector will continue to be the primary source of conservation program water savings in the District. Public supply systems lend themselves most easily to the administration of conservation programs, since they measure each water customer's water use and can focus, evaluate and adjust the program to maximize savings potential. The success of District water conservation programs for public supply systems to date is demonstrated by the 13.8 mgd in savings that has been achieved within the District since programs began in 1991 (SWFWMD, 2008b). This does not include savings from programs outside of the District's Cooperative Funding Initiative or offsets from reclaimed water.

Although some water savings in the planning region have been achieved, the potential for future public supply savings is expected to be significant. Some of the savings will occur from national and state regulations that mainly target interior plumbing fixtures and, to a limited extent, landscaping standards for single-family and multifamily residential properties. Despite savings already achieved, plumbing efficiency improvements in older (primarily pre-1995) facilities are still expected to yield considerable water savings. Spray valve retrofits for commercial hospitality establishments; waterless urinal rebates; industrial, commercial, institutional (ICI) facility assessments; and large landscape surveys provide local utilities with specific conservation measures for their commercial and institutional customers. Outdoor water use and landscape irrigation, which can account for approximately 50 percent of residential public supply demand, present very significant opportunities for water savings by customers of public water suppliers.

Conservation measures were evaluated at the utility level. Therefore, the costs indicated were assumed to be incurred by the public supply utility. Based on the methodology explained previously, it is estimated that savings for the public supply category could be 18.91 mgd by 2030 if all water conservation programs presented above are implemented (Table 4-3). The average cost-effectiveness for all planned measures is $0.46/1,000 gal. The public supply water conservation measure that will likely have the largest impact for public supply accounts in the planning region is rain sensor device rebates, which is estimated to save 8.14 mgd after 20 years at a cost of $6.5 million. The measure with the second largest impact is water-efficient landscape and irrigation evaluations, with an estimated savings of 5.09 mgd by 2030 at a total cost of $16.7 million.

#### 1.4.1.a Domestic Self-Supply

The domestic self-supply category includes individual private homes and businesses that are not utility customers and receive their domestic water supply from a well or from surface supply for uses such as irrigation. Domestic self-supply wells do not require a District water use permit. Domestic self-supply systems are not metered and, therefore, changes in water use patterns are less measurable than those that occur in the public supply sector. Conservation programs for domestic self-supply users can still be very successful, especially when outreach for the program is done in parallel with local public supply programs.

The applicable types of conservation measures that were considered to be viable in the domestic self-supply sector were the same as those for residential users of the public supply category. No commercial users were accounted for in this category, even though some commercial users are known to exist. The predicted number of measures was based on the estimated number of domestic self-supply wastewater users in the unincorporated areas.

It is estimated that savings for the domestic self-supply category could be 1.41 mgd by 2030 if all water conservation programs are implemented (Table 4-3). The average cost-effectiveness across all planned measures is $0.44/1,000 gal. The water conservation measure that will likely have the largest impact for domestic self-supply is rain sensor device rebates, which is estimated to save 0.82 mgd after 20 years at a cost of $653,600. The average cost-effectiveness of this measure through 2030 is estimated to be $0.51/1,000 gal. The measure with the second largest impact would be water-efficient landscape and irrigation evaluations, with an estimated savings of 0.36 mgd by 2030 at a total cost of $1.2 million.

1.4.2 Industrial/Commercial, Mining/Dewatering, Power Generation (I/C,M/D,PG)

*Progress Energy's Crystal River power station uses billions of gallons of salt water each day from the Gulf of Mexico for cooling purposes. The facility also uses much smaller quantities of fresh groundwater that could be reduced or replaced with reclaimed water from nearby communities.*

This water use category includes those factories, mines and other industrial enterprises that obtain water directly from surface water and/or groundwater sources through a water use permit. According to a survey sent to I/C,M/D,PG permittees, water use efficiency improvements related to industrial processes have been implemented to a limited extent since 1999. Businesses try to minimize water use to lower pumping, purchasing, treatment process and disposal costs. To date, the District has focused efforts on education, indoor and outdoor surveys and commercial applications, such as spray valves and low-flow toilets. Because of the uniqueness of the industrial processes being used in this category, the opportunities for water savings are best identified through a site-specific assessment of water use at each (or a similar) facility.

It is estimated that the savings for the I/C,M/D,PG category could be 0.06 mgd by 2030 (Table 4-3). The average cost-effectiveness across all planned measures is $0.37/1,000 gal. The water conservation measure that will likely have the largest impact for I/C,M/D,PG accounts is ICI facility assessments, which is estimated to conserve 0.05 mgd after 20 years at a cost of $70,380. The average cost efficiency of this measure through 2030 is estimated to be $0.35/1,000 gal.

1.4.3 Recreational/Aesthetic

The recreational/aesthetic water use category includes golf courses and large landscapes (e.g., cemeteries, parks and playgrounds) that obtain water directly from groundwater and surface water sources rather than from a public supply system. It is acknowledged that some amount of water savings has been achieved in this category through the use of efficient irrigation practices and technology. As previously discussed, the potential for water savings in the recreational/aesthetic category was based on the known number of accounts and assumed participation rates.

It is estimated that the savings for the recreational/aesthetic water use category could be 0.02 mgd by 2030 (Table 4-3). The average cost-effectiveness for all planned measures is $0.39/1,000 gal. The water conservation measure that will likely have the largest impact for recreational/aesthetic accounts is large landscape surveys, which is estimated to save 0.01 mgd after 20 years at a cost of $19,688. The average cost-effectiveness of this measure through 2030 is estimated at $1.30/1,000 gal.

### 1.5 Summary of Potential Water Savings from Non-Agricultural Water Conservation

Through the implementation of all conservation measures listed above for the public supply, domestic self-supply, I/C,M/D,PG and recreational/aesthetic water use categories, it is anticipated that 20.4 mgd could be saved by 2030 at a total projected cost of $39.5 million.

Table 4-3 Potential Non-Agricultural Water Conservation Savings in the Northern Planning Region

| Use Category | Water Conserved in 2030 (mgd) | Average Cost-Effectiveness ($/1,000 gal.) |
|---|---|---|
| **Public Supply** | 18.91 | $0.46 |
| **Domestic Self-Supply** | 1.41 | $0.44 |
| **I/C,M/D,PG** | 0.06 | $0.37 |
| **Recreational/Aesthetic** | 0.02 | $0.39 |
| **Total** | **20.4** | **$0.46** |

## 2.0 Agricultural Water Conservation

To estimate the quantity of water that could potentially be saved through agricultural water conservation, the District used the model farms concept. The model farms concept is a tool to determine the potential for water savings for various scenarios of irrigation system conversions and/or BMPs that are specific to a number of different agricultural commodities and associated water use factors such as soil type, climate conditions, crop type, etc. The District also achieves agricultural water savings through the Facilitating Agricultural Resource Management Systems (FARMS) Program. The FARMS Program is categorized as water resource development and, therefore, water savings achieved through the program are assigned to water resource development quantities rather than water conservation. Additional information on the FARMS Program is located in Chapter 7.

*The agricultural industry has increased the efficiency of their water use through widespread implementation of water-saving irrigation technologies promoted by the District.*

There are 20 model farm options available with different best management/irrigation system modifications applied to the existing farms. It is recognized that the model design parameters and case study results may not be directly transferable to all operations within a given commodity category. The model farm case studies should be viewed as a standard basis for comparison of cost analyses and for estimation of water savings. An additional benefit of the model farms data is that it is used to determine whether specific elements of projects implemented as part of the FARMS Program are cost-effective. The 20 model farm options were reviewed and three that represent BMPs for irrigation of citrus, nurseries and other vegetables/row crops were selected as being the most applicable in the planning region (HSW, 2004).

Sprinkler-type systems are typically used for container nurseries, field crops and sod farms. Drip systems are steadily increasing in popularity, particularly for row crops grown using plastic film mulch, and are used in conjunction with a seepage system that is used for bed preparation and crop establishment. Microjet systems are the most common system used for citrus. Since supplemental irrigation for citrus exceeds all other agricultural quantities combined, more water is delivered by microjet systems than from all other systems. Surface irrigation, which includes semi-closed systems, is the most common type of irrigation for non-citrus crops in Florida.

For the three model farm options selected for the planning region, the costs per acre required to convert to a more efficient irrigation system and the cost to implement BMPs were estimated based on publicly available data and information and interviews with local irrigation system and farm management providers. The potential savings associated with each of the model farm scenarios is included in Tables 4-4a and 4-4b. The data in these tables represent the maximum potential savings if all growers were to install the most efficient irrigation systems and implement appropriate BMPs for their respective commodities.

2.1 Potential Agricultural Water Conservation Savings

Table 4-5 shows that the potential for agricultural water savings for all commodities is 5.3 mgd through 2030 for the 5-in-10 condition. Citrus, field crops and nurseries are shown individually and the remaining commodities are summarized together.

### *Section 7. Summary of Potentially Available Water Supply*

Table 4-6 is a summary of the additional quantity of water that will potentially be available from all sources of water in each county in the planning region from 2010 through 2030. The table shows that the total quantity available could be as high as 241.5 mgd.

## Part B. Determination of Water Supply Deficits/Surpluses

Future water supply deficits/surpluses in the planning region were calculated as the difference between projected demands for 2030 and demands calculated for the 2005 base year (Table 3-6a). The projected additional water demand in the planning region for the 2005–2030 planning period is approximately 90.4 mgd. As shown in Table 4-6, up to 241.5 mgd is potentially available from water sources in the planning region to meet this demand. Based on a comparison of projected demands and available supplies, it is concluded that sufficient sources of water are available within the planning region to meet projected demands through 2030.

Table 4-4a. *Model farm potential water savings (5-in-10)*

| Description of Model Farm/Irrigation System/BMPs Scenario | | | | Water Savings (mgd) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Farm Scenario ID | Crop | Existing Irrigation System | Irrigation System Conversion | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 | Assumptions |
| 1 | Citrus – flatwoods[1] | Microjet | No, other BMPs only | 0.32 | 0.29 | 0.23 | 0.23 | 0.23 | 0.23 | 100 percent implementation, maximum improvement |
| 8 | Nurseries – container | Sprinkler | Line source emitter and other BMPs | 0.6 | 2.1 | 2.2 | 2.3 | 2.3 | 2.4 | 100 percent implementation, maximum improvement |
| 12 | Other vegetables and row crops | Semi-closed seepage | Fully-enclosed seepage and other BMPs | 1.8 | 2.3 | 2.4 | 2.4 | 2.4 | 2.5 | 100 percent implementation, 50 percent maximum improvement |

[1] Citrus model farm potential water savings were adjusted to be consistent with latest demand projections.
– Model Farm Scenario 1 (Citrus flatwoods): Existing microjet irrigation system is sufficient and no irrigation system conversion is required. Implement other BMPs only to achieve water savings. Model Farm Scenario 8 (Container nurseries): Replace existing sprinkler irrigation with line source emitters (also commonly known as "spaghetti tubing") irrigation system and implement other BMPs to achieve water savings.
– Model Farm Scenario 11 (Other vegetables and row crops): Existing, semi-closed seepage systems are sufficient and no irrigation system conversion is required. Implement other BMPs only to achieve savings. The data in this table can be viewed as the maximum potential savings if all growers were to install the most efficient irrigation systems and implement appropriate BMPs. Source: SWFWMD (2008a), Hazen and Sawyer (2009).

Table 4-4b. *Model farm potential water savings (1-in-10)*

| Description of Model Farm/Irrigation System/BMPs Scenario | | | | Water Savings (mgd) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Farm Scenario ID | Crop | Existing Irrigation System | Irrigation System Conversion | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 | Assumptions |
| 1 | Citrus – flatwoods[1] | Microjet | No, other BMPs only | 0.68 | 0.61 | 0.52 | 0.52 | 0.52 | 0.52 | 100 percent implementation, maximum improvement |
| 8 | Nurseries - Container | Sprinkler | Line source emitter and other BMPs | 0.67 | 0.81 | 0.96 | 1.12 | 1.27 | 1.36 | 100 percent implementation, maximum improvement |
| 12 | Other vegetables and row crops | Semi-closed seepage | Fully-enclosed seepage and other BMPs | 0.41 | 0.40 | 0.40 | 0.40 | 0.40 | 0.40 | 100 percent implementation, 50 percent maximum improvement |

[1] Citrus model farm potential water savings were adjusted to be consistent with latest demand projections.
– Model Farm Scenario 1 (Citrus flatwoods): Existing microjet irrigation system is sufficient and no irrigation system conversion is required. Implement other BMPs only to achieve water savings. Model Farm Scenario 8 (Container nurseries): Replace existing sprinkler irrigation with line source emitters (also commonly known as "spaghetti tubing") irrigation system and implement other BMPs to achieve water savings.
- Model Farm Scenario 11 (Other vegetables and row crops): Existing, semi-closed seepage systems are sufficient and no irrigation system conversion is required. Implement other BMPs only to achieve savings. The data in this table can be viewed as the maximum potential savings if all growers were to install the most efficient irrigation systems and implement appropriate BMPs. Source: SWFWMD (2008a), Hazen and Sawyer (2009).

Table 4-5 *Summary of potential agricultural water conservation savings by commodity (5-in-10) for the Northern Planning Region through 2030*

| Commodity | Total Estimated Savings (mgd)[1] | Total Cost ($/acre)[2] |
|---|---|---|
| **Citrus** | 0.33 | $105 |
| **Field Crops** | 2.41 | $1,800 |
| **Nursery** | 0.72 | $486 |
| **Other** | 1.85 | $100 |
| | **5.30** | |

[1]Based on 100 percent participation.
[2] Capital plus O&M cost, per planted acre for the first year of irrigation conversion. The total cost/acre for conversion to a more efficient system assumes the main and sub-main line installations are not included in cost estimation because it is assumed that the line would already exist in the previous system.

Table 4-6 *Potential additional water availability (mgd) in the Northern Planning Region (2010-2030)*

| County | Surface Water[1] | | Reclaimed Water | Desalination | | Fresh Groundwater | | Water Conservation | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | Permitted Unused | Available Unpermitted | Offsets | Seawater | Brackish Groundwater | Surficial and Intermediate | Upper Floridan Aquifer | Non-Agricultural | Agricultural | |
| **Hernando** | | | 3.8 | | | | 19.9 | 4.0 | 0.41 | **28.1** |
| **Citrus** | 0.25 | 46.6 | 5.4 | 15.0 | | | 20.3 | 6.1 | 0.14 | **93.8** |
| **Sumter** | | | 3.4 | | | | 26.9 | 7.0 | 1.62 | **38.9** |
| **Levy** | | | 0.1 | | | | 2.5 | 0.2 | 1.82 | **4.6** |
| **Lake** | | | | | | | 0.00 | 0.00 | 0.54 | **0.54** |
| **Marion** | 0.24 | 46.5 | 4.1 | | | | 20.8 | 3.2 | 0.77 | **75.6** |
| **Total** | **0.49** | **93.1** | **16.8** | **15.0** | **TBD** | **N/A** | **90.4**[2] | **20.4** | **5.3** | **241.5** |

[1]Available surface water from the Withlacoochee River is split between Citrus and Marion counties because the calculation was based on flows at a location between these two counties; however, future withdrawals from other counties may be available.
[2]It is anticipated that regional future demand can be met with groundwater, provided existing and anticipated local impacts are mitigated or avoided. The quantity of groundwater available in each county is equivalent to each county's projected 2030 demand.

*Co-location of a seawater desalination facility with the Crystal River Power Station is a potential water supply option for the planning region that could be viable over the long term when available groundwater supplies have been fully developed.*

The water supply development component of the RWSP requires the District to identify water supply options from which water users can choose to meet their individual needs. In addition, the District is to determine the associated costs of developing these options. As discussed in Chapter 4, sources of water potentially available to meet projected demand in the planning region include surface water stormwater, reclaimed water, seawater desalination, brackish groundwater desalination, fresh groundwater and conservation. Investigations were conducted to identify reasonable options for developing each of the sources, to provide planning level technical and environmental feasibility analyses, and to determine costs to develop the options.

Statutory guidance on how water supply entities are to incorporate water supply development options in the RWSP into their water supply planning and development of their comprehensive plans is presented in the Executive Summary for the RWSP.

## Part A. Overview of Water Supply Development Options

The District developed the reclaimed water and water conservation options in this Chapter. Surface water/stormwater, fresh groundwater and seawater desalination options were developed by the Withlacoochee Regional Water Supply Authority (WRWSA) as part of their Master Water Supply Planning and Implementation Program Phase II Feasibility Analysis Report (2010), which was co-funded by the District.

Options presented in the report are not necessarily the District's preferred options but are reasonable concepts that water users in the region could pursue in their water supply planning. A number of the options are of such a scale that they would likely be implemented by the WRWSA. Other options such as those involving reclaimed water and conservation, could be implemented by individual utilities. It is anticipated that users will choose an option or combine elements of different options that best fit their needs for water supply development, provided they are consistent with the RWSP. Following a decision to pursue an option identified in the RWSP, it will be necessary for the parties involved to conduct more detailed engineering, hydrologic and biologic assessments to provide the necessary technical support for developing the option and to obtain all applicable permits. The WRWSA report also provided unit production cost estimates for the surface water, groundwater and desalination options. Currency is based on 2009 US dollars. Water production costs in $/1,000 gallons provided by the WRWSA are a function of the capital cost debt service based on a 30-year life cycle at 4.625 percent interest

(2009 federal discount rate for water projects), annual O&M costs and amount of water produced.

### Section 1. Surface Water/Stormwater

In Chapter 4, the availability of surface water in the Withlacoochee River Basin for public supply water use was assessed. 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 planning level prior to initiation of specific surface water projects. 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.

*Several water supply options have been proposed for the Withlacoochee River that could be developed over the long term when available groundwater supplies have been fully developed.*

**Surface Water/Stormwater Option #1 – Withlacoochee River Surface Water Supply Facility in Northern Sumter County**

- Entity Responsible for Implementation: WRWSA

This option is for a surface water supply facility that could provide up to 10 mgd on an annual average basis to customers in the City of Wildwood and The Villages. Water would be withdrawn from the Withlacoochee River in northern Sumter County, downstream of the Outlet River from Lake Panasoffkee. During low-flow periods when withdrawals from the river would be limited, the facility would be supplemented by groundwater withdrawals in Sumter County, which would eliminate the need for a reservoir. The use of surface water would extend the availability of groundwater by reducing the frequency and duration of groundwater withdrawals. The proposed location of the facility is on property owned by the District west of Lake Panasoffkee and north of the Outlet River. Project components include a river intake and raw water pump station, water treatment facility, two 10-million gallon tanks for finished water storage, finished water pumping station and approximately 22 miles of finished water transmission mains.

| Quantity Produced (mgd) | Capital Cost | Capital Cost/mgd | Total Cost/1,000 Gallons | O&M Annual Costs |
|---|---|---|---|---|
| 10 | $93,316,000 | $9,331,600 | $2.43 | $3,052,000 |

Issues:

- Avoiding the violation of the minimum low flow at Holder, located about 17.5 miles downstream of the proposed intake for the facility, would be a primary concern.

- A detailed study of the effect of the river intake on the natural environment in the area and on the river flow regime will need to be performed in order to determine the exact location and design of the intake structure.
- Minimum lake levels have been established for Lake Panasoffkee and the Tsala Apopka Chain. Impacts to these lakes will be an important consideration during the process to permit additional groundwater and surface water withdrawals in the vicinity.

**Surface Water/Stormwater Option #2 – Withlacoochee River Surface Water Supply Near Holder**

- Entity Responsible for Implementation: WRWSA

This option is for a surface water supply facility with a capacity of 25 mgd that could potentially serve customers in Marion, Citrus, Sumter and Hernando counties. Water would be withdrawn from the Withlacoochee River near the town of Holder and would require an off-stream reservoir to achieve the desired supply reliability. The proposed location of the facility is on property owned by the District in Marion County, northeast of the town of Holder. Project components include a river intake and pumping station, off-stream reservoir with a storage capacity of 3.0 billion gallons, transfer pump station to move water from the reservoir to the treatment facility, water treatment facility, finished water storage tanks, finished water pumping station and approximately 51 miles of finished water transmission mains.

| Quantity Produced (mgd) | Capital Cost | Capital Cost/mgd | Total Cost/1,000 Gallons | O&M Annual Costs |
|---|---|---|---|---|
| 25 | $357,302,000 | $14,292,080 | $3.15 | $6,470,000 |

Issues:

- A detailed study of the effect of the river intake on the natural environment in the area and on the river flow regime will need to be performed in order to determine the exact location and design of the intake structure.
- Further geologic evaluation of the proposed reservoir area will be needed. Due to the high permeability of geologic units in the area, a reservoir liner to prevent excessive water loss was included in the conceptual design.

**Surface Water/Stormwater Option #3 – Surface Water Treatment Facility at Lake Rousseau**

- Entity Responsible for Implementation: WRWSA

This option is for a surface water supply facility with a capacity of 25 mgd with the potential to serve customers in Marion, Citrus, Sumter and Hernando counties. Water would be withdrawn directly from Lake Rousseau and pumped approximately four miles to a water treatment plant in southern Levy County on property owned by the Department of Agriculture and Consumer Services. An off-stream reservoir may not be required because of the year-round high-volume inflow from Rainbow Springs via the Rainbow River. Project components include a river intake and pumping station, a raw water transmission main, water treatment facility, finished water storage tanks, finished water pumping station and approximately 63 miles of finished water transmission main.

| Quantity Produced (mgd) | Capital Cost | Capital Cost/mgd | Total Cost/1,000 Gallons | O&M Annual Costs |
|---|---|---|---|---|
| 25 | $254,982,000 | $10,199,280 | $2.38 | $5,865,000 |

Issues:

- The District will not be setting a minimum level for Lake Rousseau because it is a reservoir. However, the U.S. Army Corps of Engineers' regulation schedule at the Inglis Dam will need to be considered.

### *Section 2. Reclaimed Water*

*Reclaimed water pump stations are components of a number of proposed options that will increase utilization and offset of reclaimed water in the planning region.*

Reclaimed water systems in the planning region are generally in the early stages of development and, as such, the representative project options are dominated by golf course, large industrial and new residential development options. Seasonal reclaimed water storage using ASR technology is generally not feasible in the region due to the lack of suitable geologic conditions in the Upper Floridan aquifer. Listed below are the different types of reclaimed water options that are compatible with the geology, hydrology, geography and available reclaimed water supplies in the planning region.

- **Augmentation With Other Sources:** introduction of another source (stormwater, surface water, groundwater) into the reclaimed water system to expand available supply
- **Distribution:** expansion of a reclaimed water system to serve more customers
- **Efficiency/Research:** the study of how utilities can maximize efficiency and offset potential of reclaimed water systems to conserve water (rate structures, telemetry control, watering restrictions, metering) and research (water quality, future uses)
- **Interconnect:** interconnection of systems to enhance supply and allow for better utilization of the resource or to enable agricultural or other water use permit exchanges
- **Natural System Restoration/Recharge:** introduction of reclaimed water to create/restore natural systems and enhance aquifer levels (indirect potable reuse)
- **Saltwater Intrusion Barrier:** injection of reclaimed water into an aquifer in coastal areas to create a salinity barrier
- **Storage:** reclaimed water storage in ground storage tanks and ponds
- **Streamflow Augmentation:** discharge of reclaimed water downstream of water intakes as replacement flow to enable additional utilization of the surface water supply
- **System Expansion:** construction of multiple components (transmission, distribution, storage) necessary to deliver reclaimed water to more customers
- **Transmission:** construction of large reclaimed water mains to serve more customers

The District developed 29 reclaimed water project options for the planning region with input from utilities and other interested parties. The determination of the quantity of reclaimed water available for each option to use was based on an analysis of wastewater flows anticipated to be available in 2030 at a utilization rate of 75 percent (Chapter 4, Table 4-2). 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. An expanded description is provided for 4 of the 29 options that are representative of the types of projects listed above. These options were subjected to a detailed analysis to more fully develop the concepts and refine cost estimates. The remaining options are listed in Table 5-1.

Flow and capital cost data for the 95 reclaimed water projects originally identified as being under development (post-2005) within the District were used to develop a representative cost per 1,000 gallons supplied and capital cost for each option. The data show that for projects anticipated to come online between 2005 and 2015, the average capital cost is approximately $5.77 million for each 1 mgd supplied. This figure was used in cost calculations for individual reclaimed water options, unless specific cost data were available. In addition to capital costs, O&M costs for each of the representative options were estimated. Reclaimed water flow data and O&M cost data associated with existing reclaimed water systems were collected to identify the median reclaimed water O&M cost estimate per 1,000 gallons supplied. The data show that reclaimed water O&M costs are relatively consistent across system sizes, with a median cost of $0.30 per 1,000 gallons supplied. This figure was used in cost calculations for individual reclaimed water options, unless system-specific O&M cost data were available.

**Reclaimed Water Option #1 – Crystal River WWTP to Progress Energy's Crystal River Facility**

- Entities Responsible for Implementation: City of Crystal River Utilities, Progress Energy

This option would supply 2.0 mgd of reclaimed water from the City of Crystal River to Progress Energy's Crystal River facility to offset existing groundwater withdrawals for cooling and process water. The option includes eight miles of 20-inch transmission main, a pump station and a two-million gallon storage tank. The implementation time frame is between 2011 and 2030.

| Quantity Produced (mgd) | Capital Cost | Cost/mgd Offset | Cost/1,000 Gallons Offset | O&M/1,000 Gallons Offset |
|---|---|---|---|---|
| 2.0 (2.0[1]) | $11,534,000 | $5,767,000 | $1.14 | $0.30 |

[1]Beneficial offset

Issues:
- Competition for reclaimed water by other options could affect viability of the project.
- The use of reclaimed water may face TMDL issues; however, they are anticipated to be less severe than direct surface water discharge.
- Additional treatment may be required.

**Reclaimed Water Option #2 – Citrus County Brentwood Golf Option**

- Entity Responsible for Implementation: Citrus County

This option includes a transmission main to interconnect the Brentwood and Meadowcrest WWTPs and to provide additional flows to the Black Diamond Ranch golf courses. A 3-million gallon storage tank, engineering services, pump station and related apparatus to allow bi-directional flow management between the Brentwood and Meadowcrest facilities is also included. Up to 1.0 mgd of reclaimed water could ultimately be provided to offset 0.75 mgd of groundwater use. The implementation time frame is expected to be between 2016 and 2030.

| Quantity Produced (mgd) | Capital Cost | Cost/mgd Offset | Cost/1,000 Gallons Offset | O&M/1,000 Gallons Offset |
|---|---|---|---|---|
| 1.00 (0.75[1]) | $4,971,000 | $6,628,000 | $1.31 | $0.40 |

[1]Beneficial offset

Issues:
- Competition for reclaimed water by other options could affect viability of the project.
- The option would require that related ongoing reclaimed water projects be completed.

**Reclaimed Water Option #3 – Marion County Summerglen Reclaimed Water Project**

- Entity Responsible for Implementation: Marion County

This option includes 20,000 feet of 8-inch transmission main from the Marion Oaks WWTP plant to the Summerglen WWTP then to the Summerglen Golf Course, a pump station and related apparatus. The county would deliver 0.5 mgd of reclaimed water to the golf course to offset 0.37 mgd of groundwater withdrawals. The implementation time frame is between 2011 and 2030.

| Quantity Produced (mgd) | Capital Cost | Cost/mgd Offset | Cost/1,000 Gallons | O&M/1,000 Gallons Offset |
|---|---|---|---|---|
| 0.5 (0.37[1]) | $4,200,000 | $11,351,351 | $2.20 | $0.40 |

[1]Beneficial offset

Issues:
- Competition for funding for other county projects could affect viability of the project.
- The WWTP would require upgrading to meet FDEP reclaimed water standards.

**Reclaimed Water Option #4 – Continental Country Club Reclaimed Water Project**

- Entity Responsible for Implementation: Continental Utilities (Sumter County)

This option would provide reclaimed water from the Continental Utilities WWTP to the Continental Golf Course. A feasibility study is ongoing and if construction is pursued, design, permitting and construction of a transmission main, pump station and storage pond would be included. The project could deliver 0.12 mgd of reclaimed water to the golf course to offset 0.09 mgd of groundwater withdrawals. The implementation time frame is between 2011 and 2030.

| Quantity Produced (mgd) | Capital Cost | Cost/mgd Offset | Cost/1,000 Gallons | O&M/1,000 Gallons Offset |
|---|---|---|---|---|
| 0.12 (0.09[1]) | $250,000 | $2,777,777 | $0.55 | $0.40 |

[1]Beneficial offset

Issues:
- Competition for the funding of other utility projects could affect the viability of the project.
- The WWTP would require upgrading to meet FDEP reclaimed water standards.

Table 5-1. *List of reclaimed water options for the Northern Planning Region*

| Option Name and Entity Responsible for Implementation | County | Type | Supply | Offset | Capital Cost | Cost/Ben | O&M/Offset |
|---|---|---|---|---|---|---|---|
| Reuse Expan. In Williston WWTP 2011–2030, City of Williston | Levy | Sys. Expan. | 0.15 | 0.11 | $865,050 | $1.56 | $0.40 |
| Reuse Expan. Citrus Beverly Hills/Rolling Oaks WWTP 2011–2030, Citrus County | Citrus | Sys. Expan. | 0.35 | 0.26 | $2,018,450 | $1.56 | $0.40 |
| Reuse Expan. Citrus Brentwood WWTP 2011–2030, Citrus County | Citrus | Sys. Expan. | 1.00 | 0.75 | $4,971,000 | $1.31 | $0.40 |
| Reuse Expan. Citrus Meadowcrest WWTP 2011–2030, Citrus County | Citrus | Sys. Expan. | 0.80 | 0.60 | $4,613,600 | $1.56 | $0.40 |
| Reuse Expan. Citrus Sugar Mill Woods WWTP 2011–2030, Citrus County | Citrus | Sys. Expan. | 0.70 | 0.52 | $4,036,900 | $1.56 | $0.40 |
| Reuse Expan. Citrus Springs WWTP 2011–2030, Citrus County | Citrus | Sys. Expan. | 1.00 | 0.75 | $5,767,000 | $1.56 | $0.40 |
| Reuse Expan. Crystal River WWTP 2011–2030, City of Crystal River | Citrus | Sys. Expan. | 1.50 | 1.12 | $8,650,500 | $1.56 | $0.40 |
| Crystal River WWTP Transmission to Florida Power Crystal River Energy Facility, City of Crystal River | Citrus | Sys. Expan. | 2.00 | 2.00 | $11,534,000 | $1.14 | $0.30 |
| Reuse Expan. City of Inverness WWTP 2011–2030, City of Inverness | Citrus | Sys. Expan. | 1.75 | 1.31 | $10,092,250 | $1.56 | $0.30 |
| Continental County Club WWTP Reclaimed Water Project 2011–2030, Continental Utilities | Sumter | Sys. Expan. | 0.12 | 0.09 | $250,000 | $0.55 | $0.40 |
| Reuse Expan. City of Bushnell WWTP 2011–2030, City of Bushnell | Sumter | Sys. Expan. | 0.40 | 0.30 | $2,306,800 | $1.56 | $0.40 |
| Reuse Expan. Little Sumter WWTP 2011–2030, Villages | Sumter | Sys. Expan. | 1.40 | 1.05 | $8,073,800 | $1.56 | $0.40 |
| Reuse Expan. North Sumter WWTP 2011–2030, Villages | Sumter | Sys. Expan. | 1.60 | 1.20 | $9,227,200 | $1.56 | $0.40 |
| Reuse Expan. Sumter Correctional WWTP 2011–2030 (To Existing Customer) | Sumter | Sys. Expan. | 0.02 | 0.01 | $0 | | $0.40 |
| Reuse Expan. City of Wildwood WWTP 2011–2030, City of Wildwood | Sumter | Sys. Expan. | 1.00 | 0.75 | $5,767,000 | $1.56 | $0.40 |
| Reuse Expan. City of Dunnellon WWTP 2011–2030, City of Dunnellon | Marion | Sys. Expan. | 0.50 | 0.38 | $2,883,500 | $1.56 | $0.40 |
| Reuse Supply Expan. City of Ocala WWTPs #1 and #2, City of Ocala (Supplies Coming Into District) | Marion | Sys. Expan. | TBD | TBD | TBD | TBD | TBD |

Southwest Florida Water Management District

Table 5-1. *List of reclaimed water options for the Northern Planning Region (continued)*

| Option Name and Entity Responsible for Implementation | County | Type | Supply | Offset | Capital Cost | Cost/Ben | O&M/Offset |
|---|---|---|---|---|---|---|---|
| Reuse Expan. Marion Oaks and/or Golden Ocala WWTP 2011–2030, Marion County | Marion | Sys. Expan. | 1.00 | 0.75 | $5,767,000 | $1.56 | *$0.40* |
| Reuse Expan. Marion Summerglen WWTP 2011–2030, Marion County | Marion | Sys. Expan. | 0.50 | 0.37 | $4,200,000 | $2.22 | *$0.40* |
| Reuse Expan. Marion Oak Run WWTP 2011–2030, Marion County | Marion | Sys. Expan. | *0.10* | *0.07* | *$576,700* | *$1.56* | *$0.40* |
| Reuse Expan. Rainbow Springs WWTP 2011–2030, Rainbow Springs Utilities | Marion | Sys. Expan. | *0.20* | *0.15* | *$1,153,400* | *$1.56* | *$0.40* |
| Reuse Expan. Hern Co. Berkeley Manor WWTP 2011–2030, Hern Co (Likely Transfer to The Glenn WWTP) | Hernando | Sys. Expan. | *0.50* | *0.38* | *$2,883,500* | *$1.56* | *$0.40* |
| Reuse Expan. Hernando Co. Brookridge WWTP 2011–2030, Hern. Co. | Hernando | Sys. Expan. | *0.50* | *0.38* | *$2,883,500* | *$1.56* | *$0.40* |
| Reuse Expan. Hern Co. Hern Beach WWTP 2011–2030, Hern Co (Transfer to The Glenn WWTP) | Hernando | Sys. Expan. | *0.50* | *0.38* | *$2,883,500* | *$1.56* | *$0.40* |
| Reuse Expan. Hern. Co. Airport WWTP 2011–2030, Hern. Co. | Hernando | Sys. Expan. | *0.75* | *0.56* | *$4,325,250* | *$1.56* | *$0.40* |
| Reuse Expan. Hern Co. Spring Hill WWTP 2011–2030, Hern Co. (Likely Transfer to Airport WWTP) | Hernando | Sys. Expan. | *0.50* | *0.38* | *$2,883,500* | *$1.56* | *$0.40* |
| Reuse Expan. Hernando Co. The Glenn WWTP 2011–2030, Hern. Co. | Hernando | Sys. Expan. | *0.70* | *0.52* | *$4,036,900* | *$1.56* | *$0.40* |
| Reuse Expan. Hern Co. Weeki Wachee WWTP 2011–2030, Hern. Co. (Transfer to Glenn WWTP) | Hernando | Sys. Expan. | *0.40* | *0.30* | *$2,306,800* | *$1.56* | *$0.40* |
| Reuse Expan. City of Brooksville WWTP 2011–2030, City of Brooksville | Hernando | Sys. Expan. | *0.10* | *0.07* | *$576,700* | *$1.56* | *$0.40* |
| **Conceptual Totals: 29 Projects** | | | ***20.04*** | ***15.51*** | ***$115,533,800*** | | |

Use of italics denotes District estimations.
Not all projects have estimated costs. Some options are contingent upon others.
WWTPs with no available (unused) 2030 flows not included.
Mgd offset = (if est) annualized supply: 1. x 75% for Ag, & R/A/C, 2. x 100% for I/C, NSR, & PG. 3. x 75% for Variety and 4. for RES is number of customers X 300 gpd. Total Cost = (if est) = annualized supply x $5.77/gal (calc. of 96 draft under development 2005–2015 District-funded projects (@ $431.4 million for 74.8 mgd reuse supply).
Preliminary cost/1,000 gallons offset = Project cost amortized over 30 years @ a 6% interest rate.
System expansion supply 2011–2030 = Projected 2030 WWTP flow x 75% minus 2015 reuse (existing and planned reuse projects).

### Section 3. Brackish Groundwater Desalination

*The pretreatment component of a brackish groundwater reverse osmosis treatment facility. Such a facility could someday be developed in the planning region to desalinate water from the Lower Floridan aquifer.*

Brackish groundwater is used extensively in the Southern and Tampa Bay planning regions where it is treated through reverse osmosis and other processes and used for potable supply. In certain areas of the Northern Planning Region, brackish groundwater obtained from the Upper Floridan and Lower Floridan aquifers could be a viable source of water supply. Requests for brackish groundwater withdrawals will be evaluated similarly to requests for fresh groundwater withdrawals because any withdrawal, regardless of quality, cannot impact or delay the recovery of a stressed MFL water resource.

In the coastal portions of the planning region, salt water is close to the surface and exists as a wedge beneath a relatively thin freshwater lens in the Upper Floridan aquifer. As a result, the potential for induced saltwater intrusion from brackish groundwater withdrawals would be significant, and extensive analysis and modeling would be required to permit a sustainable withdrawal. In inland areas, the freshwater zone in the Upper Floridan aquifer is only a few hundred feet thick. Below this level, water becomes increasingly more mineralized, mainly due to the presence of sulfate. In The Villages in Sumter County, this mineralized water is used for landscape irrigation without treatment. Use of this water offsets demand for potable-quality groundwater in the upper, potable portions of the aquifer. Significant inland withdrawals from the Lower Floridan aquifer may be possible, and District efforts to investigate the feasibility of such withdrawals are in progress.

Because of the significant availability of fresh groundwater and reclaimed water in the planning region and the District's policy to aggressively promote water conservation strategies to reduce demand, project options for developing brackish groundwater were not developed for the Northern Planning Region.

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### *Section 4. Seawater Desalination*

*An interior view of Tampa Bay Water's seawater desalination facility on Tampa Bay.*

Desalinated seawater continues to be the most expensive alternative water source due the level of complexity of the equipment and high levels of energy required to produce potable water. There are currently no seawater desalination plants operating or planned in the planning region. The evaluation of seawater desalination as a source focused on locating sites that would (1) be compatible with adjacent land uses, (2) be near existing potable water transmission infrastructure, (3) be near water supply demand centers, (4) have the potential for co-location with an existing power station that uses seawater for cooling and (5) could be permitted for disposal of the concentrate. Disposal of concentrate is a significant issue because the concentrate can have twice the dissolved solids of seawater. Complicating the disposal issue is the fact that numerous near-shore areas in the region have been designated as either Outstanding Florida Waters (OFW) or aquatic preserves. The Crystal River power station complex is the only site in the planning region that met all these criteria.

**Seawater Desalination Option #1 – Crystal River Power Station**

- Entity Responsible for Implementation: WRWSA

This option is for the development of a seawater desalination plant with a capacity of 15 mgd that would be co-located with Progress Energy's Crystal River power station complex in Citrus County. The facility could serve utilities in Citrus, Marion and Hernando counties. The facility cost analysis was based on a capacity of 15 mgd, although the facility could be incrementally expanded in the future. This site offers advantages such as the power station's pre-filtered cooling water, which would serve as source water for the desalination plant, and a large volume of discharged cooling water for dilution of the plant's concentrate byproduct. The power station circulates from 1.5 to 2.5 billion gallons of seawater per day through a lengthy canal/jetty system that releases the cooling water far offshore. The concentrate created by the desalination process would be mixed with the heated cooling water discharge of the power station immediately down-pipe from the intake for the desalination plant feed water. Assuming a 16:1 dilution ratio for the concentrate, as required by FDEP for Tampa Bay Water's seawater desalination facility on Tampa Bay, the total potable water production capacity of the Crystal River facility could be as high as 85 mgd. A secondary intake structure could potentially be located in the nearby Barge Canal, where salinities vary seasonally around 15 to 20 ppt. The conceptual project cost includes 37 miles of transmission main. Available reserve capacity will allow for potential additional partners and for future growth. The plant could initially be constructed with a relatively small capacity and expanded in phases as regional demands increase.

| Quantity Produced (mgd) | Capital Cost | Capital Cost/mgd | Total Cost/1,000 Gallons | O&M Annual Costs |
|---|---|---|---|---|
| 15 | $170,321,000 | $11,354,700 | $4.27 | $12,796,000 |

Issues:

- Maintenance, operational and life cycle issues at the co-located power station could affect reliability and will require further investigation. However, the Crystal River power station provides a significant fraction of Florida's power and is expected to remain functional well into the future. The current Nuclear Regulatory Commission (NRC) operating permit for the plant expires in 2016, but an expansion and capacity upgrade for the nuclear unit has been proposed and would extend the permit.
- Permitting of the source will require coordination with the NRC.
- The source is distant from demand areas and existing infrastructure. An extensive distribution system would be required to provide product water to utilities. Transmission infrastructure accounts for 30 percent of the capital cost.
- Since the proposed location of the facility is directly on the coast at a low elevation, the potential for the facility to be affected by higher storm tides due to rising sea level should be considered.

### *Section 5. Fresh Groundwater*

Groundwater flow modeling using the District's Northern District Model has indicated that it may be feasible to develop wellfields of significant size in various portions of the planning region. The options below are for new wellfields in the region. Initial conceptual-level cost estimates were developed based on the overall system description and general site layout and conceptual transmission systems. Conceptual transmission system layouts assume centrally located delivery points within utility service areas. O&M costs consist of labor, chemical and electrical costs.

*A number of options have been proposed to develop new wellfields to produce additional groundwater supplies in the planning region.*

**Fresh Groundwater Option #1 – Sumter County Regional Wellfield**

- Entity Responsible for Implementation: WRWSA

The Sumter County Regional Wellfield option is for a 10 mgd facility located in northern Sumter County in an area west of The Villages and northwest of the City of Wildwood. It would supply The Villages and the City of Wildwood and disperse projected groundwater withdrawals at The Villages. The wellfield would consist of five Upper Floridan aquifer wells, each with the capacity to produce 2.0 mgd. The depths of each well would be determined through analysis of local aquifer characteristics and aquifer performance testing. A single pipeline would connect the five wells and convey raw water to a centrally located treatment facility. It is anticipated that groundwater produced in the wellfield will be of high quality and will therefore require only aeration and disinfection to control taste, odor and pathogens. A finished water pump station will be necessary to convey water through transmission mains to connection points with the existing distribution systems of the proposed customers.

| Quantity Produced (mgd) | Capital Cost | Capital Cost/mgd | Total Cost/1,000 Gallons | O&M Annual Costs |
|---|---|---|---|---|
| 10 | $34,516,000 | $3,451,600 | $0.77 | $530,000 |

Issues:

- An extensive distribution system would be required to provide water to the dispersed utilities. Transmission infrastructure includes approximately 16 miles of pipelines and accounts for 40 percent of the capital cost.

**Fresh Groundwater Option #2 – Citrus County Regional Wellfield**

- Entity Responsible for Implementation: WRWSA

The Citrus County Regional Wellfield option is for a 7.5 mgd facility located in southern Citrus County. It could potentially supply Citrus County Utilities (Sugarmill Woods), Hernando County Utilities and the City of Brooksville. The design capacity of the wellfield was set at 7.5 mgd to provide reserve capacity to meet future demands. The facility could initially be developed with a smaller capacity and expanded in phases to keep pace with increasing demands. The wellfield would be configured to minimize impacts to MFL-priority water resources such as lakes in the Tsala Apopka Chain and Chassahowitzka and Homosassa springs. Withdrawals from the wellfield could also reduce proposed withdrawals in western Hernando County, which would reduce impacts to Weeki Wachee Spring and Weeki Wachee Prairie.

The wellfield would consist of 3 Upper Floridan aquifer wells, each with the capacity to produce 2.5 mgd. The depths of each well would be determined through analysis of local aquifer characteristics and aquifer performance testing. A single pipeline would connect the three wells and convey raw water to a centrally located treatment facility. It is anticipated that groundwater produced in the wellfield will be of high quality and will therefore require only aeration and disinfection to control taste, odor and pathogens. A finished water pump station would be necessary to convey water through transmission lines to connection points with the existing distribution systems of the proposed customers.

| Quantity Produced (mgd) | Capital Cost | Capital Cost/mgd | Total Cost/1,000 Gallons | O&M Annual Costs |
|---|---|---|---|---|
| 7.5 | $13,312,000 | $1,774,900 | $0.42 | $298,000 |

Issues:

- Transmission infrastructure included in the cost estimate is not sufficient to convey the full design capacity and includes approximately 11 miles of pipeline.

**Fresh Groundwater Option #3 – Marion County Northwestern Regional Wellfield**

- Entity Responsible for Implementation: WRWSA

The WRWSA is considering the development of two regional wellfields to serve Marion County, one of which is located in the District. The location for the wellfield, near the town of Reddick, was selected because its distance from Rainbow and Silver springs was assumed to be sufficient to avoid impacts. The wellfield would serve the City of Ocala and other utilities in the District.

The groundwater withdrawal system would include five Upper Floridan aquifer wells, each with a capacity of 3 mgd. The location of the wells will be determined during preliminary design based on the availability of public and/or private lands, water resource constraints and other factors. It is anticipated that groundwater produced in the wellfield will be of high quality and will therefore require only aeration and disinfection to control taste, odor and pathogens.

| Quantity Produced (mgd) | Capital Cost | Capital Cost/mgd | Total Cost/1,000 Gallons | O&M Annual Costs |
|---|---|---|---|---|
| 15 | $41,094,000 | $2,739,600 | $0.63 | $758,000 |

Issues:

- An extensive distribution system would be required to provide product water to the dispersed utilities. Transmission infrastructure includes approximately 18 miles of pipeline accounted for 38 percent of the capital cost.

**Fresh Groundwater Option #4 – Regional Water Supply Framework**

- Entity Responsible for Implementation: WRWSA

A regional water supply framework has been proposed by the WRWSA to assist in the participation between member governments for developing a water supply strategy that will manage the technical, economic, environmental and political issues associated with the procurement of long-term, sustainable water supplies. The framework will allow member governments to integrate water supply planning and development in a regional context. One major goal of the framework is to ensure that the development of transmission infrastructure associated with wellfields and interconnects will be compatible with the eventual introduction of alternative water supplies that will be needed once groundwater resources reach their limits. Participation in the framework may benefit participating governments by potentially increasing project funding opportunities, allowing for longer water use permit durations and incrementally preparing for the delivery of a regional alternative water supply source. Once participants are identified, a feasibility/routing study will be conducted to identify potential transmission corridors. Costs have not been developed for the framework because the interconnect systems have not been conceptually designed.

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## Section 6. Water Conservation

### 1.0 Non-Agricultural Water Conservation

*Water-efficient landscape rebates and large landscape surveys are water conservation options that can help reduce the large quantity of water used for outdoor irrigation in the planning region.*

The District identified a series of conservation measures that are appropriate for implementation by the public supply, domestic self-supply, recreational aesthetic and I/C,M/D,PG water use sectors. A complete description of the criteria used in selecting these measures and the methodology for determining the water savings potential for each measure within each non-agricultural water use category is described in detail in Chapter 4, Section 6.

Some readily applicable conservation options were not addressed due to the wide variance in implementation costs and the site-specific nature of their implementation. Two such measures in particular, which have savings potential but will not be addressed as part of this RWSP, are water-conserving rate structures and local codes/ordinances that require water conservation. The District strongly encourages these measures and when designed properly, they can be effective at conserving water. In addition, permittees are required to address these measures in their water conservation plan, which is part of the package provided by permittees during the water use permit application or renewal period. The following is a description of each non-agricultural water conservation option. Data source references for costs and savings can be found in the Chapter 5 Appendix.

**Non-Agricultural Water Conservation Option #1 – Clothes Washer Rebates**

- Entities Responsible for Implementation: Utilities, Municipalities, Counties and Industrial Organizations

This option is for rebates for installation of water-efficient clothes washers in single-family homes, multifamily housing and commercial establishments. Laundry washing is a large water user in the average home, accounting for 15 to 40 percent of the overall water consumption inside a typical household of four persons. A family of four using a standard clothes washer may generate more than 300 loads per year, consuming 12,000 gallons of water annually. High-efficiency clothes washers can reduce this water use by more than 6,000 gallons per year. Additional benefits include using less laundry detergent, less energy and more effective cleaning. Most high-efficiency washers use only 15 to 30 gallons of water to wash the same amount of clothes as traditional washers (29 to 45 gallons per load).

The variable cost per rebate is approximately $160. The variable cost refers to the actual direct costs of each individual measure — in this case, the value of the rebate and some administrative costs. The potential for water savings varies, depending on how often the washer is used. The savings are estimated at 16.3 gpd. For the purposes of this RWSP, the measure was evaluated based on the current variable costs and for single-family uses only. Higher savings and lower costs could be achieved in multifamily or commercial laundry facilities.

| Sector | Water Savings in 2030 (mgd) | Cost Effectiveness ($/1,000 gal) | Total Cost |
|---|---|---|---|
| **Public Supply** | 0.2 | $2.31 | $1,998,400 |
| **Total** | **0.2** | **$2.31** | **$1,998,400** |

**Non-Agricultural Water Conservation Option #2 – Plumbing Retrofit Kits (Residential Users)**

- Entities Responsible for Implementation: Utilities, Municipalities, Counties and Industrial Organizations

Plumbing retrofit kits conserve water through the distribution of plumbing fixtures to retrofit high-flow plumbing fixtures with low-flow equivalents. This option is appropriate for implementation in the domestic self-supply category and multifamily and single-family residential uses in the public supply category. Typically, retrofit kits contain easy-to-install low-flow showerheads, faucet aerators and toilet leak detection tablets. Plumbing retrofit programs can be designed as a giveaway or exchange program and require outreach and marketing efforts to promote the program. Purchasing higher-quality kit contents would be a tradeoff between higher retention rates and higher program costs. The average cost per kit (including program administration and purchasing price) is approximately $12. The water savings is estimated at 12.0 gpd. Additional savings could be achieved by providing EPA WaterSense-certified low-flow showerheads.

| Sector | Water Savings in 2030 (mgd) | Cost Effectiveness ($/1,000 gal) | Total Cost |
|---|---|---|---|
| **Public Supply** | 0.72 | $0.24 | $717,756 |
| **Domestic Self-Supply** | 0.09 | $0.24 | $87,600 |
| **Total** | **0.81** | **$0.24** | **$805,356** |

**Non-Agricultural Water Conservation Option #3 – Ultra Low-Flow Toilet (ULFT), Rebates (Residential and Commercial Users)**

- Entities Responsible for Implementation: Utilities, Municipalities, Counties and Industrial Organizations

ULFT programs offer rebates as an incentive for replacement of high-flow toilets with water-efficient models. ULFTs use 1.6 gallons per flush (gpf), as opposed to older, less-efficient models that use 3.5 to 7.0 gpf, depending on the age of the fixture. Other fixtures such as high-efficiency toilets (HETs) and dual-flush toilets (DFTs) use even less water but can be rebated for the same amount, resulting in even higher savings than those presented here. HETs use about 1.28 gpf, while DFTs have the option to use 0.8 gallons of water for liquid removal or 1.6 gallons for full flush solid removal. Additional savings could be achieved by providing only rebates for EPA WaterSense-certified HETs, which use 1.28 gpf or less. A DFT rebate program may be used in conjunction with a ULFT or HET rebate program; however, over-estimating the potential for future water savings by "double-dipping" from both toilet types should be avoided. Since these two conservation measures are mutually exclusive, only the more conservative savings from ULFTs are presented below.

Toilet rebate programs should be accompanied by customer education regarding proper flapper selection and replacement to sustain water savings over the lifetime of the fixture. The variable cost per measure can range from $135 to $210, depending on the program. The water savings is estimated at 27 gpd.

| ULFT Rebate | | | |
|---|---|---|---|
| **Sector** | **Water Savings in 2030 (mgd)** | **Cost-Effectiveness ($/1,000 gal)** | **Total Cost** |
| **Public Supply** | 1.51 | $1.18 | $7,548,255 |
| **Domestic Self-Supply** | 0.14 | $1.18 | $712,125 |
| **I/C,M/D,PG** | 0.002 | $1.18 | $8,262 |
| **Total** | **1.65** | **$1.18** | **$8,268,642** |

**Non-Agricultural Water Conservation Option #4 – Water-Efficient Landscape and Irrigation/Evaluation Rebates and Large Landscape Surveys (All Users)**

- Entities Responsible for Implementation: Utilities, Municipalities, Counties and Industrial Organizations

Landscape and irrigation evaluation rebates (evaluations) and large landscape surveys (surveys) obtain water savings by evaluating individual irrigation systems, providing expert tips on opportunities to increase water efficiency and offering targeted rebates or incentives based on those recommendations. Evaluations are applicable to all accounts that use inground sprinkler systems for landscape irrigation and have irrigated landscapes larger than one acre in size. Surveys apply only to the non-residential sub-category of the public supply category and the I/C,M/D,PG and recreational/aesthetic categories. The cost-effectiveness is greatest for these large accounts. The cost of the option increases with the area surveyed. The variable cost of each evaluation (smaller accounts) is $460, and the variable cost for each survey (large accounts) is $875. The average water savings rate is 140 gpd for evaluations and 428 gpd for surveys. On-site follow-up evaluations are recommended to verify water savings. Since these measures depend on behavior modifications and equipment that typically have a five-year life, the “life span” of the water savings is limited to five years.

| Water-Efficient Landscape and Irrigation/Evaluation Rebates | | | |
|---|---|---|---|
| **Sector** | **Water Savings in 2030 (mgd)** | **Cost Effectiveness ($/1,000 gal)** | **Total Cost** |
| **Public Supply** | 5.09 | $2.09 | $16,708,120 |
| **Domestic Self-Supply** | 0.36 | $2.09 | $1,196,000 |
| **I/C,M/D,PG** | 0.003 | $2.09 | $9,384 |
| **Recreational/Aesthetic** | 0.003 | $2.09 | $10,350 |
| **Total** | **5.46** | **$2.09** | **$17,923,854** |

| Large Landscape Surveys | | | |
|---|---|---|---|
| **Sector** | **Water Savings in 2030 (mgd)** | **Cost-Effectiveness ($/1,000 gal)** | **Total Cost** |
| **Public Supply** | 0.03 | $1.30 | $66,500 |
| **Recreational/Aesthetic** | 0.01 | $1.30 | $19,688 |
| **Total** | **0.04** | **$1.30** | **$86,188** |

**Non-Agricultural Water Conservation Option #5 – Rain Sensor Device Rebates (All Users)**

- Entities Responsible for Implementation: Utilities, Municipalities, Counties and Industrial Organizations

Rain sensor devices reduce water used by automatic irrigation systems by shutting down irrigation controllers or shutting irrigation control valves during rain events. This measure can be effective for any water user that has an automatic irrigation system because Florida law requires all systems to use an automatic shutoff device. In Florida, Senate Bill 494, which took effect in July 2009, requires all automatic irrigation systems to use an automatic shutoff device. The rain sensor program would provide rebates for the purchase and installation of rain sensors. The variable cost of each measure is $80, most of which is driven by the actual value of the rebate. The average water savings per device is estimated to be 100 gpd. Since the devices typically have a five-year life, the "life span" of the water savings is limited to five years. Other weather-based control devices for irrigation systems, such as soil moisture sensor devices, have shown in certain circumstances to be capable of saving even more water in residential settings. Similar to rain sensor devices, these measures can be effective for any water user that has an automatic irrigation system, and they could potentially save greater quantities than those presented below.

| Sector | Water Savings in 2030 (mgd) | Cost Effectiveness ($/1,000 gal) | Total Cost |
|---|---|---|---|
| **Public Supply** | 8.14 | $0.51 | $6,507,200 |
| **Domestic Self-Supply** | 0.82 | $0.51 | $653,600 |
| **I/C,M/D,PG** | 0.002 | $0.51 | $1,632 |
| **Recreational/Aesthetic** | 0.005 | $0.51 | $3,600 |
| **Total** | **8.96** | **$0.51** | **$7,166,032** |

**Non-Agricultural Water Conservation Option #6 – Industrial Commercial Pre-Rinse Spray Valve Replacement Rebates (Industrial and Commercial Users)**

- Entities Responsible for Implementation: Utilities, Municipalities, Counties and Industrial Organizations

This measure offers rebates to hospitality facilities to replace high-volume spray valves with water-conserving low-volume spray valves. The measure could apply to non-residential customers of the public supply sector or any other applicable customers within the I/C,M/D,PG sector. A traditional spray valve uses 2 to 5 gpm, while high-efficiency spray valves use no more than 1.6 gpm. High-efficiency valves are also more effective at removing food from dishware. As with other rebate programs, the customer would first apply for a rebate, install or replace the spray valve(s) and provide documentation of purchase with a request for rebate payment. The variable cost of each spray valve measure is estimated at $92, most of which includes the actual value of the rebate. The average water savings is estimated at 200 gpd per device.

| Sector | Water Savings in 2030 (mgd) | Cost Effectiveness ($/1,000 gal) | Total Cost |
|---|---|---|---|
| **Public Supply** | 0.54 | $0.11 | $247,112 |
| **I/C, M/D, PG** | 0.004 | $0.11 | $1,877 |
| **Total** | **0.54** | **$0.11** | **$248,989** |

**Non-Agricultural Water Conservation Option #7 – Industrial, Commercial, Institutional Facility Assessments (Industrial, Commercial, Institutional Users)**

- Entities Responsible for Implementation: Utilities, Municipalities, Counties and Industrial Organizations

The objective of industrial, commercial, institutional (ICI) facility assessments is to reduce water consumption by conducting assessments of water use at non-residential facilities to identify the potential for improved efficiency. ICI facilities can use water for a variety of purposes including cooling, dissolving, energy storage, pressure source, raw material or for more traditional domestic uses. Surveys typically include a site visit, characterization of existing water uses and a review of operational practices, followed by recommended measures to improve water use efficiency. The cost of the measures (minus the value of rebates and incentives) is weighed against a payback period through reduced water and sewer bills and any associated energy savings. While the average survey will have a variable cost of $3,450, the average savings rate is 2,308 gpd. On-site follow-up surveys are recommended to verify water savings. The savings related to the surveys result from the implementation of recommendations. Offering rebates along with the surveys will enhance the likelihood that recommended measures get implemented, but it will also increase the program costs. In addition, it should be noted that many performance contractors are also available to conduct ICI surveys and will normally invest in the efficiency improvements for an agreed-upon percentage of the financial savings achieved through the water, sewer and energy savings.

| Sector | Water Savings in 2030 (mgd) | Cost Effectiveness ($/1,000 gal) | Total Cost |
|---|---|---|---|
| **Public Supply** | 1.89 | $0.35 | $2,832,450 |
| **I/C,M/D,PG** | 0.05 | $0.35 | $70,380 |
| **Total** | **1.94** | **$0.35** | **$2,902,830** |

**Non-Agricultural Water Conservation Option #8 – Landscape Water Budgeting (All Users)**

- Entities Responsible for Implementation: Utilities, Municipalities, Counties and Industrial Organizations

A water budget is a calculation of an adequate amount of water for a landscaped area based on the actual needs of the associated flora. A water budget requires site-specific information regarding the size of the landscaped area, the composition of plants, crop coefficient values, soil conditions and weather data, including precipitation and temperature. This measure targets water users that have inground irrigation systems and is based on reducing the number of irrigation events per year. Each account would be given a tailored water budget and would be required to remain within that budget. Program participants would be required to follow the local water restrictions. Utilities (or counties) would track each account's metered use to monitor and enforce the budgets. This option represents the only enforceable measure not required by local plumbing codes being evaluated in this RWSP. One common way to encourage adherence to a water budget, without strictly requiring adherence, is by tying the water allocations from the water budget to a tiered rate structure. When accounts surpass different levels of water consumption relative to their water budget, they are required to pay more per unit of water. Since this measure is an ongoing program that targets all accounts, the variable cost is $11 per account per year, regardless of the participation rate. This is based on standard monitoring and enforcement of water budgets, which is ideally automated through the billing system. The average savings for this option is estimated at 78 gpd. The savings benchmark is based on the annual average use of residential irrigation systems and the amount that would be used if those systems were following a water budget.

| Sector | Water Savings in 2030 (mgd) | Cost Effectiveness ($/1,000 gal) | Total Cost |
|---|---|---|---|
| **Public Supply** | 0.80 | $0.09 | $112,629 |
| **Domestic Self-Supply Recreational/Aesthetic** | 0.004 | $0.09 | $495 |
| **Total** | **0.80** | **$0.09** | **$113,124** |

## 2.0 Agricultural Water Conservation

*The FARMS Program is a partnership with state and federal agencies that provides cost-share funding for growers to install water-saving technologies.*

The District has a comprehensive strategy to significantly increase the efficiency of agricultural water use over the next 20 years. A key component of this strategy is the cooperative programs the District has established with other agencies to provide the agricultural community with a wide array of technical and financial assistance programs to facilitate increases in water use efficiency. For nearly 30 years, the District has administered programs that have provided millions of dollars to fund more than 100 projects that have helped farmers increase the efficiency of their water use and improve water quality. Water conservation options for which the District will provide assistance as part of

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FARMS and other programs are described below. For some of the programs, examples of options that could be implemented by growers are included with basic technical specifications and costs.

2.1 Facilitating Agricultural Resource Management Systems (FARMS)

The District, in cooperation with the Florida Department of Agriculture and Consumer Services (FDACS), initiated the FARMS Program in 2003. FARMS provides cost-share reimbursement for the implementation of agricultural BMPs that involve both water-quantity and water-quality aspects. It is intended to expedite the implementation of production-scale agricultural BMPs that will help farmers become more efficient in their water use, improve water quality and restore and augment natural systems. FARMS is a public/private partnership between the District and FDACS and private agriculturalists. Reimbursement cost-share rates for agriculturalists are based on the degree to which they implement both water quantity and water quality BMPs. The goal for the FARMS Program is to offset 40 mgd of groundwater use for agriculture by 2025. Because the District classifies FARMS projects as water resource development, additional information pertaining to the program, status of project implementation and water savings achieved to date is provided in Chapter 7.

2.2 Well Back-Plugging Program

The well back-plugging program provides funding assistance for property owners to partially back-plug wells with poor water quality. Back-plugging involves plugging the lower portion of deep wells with cement to isolate the geological formation where poor-quality groundwater originates. Back-plugged wells show a dramatic reduction in concentrations of chloride and sulfate, which are the constituents that typically exceed standards in the region.

2.3 Institute of Food and Agricultural Sciences (IFAS) Research and Education Projects

The District provides funding for IFAS to investigate a variety of agricultural issues that involve water conservation. These include development of tailwater recovery technology, determination of crop water use requirements, field irrigation scheduling, frost/freeze protection, etc. IFAS conducts the research and then promotes the results to the agricultural community.

2.4 Mobile Irrigation Laboratory

The mobile irrigation lab program is a cooperative initiative between the District and the Natural Resources Conservation Service (NRCS). The NRCS conducts efficiency and conservation evaluations of agricultural irrigation systems. Since 1986, the mobile irrigation lab service has evaluated irrigation systems at more than 900 sites in the District and recommended management strategies and/or irrigation system adjustments.

2.5 Model Farms

The model farms concept is a tool to determine the potential for water savings for various scenarios of irrigation system conversions and/or BMPs for a number of different agricultural commodities. There are 20 model farms available with different best management/irrigation system modifications applied to the existing farms.

2.6 Best Management Practices (BMPs)

BMPs are innovative, dynamic and improved water management approaches applied to agricultural irrigation practices and crop production to help promote surface and groundwater resource sustainability. BMPs help protect water resources and water quality, manage natural resources and promote water conservation. Some BMPs are as simple as preparing a schedule for irrigation to help reduce water consumption in a rainy season, while others involve cutting-edge technologies, such as soil moisture monitors, customized weather stations and computer programs for localized irrigation systems. Below are a number of BMP options that the District, its cooperators and the agricultural community have successfully implemented in the planning region.

**BMP Option #1 – Tailwater Recovery System**

Tailwater recovery has proven to achieve both water-quality improvements and groundwater conservation. Tailwater ponds are typically excavated below ground level at the low end of a farm to collect excess irrigation water and stormwater runoff. To use the pond as a source of irrigation water, pumps, filters and other equipment are needed to connect the pond to the existing irrigation system. The use of these ponds for irrigation offsets a portion of the groundwater used to irrigate the commodity and can improve water quality of the downstream watershed by reducing the concentration of mineralized groundwater applied to fields.

An example of a tailwater recovery project that could be developed in the planning region is the ESDA Dairy project located in Manatee County. The purpose of the project is to improve water quality and reduce irrigation quantities through irrigation using a surface water and irrigation tailwater recovery reservoir system. The permitted annual average groundwater withdrawal is 0.32 mgd. Estimated water savings for this project is 14 percent of the permitted withdrawals, or 0.045 mgd. Total project cost is $568,234 and estimated cost per thousand gallons is $2.38 over a 30-year period.

| Option | Potential Savings (mgd)[1] | Capital Cost Per Acre ($)[2] | O&M Cost ($)/Acre[3] | Cost/1,000 Gallons[4] |
|---|---|---|---|---|
| Tailwater Recovery System | 0.32 | $530 | $1.51 | $0.34 |

[1]If implemented in year 2010 on all acreage.
[2]Costs estimated in 2008 and included depreciation, insurance, taxes and repairs (for a 300-acre farm).
[3]Hazen and Sawyer (2009 Update of Best Management Practices Cost Information for Model Farms Presented in the August 2000 and October 2004 HSW Reports), using 2008 construction costs.

**BMP Option #2 – Precision Irrigation Systems**

Precision irrigation systems allow for the automatic remote control of irrigation pumps based upon information derived from soil moisture sensors, which measure and monitor discrete subsurface moisture levels. The system enables the grower to maintain soil moisture within optimized ranges, which reduces the potential for overwatering and prevents underwatering to avoid reduction in crop yields. A second system that increases irrigation efficiencies involves the use of automatic valves and on-off timers. These devices can be programmed to start and stop irrigation pumps to achieve maximum efficient irrigation durations. Without automatic valves and timers, the pumps must be manually turned off, which may not occur at the most optimum time. Several different types of electronic systems that increase irrigation system efficiency have been implemented through the FARMS Program.

**BMP Option #3 – Farm-Sited Weather Stations**

Regional weather information is often generalized and cannot account for the wide spatial variation of rainfall and temperature. The use of basic weather monitoring stations on individual farms can provide the grower with an effective tool to make decisions of when to initiate a daily irrigation event or to turn pumps on or off during a frost/freeze event. Using water for cold protection has long been an accepted practice for a variety of crops in Florida, but it must be properly applied to avoid damage. During frost/freeze events, the weather stations can notify the grower when conditions are likely for damage to occur or when the danger of frost/freeze has passed. Turning pumps on too early before damaging conditions occur will waste water and fuel, while turning the pumps off too early could cause damage to crops through evaporative cooling. The use of a farm-sited weather station can reduce water consumption and improve surface water quality in areas where poor quality groundwater is used for cold protection.

*The District partners with state and federal agencies to provide cost-share funding for growers to install weather stations that help decrease the quantity of water used for freeze protection.*

2.7 Development of Alternative Water Sources for Agricultural Irrigation

The District has identified three alternative water sources that could be used for irrigation of row crops and citrus. These include (1) rainwater harvesting, (2) substituting reclaimed water for groundwater and (3) use of the surficial aquifer. Although these sources are not applicable to every site and are not necessarily the most cost-effective, they are examples of practical alternatives that could reduce the use of groundwater from the Upper Floridan aquifer.

**Agricultural Alternative Water Source Option #1 – Rainwater Harvesting**

A farm-scale prototype rainwater harvesting plan was developed to generate planning estimates of potential water savings and costs. The site would be typical of many row crop farms in the planning region. The crops would be fall and spring tomatoes and strawberries grown on 1,000 acres, with only a third of the acreage in production at any one time. This scenario could be permitted for an annual average of approximately 1.5 mgd of irrigation quantities. Components of the system would include a surface water withdrawal pump station, 30-acre reservoir, pump station and distribution system, and a surface water runoff interception/diversion ditch. A 500-foot intake ditch would convey water from an intermittent stream to a sump where it would be withdrawn by a 3,000-gpm pump and conveyed via a 6,000 foot, 16-inch diameter pipe to a 30-acre irrigation reservoir. Water from the reservoir would be distributed to the fields using two 2,500 gpm pumps and 25,000 feet of irrigation main. A 6,100-foot interception ditch would divert runoff to an existing wetland perimeter ditch that would discharge into the sump. Control structures would be installed on the interception ditch to maintain base flow downstream and allow large storm events to bypass the ditch. The amount of rainwater that could be harvested is conservatively estimated to be 0.53 mgd, which is 35 percent of the annual average water use allocation and 76 percent of the fall allocation. Assuming the grower participated in incentive programs such as FARMS and the NRCS Environmental Quality Incentives Program, the cost to the grower could be significantly less than the $2,980,000 capital cost. The water savings that could be achieved by implementing similar rainwater harvesting systems in the planning region is conservatively estimated to be 12.4 mgd.

| Option | Potential Savings (mgd)[1] | Capital Cost[2] | O&M Cost | Cost/1,000 Gallons[3] |
|---|---|---|---|---|
| Rainwater Harvesting | 12.4 | $2,980,000 | $98.90/Acre | $2.16 |

[1]If implemented in year 2010 on all acreage; does not include nurseries.
[2]Costs estimated in 2004 and included depreciation, insurance, taxes and repairs.
[3]HSW (2004).

**Agricultural Alternative Source Option #2 – Reclaimed Water**

Reclaimed water has safely been used for more than 40 years for agricultural irrigation in Florida, and currently more than 9,000 acres of edible crops within the District are irrigated with reclaimed water (FDEP 2008 Reuse Inventory, 2010). The feasibility of using reclaimed water for agriculture depends on the location of reclaimed water infrastructure and type of crop requiring irrigation. In accordance with F.A.C. 62-610.475, edible crops irrigated with reclaimed water are required to be peeled, skinned, cooked or thermally processed before consumption. Indirect application methods are also allowable, such as ridge and furrow irrigation, drip irrigation or subsurface distribution systems for use on crops such as tomatoes, strawberries and vegetables. Chapter 4, Section 2 contains a discussion of reclaimed water availability, and Chapter 5, Section 2 contains a list of identified reclaimed water options, including agricultural supply.

**Agricultural Alternative Source Option #3 – Surface Water Sources**

A field-scale example of this option is M.D. Council and Sons Surface Water Withdrawal Project in Hillsborough County. The project includes a surface water irrigation reservoir, two surface water irrigation pump stations and the necessary piping to connect the surface water reservoir to the existing irrigation system. The annual average groundwater withdrawal is 0.28 mgd for irrigation of 60 acres of strawberries and melons. The estimated water savings from this project is 30 percent of permitted quantity, or approximately 0.08 mgd.

| Option | Potential Savings (mgd) | Capital Cost | O&M Cost ($)/Acre | Cost/1,000 Gallons |
|---|---|---|---|---|
| **Surface Water Project** | **0.08** | **$270,000** | **N/A** | **$0.77** |

*Water supply systems in the planning region may eventually be interconnected as has been done in other planning regions with the help of District matching funds.*

This chapter is an overview of water supply projects that are under development in the Northern Planning Region. Projects under development are those the District is co-funding that have either been (1) completed since the year 2005 (the base year for the 2010 RWSP), (2) are in the planning, design or construction phase or (3) are not yet in the planning phase but have been at least partially funded through the 2010 fiscal year. The demand projections presented in Chapter 3 show that approximately 90 mgd of new water supply will need to be developed during the 2005–2030 planning period to meet demand for all use sectors in the planning region. As of 2010, it is estimated that at least 4 percent of that demand (3.5 mgd) has either been met or will be met by projects that meet the District's definition of being "under development." In addition, it is probable that additional water supplies are being developed by various entities in the planning region outside of the District's funding programs.

## Part A. Projects Under Development

### *Section 1. Reclaimed Water*

Table 6-1 is a list, description and summary of the benefits and costs that have been or will be realized by reclaimed water projects currently under development. It is anticipated that these projects will be online by 2015. Expanded descriptions of two of the projects in the table that are representative of the types of projects under development are provided below.

1.0 Reclaimed Water Projects – Transmission, Storage, Feasibility

**Reclaimed Water Project #1 – Marion County Oak Run Reclaimed Water Main**

The project consists of design, permitting and construction of a transmission main, pump station, 5-million gallon storage pond, instrumentation, controls and related appurtenances. The District is funding 50 percent of the $3,116,000 project cost. When completed in 2012, the project will provide 0.5 mgd of reclaimed water that will offset 0.38 mgd of groundwater used to irrigate the subdivision's golf courses.

Table 6-1. *List of reclaimed water projects under development in the Northern Planning Region*

| Cooperator | General Project Description | Reuse (mgd) | | | Customer (#) | | Costs | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Produced | Offset | Stored | Type | Total | Total | District[1] | $/1,000[2] |
| **Citrus County** | | | | | | | | | |
| City of Inverness | Trans/Pump L468 | 0.41 | 0.31 | 3.00 | GC, Rec | 3 | $2,010,000 | $1,138,650 | $1.26 |
| Citrus Meadowcrest | Trans/Pump K748 | 0.25 | 0.18 | 0.25 | GC | 1 | $1,200,000 | $600,000 | N/A |
| Citrus Homosassa | Initial Trans K222 | 0 | 0 | 0 | N/A | N/A | $14,511,936 | $3,000,000 | N/A |
| **Hernando County** | | | | | | | | | |
| City of Brooksville | Pump/Store/Trans L169 | 0.64 | 0.38 | 10.50 | GC, Res | 1 | $5,089,140 | $2,544,570 | $2.61 |
| Hernando County | Feasibility Study L959 | N/A | N/A | N/A | N/A | N/A | $100,000 | $50,000 | N/A |
| Hernando/Hickory Hills LLC | Pump/Store/Trans L960 | 1.25 | 0.75 | 8.28 | Rec,GC | 1 | $6,658,900 | $3,329,450 | $1.75 |
| **Marion County** | | | | | | | | | |
| Marion County | Pump/Store/Trans L650 | 0.50 | 0.38 | 5.00 | GC | 2 | $3,116,000 | $1,558,000 | $1.64 |
| Bay Laurel Center Community | Pump/Store/Trans L786 | 0.79 | 0.59 | 2.50 | Rec, GC | 4 | $2,198,000 | $1,099,000 | $0.73 |
| **Sumter County** | | | | | | | | | |
| City of Wildwood | Pump/Store/Trans K934 | 1.20 | 0.90 | 1.50 | Rec,GC | 5 | $615,500 | $307,750 | $0.13 |
| Continental Utilities, Inc. | Feasibility Study N061 | N/A | N/A | N/A | N/A | N/A | $25,000 | $12,500 | N/A |
| **Total** | **10 Projects** | **5.04** | **3.49** | **31.03** | | **17** | **$35,524,476** | **$13,639,920** | **2.01** |

[1]Costs include all revenue sources budgeted by the District.
[2]Cost per 1,000 gal calculated at 6% interest amortized over a 30-year project life.

**Reclaimed Water Project #2 – On Top Of The World Reclaimed Water Project**

The project consists of design, permitting and construction of a reclaimed water storage and transmission system at the On Top of the World subdivision in Marion County. The project includes a 2.5-million gallon storage tank, transmission mains and the conversion of the Bay Laurel Center Community Development District South WWTP to a reclaimed water pump station and storage facility. The District is funding 50 percent of the $2,198,000 project cost. When completed in 2011, the project will provide 0.79 mgd of reclaimed water that will offset 0.59 mgd of groundwater used to irrigate the subdivision's golf course, the Candler Hills golf course and two other recreational irrigation customers.

2.0 Reclaimed Water Projects – Research, Monitoring, and Education

Continued support of reclaimed water research and monitoring is central to maximizing reclaimed water use and to increasing benefits. The District assists utilities in exploring opportunities for increased utilization of reclaimed water and supports applied research projects, which not only include innovative treatment and novel uses of reclaimed water but also nutrient and constituent monitoring. Table 6-2 includes general descriptions and a summary of nine research projects for which the District has provided more than $985,000 in funding. The District has also committed to developing a comprehensive reclaimed water education strategy. All reclaimed water construction projects funded by the District require education programs that stress the value and benefits of efficient and effective water use, regardless of the source. To provide reclaimed water information to a broader audience, the District has developed a web page, which is one of the top Internet sources of reuse information. The District also produces reclaimed water publications that are offered to residents, utilities, engineering firms, environmental agencies and other parties interested in developing and expanding reclaimed water systems.

Table 6-2. *List of reclaimed water research projects under development in the District*

| Cooperator | General Project Description | Costs[1] | |
|---|---|---|---|
| | | Total | District[2] |
| WateReuse Foundation | Water Treatment Study L112 | $500,000 | $275,000 |
| WateReuse Foundation | Water Quality Study P872 | $520,000 | $282,722 |
| WateReuse Foundation | Pathogen Study P173 | $216,000 | $34,023 |
| WateReuse Foundation | Research Cost Study P174 | $200,000 | $70,875 |
| WateReuse Foundation | Research Study ASR P175 | $393,000 | $72,410 |
| WateReuse Foundation | Storage Study P694 | $300,000 | $100,000 |
| WateReuse Foundation | Soil Aquifer Treatment P695 | $200,000 | $66,667 |
| WateReuse Foundation | Wetlands Study P696 | $200,000 | $66,667 |
| WateReuse Foundation | Nutrient Study P698 | $305,100 | $16,700 |
| **TOTALS IN DISTRICT WIDE** | **9 Projects** | **$2,834,100** | **$985,064** |

[1]Cost per 1,000 gal benefits not applicable to research studies.
[2]Costs include all revenue sources budgeted by the District.

## Section 2. Water Conservation

### 1.0 Non-Agricultural Water Conservation

#### 1.1 Indoor Water Conservation Projects

*Rebate programs to provide incentives for homeowners to purchase water-efficient clothes washers could reduce indoor water use.*

The Northern Planning Region is relatively new to water conservation planning and implementation and is an area with opportunities for partnerships through the Cooperative Funding Initiative. Since 1996, the District has assisted local utilities in the planning region with the distribution of nearly 323 ultra low-flow or high-efficiency toilets and 12,356 plumbing retrofit kits. These programs have cost the District and cooperating local governments a combined $121,960 and have yielded a potable water savings of 238,532 gallons per day. The WRWSA has identified various additional indoor water conservation initiatives for future implementation, including toilet rebates and water-efficient plumbing retrofit kits, as part of their water supply planning. To support these efforts, the District provides technical assistance to local entities to develop these conservation programs and continually participates in research to ensure the latest conservation information is available to stakeholders. Currently, there are no indoor water conservation projects under development in the planning region.

#### 1.2 Outdoor Water Conservation

*Use of a drip system to irrigate residential landscaping can help reduce outdoor water use.*

Outdoor water use and water savings associated with outdoor water conservation projects can be difficult to measure since the plant materials, soils, irrigation systems and size of all irrigated areas are not the same. Because irrigation can account for as much as 50 percent of each residential account's metered use, outdoor water use can be a significant portion of a water supply utility's total demand. Since a large portion of this use can be attributed to a lack of education, operational experience and preventative maintenance, the District plan emphasizes BMPs and current technologies that address the reduction of outdoor water use. These include Florida-Friendly Landscaping (FFL) and Florida Yards & Neighborhoods, outdoor water audits, retrofit programs for rain and soil moisture sensor shutoff systems, and irrigation system efficiency analyses. The District also provides leak detection surveys for utility systems to reduce unaccounted for water use associated with distribution system leaks and inaccurate metering. These District programs emphasize public information and education, social-based marketing campaigns, cooperative funding of demonstration projects, research, the use of FFL on District properties, development of model landscape ordinances and assistance with the local adoption of recently passed state legislation promoting the use of FFL. The WRWSA is also planning a regional irrigation audit campaign designed to reduce residential outdoor water use. This project will assist the WRWSA's member governments with reducing their outdoor residential irrigation demand. The WRWSA has identified various outdoor water conservation initiatives for future implementation, including the use of irrigation system automatic shutoff devices such as rain and soil moisture sensors, in their water supply planning. Since 1995, the District has assisted utilities in the planning region with 422 rain sensor rebates. These programs have cost the District and cooperating local governments a combined $16,780 and have yielded a potable water savings of 40,798 gallons per day. Table 6-3 provides information on outdoor water conservation projects that are under development in the planning region.

Table 6-3. *List of outdoor conservation projects under development in the Northern Planning Region*

| Cooperator | Project Number | General Description | Savings (gpd) | Sensors/ Audits | Total Cost[1] | District Cost | $/1,000 gal Saved |
|---|---|---|---|---|---|---|---|
| Hernando County | L466 | Irrigation Evaluation w/ Retrofit Rebate | 35,000 | 250 | $51,000 | $25,500 | $0.46 |
| **Total:** | | | **35,000** | **250** | **$51,000** | **$25,500** | **$0.46[2]** |

[1]The total project cost may include variable project-specific costs including marketing, education and administration.
[2]Total cost efficiency is weighted by each project's percent share of total savings in relation to the cost.

## 2.0 Agricultural Water Conservation Projects

The following is information on agricultural water conservation projects that are under development in the planning region. The District's largest agricultural water conservation initiatives, the Facilitating Agricultural Resource Management Systems (FARMS) Program and the well back-plugging program, are not included in this section because the District classifies the programs as water resource development. Details of the programs, including projects under development, are contained in Chapter 7.

### 2.1 Institute of Food and Agricultural Sciences (IFAS) Research and Education Projects

The District provides funding for IFAS to investigate a variety of agriculture issues that involve water conservation. These include development of tailwater recovery technology, determination of crop water use requirements, field irrigation scheduling, frost/freeze protection, etc. IFAS conducts the research and then promotes the results to the agricultural community. Table 6-4 is a listing of agricultural water conservation research projects that are in progress or have been completed that benefit the planning region.

Table 6.4 *List of agricultural water conservation research projects*

| Project | Total Project Cost + District Cooperator | Total Project and Land Cost | Funding Source | Planning Region(s)[1] |
|---|---|---|---|---|
| Enhancing Irrigation and Nutrient BMPs for Seepage-Irrigated Vegetable Production | $110,000 | $110,000 | District | Southern |
| Impact of Organic Amendments on Soil Water Retention and Water Conservation | $175,000 | $175,000 | District | Southern |
| Tailwater Recovery | $135,000 | $135,000 | District | Southern |
| Evaluation of Soil Moisture-Based On-Demand Irrigation Controllers | $143,000 | $143,000 | District | Southern |
| **Total** | **$683,000** | **$683,000** | | |

[1]Selected research projects affect the Southern Planning Region, but the outcome can benefit other planning regions.


*Installation of a culvert for a tailwater recovery project in the Southern Planning Region that will recover and reuse excess irrigation water. The District will provide funding for similar projects in the Northern Planning Region.*

# Chapter 7: Water Resource Development Component



This chapter addresses the legislatively required water resource development projects identified through the water supply planning process. The numerous water-related projects receiving District funding assistance are categorized as either water supply development or water resource development. The District has chosen to place most of the proposed project options (Chapter 5) and projects under development (Chapter 6) in the water supply development category. This chapter contains a much smaller number of projects that the District has categorized as water resource development, as defined below.

*Highly treated reclaimed water produced in the Orlando area is piped to large rapid infiltration basins (RIBs) as part of the CONSERVE project. This type of water resource development project could be constructed in the Northern Planning Region to offset the potential impacts of groundwater withdrawals.*

The intent of water resource development projects is to enhance the amount of water available for water supply development. Chapter 373, F.S., defines water resource development as "the formulation and implementation of regional water resource management strategies, including the collection and evaluation of surface water and groundwater data; structural and nonstructural programs to protect and manage water resources; the development of regional water resource implementation programs; the construction, operation and maintenance of major public works facilities to provide for flood control, surface and underground water storage, and groundwater recharge augmentation; and related technical assistance to local governments and to government-owned and privately owned water utilities" (Subsection 373.019[22], F.S.).

## Part A. Overview of Water Resource Development Projects

The District classifies water resource development projects into two broad categories. The first category encompasses data collection and analysis activities that support water supply development by local governments, utilities, regional water supply authorities and others. These activities are included in Section 1. The second category includes projects that meet the more narrow definition of water resource development, i.e., "regional projects designed to create, from traditional or alternative sources, an identifiable, quantifiable supply of water for existing and/or future reasonable-beneficial uses." These projects are included in Section 2.

### *Section 1. Data Collection and Analysis Activities*

The District has budgeted significant funds in FY2010 to implement the water resource development component of the RWSP. The activities summarized in Table 7-1 are mainly data collection and analysis activities that support water supply development by local governments, utilities, regional water supply authorities and others. The table indicates that approximately $31 million will be allocated annually toward these activities Districtwide between FY2010 and FY2014 for a total of approximately $154 million. Because budgets for the years beyond FY2010 have not yet been developed, funds for FY2011 through FY2014 were set equal to FY2010 funding. This is a practical approach because even though funding for each activity is expected to vary somewhat each year, the total cost of data collection and analysis activities for each fiscal year is expected to remain relatively constant through 2014. Funding for these activities is from the District's Governing Board and Basin Boards, water supply authorities, local governments and the United States Geological Survey (USGS). Each of the activities included in Table 7-1 is described in greater detail below.

1.0 Hydrologic Data Collection

The District has a comprehensive hydrologic conditions monitoring program, which includes data collected by District staff and permittees as well as data collected as part of the District's cooperative program with the USGS. Data collected from this program allows the District to gage changes in the health of water resources, monitor trends in conditions, identify and analyze existing or potential resource problems, and develop programs to correct existing problems and prevent future problems from occurring. The primary hydrologic conditions that are monitored include rainfall, evapotranspiration, lake levels, discharge and stage height of major streams and rivers, groundwater levels, various water quality parameters of both surface water and groundwater (including springs), and water use. In addition, the District monitors ecological conditions as they relate to both potential water use impacts and changes in hydrologic conditions. The District also monitors data submitted by water use permit holders to ensure compliance with permit conditions and to assist in monitoring hydrologic conditions.

2.0 Regional Observation and Monitor-well Program (ROMP)

This purpose of ROMP is to develop a regional groundwater monitoring network through well construction and an understanding of the hydrogeologic framework of the District through aquifer testing. Data from these monitoring sites is used to evaluate seasonal and long-term changes in groundwater levels as well as quality, and the interaction and connectivity between groundwater and surface water bodies. Geophysical logging is also conducted on existing wells to provide data on well construction and water quality, most of which is incorporated into the District's geographic information system (GIS) database. Impacts resulting from increased groundwater withdrawals over nearly four decades have been documented and assessed through analysis of data collected from the ROMP well network. These impacts

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Table 7-1. *Water resource development data collection and analysis activities in the District*

| Project | FY2010 Costs | FY2011 Costs | FY2012 Costs | FY2013 Costs | FY2014 Costs | Total Costs | Funding Source |
|---|---|---|---|---|---|---|---|
| (1) Hydrologic Data Collection | $4,137,158 | $4,137,158 | $4,137,158 | $4,137,158 | $4,137,158 | $20,685,790 | District, USGS |
| (2) Regional Observation and Monitor-well Program | $3,022,052 | $3,022,052 | $3,022,052 | $3,022,052 | $3,022,052 | $15,110,260 | District, local partnerships |
| (3) Quality of Water Improvement Program | $699,341 | $699,341 | $699,341 | $699,341 | $699,341 | $3,496,705 | District |
| (4) Flood Control Projects: | | | | | | | |
| (a) Data Collection | Included in Hydrologic Data Collection | Included in Hydrologic Data Collection | Included in Hydrologic Data Collection | Included in Hydrologic Data Collection | Included in Hydrologic Data Collection | Included in Hydrologic Data Collection | District, USGS |
| (b) Remediating Existing Problems | $17,450,106 | $17,450,106 | $17,450,106 | $17,450,106 | $17,450,106 | $87,250,530 | District, Local Government Cooperators |
| (c) Lake Levels/MFLs Program | $3,837,712 | $3,837,712 | $3,837,712 | $3,837,712 | $3,837,712 | $19,188,560 | District |
| (5) Hydrologic Investigations: | | | | | | | |
| (a) USGS Hydrologic Studies | $439,250 | $439,250 | $439,250 | $439,250 | $439,250 | $2,196,250 | District/USGS Local Government Cooperators |
| (b) Water Resource Assessment Projects | $1,116,987 | $1,116,987 | $1,116,987 | $1,116,987 | $1,116,987 | $5,584,935 | District/USGS Local Government Cooperators |
| **Totals** | **$30,702,606** | **$30,702,606** | **$30,702,606** | **$30,702,606** | **$30,702,606** | **$153,513,030** | |

directly affect the District's planning, regulatory policies and programs. For example, ROMP data is used during the permitting process to model potential impacts of new uses and to monitor existing permittees to prevent impacts to natural systems and existing legal users. During construction of new monitor wells, valuable hydrogeologic information such as cores, aquifer hydrologic characteristics, water quality data and potentiometric levels are collected. From these data, aquifers and confining units are delineated, location of the freshwater/saltwater interface is determined and water quality within aquifers is characterized. The installation of long-term groundwater monitoring sites for the next few years will continue to target the District's water use caution areas (WUCAs) as well as the northern portion of the District where additional data is needed to support preventative measures. The additional data will be used for water resource assessment projects (WRAPs), the aquifer characteristics inventory and wellhead protection projects.

## 3.0 Quality of Water Improvement Program (QWIP)

The QWIP was established in 1974 through Chapter 373, F.S., to restore groundwater conditions altered by well drilling activities. The QWIP's primary goal is to preserve groundwater and surface water resources through proper well abandonment. Plugging abandoned artesian wells eliminates the waste of water at the surface and the degradation of groundwater from inter-aquifer contamination. Thousands of wells constructed prior to current well construction standards were often deficient in casing, which interconnected aquifers and enabled poor-quality mineralized water from deeper aquifers to migrate into shallower aquifers that contain potable-quality water. These wells also allow mineralized water to flow to the surface and contaminate surface water. Plugging wells involves filling the abandoned well with cement. Isolation of the aquifers is reestablished and the mixing of varying water qualities and free flow is stopped. Prior to plugging an abandoned well, geophysical logging is performed to determine the proper plugging method and to provide groundwater quality and geologic data for inclusion in the District's database. The emphasis of the QWIP is primarily in coastal portions of the Southern Water Use Caution Area (SWUCA) where the Upper Floridan aquifer is confined and flowing wells can exist. Historically, the QWIP has proven to be a cost-effective method to prevent waste and contamination of potable groundwater and surface waters. In January 1994, the District increased QWIP funding as an incentive for property owners to comply with well plugging requirements contained in the Florida Statutes.

## 4.0 Flood Control Projects

The District undertakes a number of flood protection activities. These activities include data collection, the watershed management program (WMP) and the lake levels program. Each of these flood protection efforts is described below:

### 4.1 Data Collection

Data collection related to flood protection includes the regular assembly of information on such key indicators as rainfall, water levels and stream flows. The District's capability to assist in flood control has continued to improve during the past several years with the expansion of the District's Supervisory Control and Data Acquisition (SCADA) system. This computerized data collection system comprises the cornerstone of the District's flood data collection through a Districtwide network of more than 254 continuous water level and rainfall data collection stations. These stations are considered "near-real time," meaning the data is available to District staff within minutes of being measured. These data are augmented by 66 remote data loggers that record continuous water level and rainfall data until the data are manually downloaded to a computer in the field by a technician.

The SCADA system provides an early warning mechanism that allows flood problems to be anticipated by observing water level and rainfall trends. This information, which is automatically transmitted to District headquarters by radio, allows the District to operate its structures much more effectively during rainfall events and provides limited capability to remotely operate gates at water-control structures. The system was designed with several fail-safe components to keep it operational during major storm events, when traditional communication lines may be inoperable.

The amount and detail of rainfall and stream level data now available for use by modelers has expanded significantly in recent years. In addition to the 138 rainfall sites on SCADA, the District operates 46 other recording rainfall gages without telemetry. These instruments record rainfall accumulations every 15 minutes, transmitting data hourly or daily. More recording rain gages are being installed to develop a dense, Districtwide network of precipitation data. The USGS has monitored flow on all major rivers and streams in west-central Florida during the past few years, mostly through a cooperatively funded program with the District. The USGS has instrumented 130 surface water sites on these rivers and streams with data collection instruments that have the capability to relay data in near-real time by satellite. These data are posted on the USGS' web site, increasing accessibility for the many entities that use this information.

### 4.2 Watershed Management Program (WMP)

While much of the District's focus is on flood prevention, existing problem areas can be addressed in numerous ways. An example is the WMP, which is being implemented by the District in cooperation with local governments. The WMP evaluates the capacity of a watershed to protect, enhance and restore water quality and natural systems while achieving flood protection. It identifies ways to effectively coordinate and implement watershed management strategies and has five elements: (1) collecting topographic information to delineate surface features and understand the boundaries of each watershed, (2) developing a watershed evaluation using the topographic information, (3) determining whether a watershed can provide adequate water for water supply and the environment and provide flood protection and good water quality, (4) implementing BMPs to improve a watershed when its level of service is below targets assigned by local governments and (5) maintaining watershed Information to account for changes to watershed features produced by new growth, land alteration and other natural or anthropogenic events. Local governments and the District combine their resources and exchange watershed data to implement the WMP. The District will create coordination documents for each county government (and city government as requested) to address coordination and enhance cooperation. Local governments' capital improvement plans and the District's Cooperative Funding Initiative will provide funding for local elements of the WMP. Additionally, flood hazard information generated by watershed evaluations is used by the Federal Emergency Management Agency (FEMA) to revise the Flood Insurance Rate Maps. Since the WMP may change based on growth and shifting priorities, decision-makers will have opportunities throughout the program to determine when and where funds are needed.

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### 4.3 Lake Levels Program

The District's lake levels program, established in the 1970s, has provided the adopted management levels for more than 400 lakes throughout the District. Flood stage information from this program is used by many local governments in regulating development adjacent to lakes, as well as by the District in public flood protection education efforts. Information relative to flood protection from the lake levels program is contained in the District's publication, *Flood-Stage Frequency Relations for Selected Lakes* (SWFWMD, 1992). This report, a compilation of flood level information for all lakes for which it is available, has been distributed to numerous local governments and is available from the District upon request. The lake levels program merged with the District's minimum flows and levels (MFLs) program in an effort to expand and enhance the management and protection of surface and groundwater resources.

## 5.0 Hydrologic Investigations

Hydrologic investigations include USGS hydrologic studies and District WRAP studies, each of which is described below:

### 5.1 USGS Hydrologic Studies

The District has a long-term cooperative funding program with the USGS to collect hydrologic data and conduct regional hydrogeologic investigations. The goals of this program are to monitor for changes in the hydrologic system and improve the understanding of cause-and-effect relationships. Funding for this program is generally on a 50/50 cost-share basis; however, this varies based on whether other cooperators are involved in the project and whether requests for non-routine data collection or special project assignments are implemented. Hydrologic data collection is a large part of the cooperative funding program and is closely coordinated with the District's Hydrologic Data Section. The USGS provides ongoing monitoring of 135 surface water sites within the entire District.

Regional investigations of the hydrogeology of the District are an important aspect of the cooperative program. These investigations are intended to augment work conducted by the District and are focused on improving the understanding of cause-and-effect relationships and developing analytical tools to be used in resource evaluations. A listing of completed and ongoing investigations is contained in Chapter 1, Table 1-2.

5.2 Water Resource Assessment Projects (WRAPs)

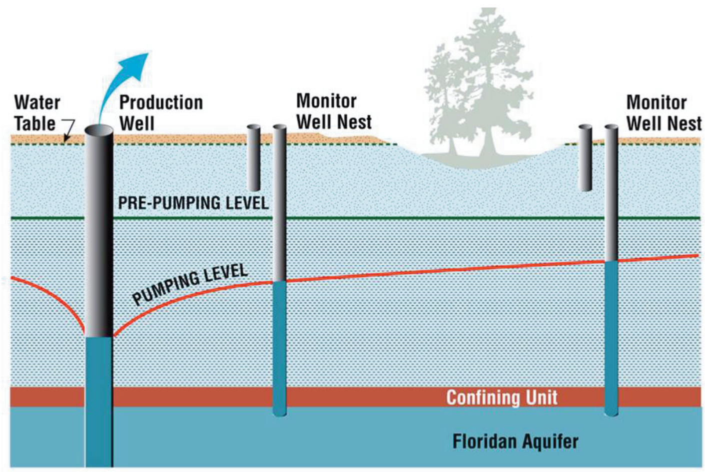


*Diagram of an aquifer performance test. Data collected from these tests help determine how to avoid impacts to established minimum flows and levels while maximizing the amount of groundwater that can be produced.*

In the late 1980s, the District initiated a program to conduct WRAPs to assess water availability in several regions and to support the development and establishment of MFLs. These projects are detailed assessments of regional water resources and include intensive data collection and monitoring to characterize hydrologic conditions and determine effects of water withdrawals. There are five areas in the District for which WRAPs have been initiated. The first three WRAPs were initiated in the late 1980s and early 1990s for the Northern Tampa Bay (NTB), Eastern Tampa Bay (ETB) and Highlands Ridge (HR) areas. These projects were initiated in response to declining lake and wetland water levels and the increased inland movement of the freshwater/saltwater interface. In the mid-1990s, a fourth WRAP was initiated that encompassed the southern portion of the District, including the ETB and HR WRAPs. A fifth WRAP is being conducted for the northern portion of the District, primarily focusing on areas north of Pasco County. The data collection element for the Northern District WRAP was initiated in 1998 to determine baseline hydrologic conditions. The ETB WRAP was completed in 1993 and the NTB WRAP was completed in 1996. The Southern District WRAP is ongoing, but a groundwater flow model is complete. The Northern District WRAP program is also ongoing and a groundwater model was completed in May 2008. As these projects progress, they provide the foundation for determining water availability and can assist in the establishment of MFLs. Once the studies are completed, water resource management programs established in these areas will be modified as necessary.

In 1999, the District initiated the NTB Phase II investigation as a follow-up to the NTB WRAP. This study will continue assessments of the biologic and hydrologic systems in NTB to support the ongoing development of MFLs, water resources recovery, water use permitting and environmental resource permitting. Projects will include the further development of MFLs' methodologies, assessments of various techniques for restoring water levels in surface water features and expanded biologic and hydrologic data collection. These studies will continue through 2010. A key component of the NTB Phase II study is the extensive network of hydrologic and biologic data collection sites. The significant data collection network currently maintained by the District, Tampa Bay Water and local governments will be reassessed, updated and expanded as part of the study. Impacts to surface water features are generally the most limiting factor to water supply development in the NTB area. Because the data from monitoring sites in surface water features will form the basis of decisions concerning key water management issues, it is critical that data in the NTB area be collected for various types of systems throughout the study area. Specific target areas for expansion and upgrade include hydrologic and biologic data collection in a wider variety of wetland types, increased spatial coverage of wetland and nested aquifer monitor wells and staff gages, and data collection in areas of minimal hydrologic impacts for control purposes. Upon completion, the District and Tampa Bay Water's combined network is projected to include more than 600 wetland and more than 500 aquifer monitoring sites.

## *Section 2. Water Resource Development Projects*

The District has 20 projects that meet the more narrow definition of water resource development projects, as defined by the Executive Office of the Governor, i.e., "regional projects designed to create from traditional or alternative sources an identifiable, quantifiable supply of water for existing and/or future reasonable-beneficial uses." Districtwide, the total cost of these projects is approximately $197 million, and a minimum of 55 mgd of additional water supply will be produced or conserved. Four of the District's 20 projects are located in or will benefit the planning region and are summarized in Table 7-2. These projects are agricultural/environmental restoration projects. Other water resource development projects that are ongoing in other planning regions include alternative water supply research/pilot projects and projects to restore minimum flows to the Lower Hillsborough and Upper Peace rivers. These projects may serve as models for future recovery strategies, if necessary, for the planning region. Each of the projects included in Table 7-2 is described in greater detail below.

Table 7-2. *Project cost and District funding for water resource development projects that benefit the Northern Planning Region*

| Project | Total Prior District Funding | FY2010 District Cost | Total Cost District + Cooperator | Funding Source[1] | Quantity Developed or Conserved (mgd) |
|---|---|---|---|---|---|
| (a) FARMS Program[2] | $17,075,018 | $1,698,720 | $21,859,752 | FDACS, District, State of Florida | 40 |
| (b) Mini-FARMS Program | $75,000 | $0 | $75,000 | FDACS, District | 2 |
| **Totals** | **$17,150,018** | **$1,698,720** | **$21,934,752** | | |

[1]Acronyms: FDACS – Florida Department of Agriculture and Consumer Services; FEMA – Federal Emergency Management Agency. Funding from the Water Protection and Sustainability Trust Fund is indicated as State of Florida.
[2]FARMS budget represents the Districtwide project cost. Ongoing components of the FARMS Program specific to the Northern Planning Region are included in Table 7-3.

### 1.0 Agricultural/Environmental Restoration Projects

These projects use many of the agricultural water conservation strategies described in Chapter 5 to reduce groundwater withdrawals by increasing the water use efficiency of agricultural operations. The projects have the added benefit of reducing agricultural impacts to surface water features. The projects are public/private partnerships where the District provides financial incentives to farmers to increase the water use efficiency of their operations.

**a) Facilitating Agricultural Resource Management Systems (FARMS) Program.**

*The FARMS Program is a partnership with state and federal agencies that provides cost-share funding for growers to install water-saving technologies. The District classifies FARMS as water resource development.*

The purpose of the FARMS program is to provide an incentive to the agricultural community to implement agricultural BMPs. The resource benefits of these BMPs include water-quality improvements, reduced groundwater withdrawals, and conservation, restoration or augmentation of the water resources and ecology. The program is a public/private partnership developed by the District and the Florida Department of Agriculture and Consumer Services (FDACS). The goal of the program is to offset 40 mgd of groundwater use in the SWUCA. The performance of each FARMS project is tracked to determine its effectiveness. The FARMS Program also funds non-project related outreach activities and data collection efforts such as the Institute of Food and Agricultural Sciences' (IFAS) Flatwood Citrus BMP Implementation and the Upper Myakka Surface-Water Quality Monitoring Network, which enhances the District's understanding of agricultural impacts on Flatford Swamp and the effectiveness of FARMS projects.

The FARMS Program has 83 active projects in six of the District's eight basins. Projected offset from these projects is 13.8 mgd. To date, the cost of the groundwater offset achieved is $1.40 per 1,000 gallons. Table 7-3 is a summary of four active FARMS projects in the planning region. Each of the projects reduces groundwater withdrawals through a combination of improved irrigation efficiency, surface water storage and use, and/or tailwater capture and reuse. Several of the projects have the additional benefit of improving surface water quality by reducing runoff of mineralized groundwater. Many cooperators are finding that implementation of FARMS' BMPs has the additional benefit of improving crop yields. One of the projects is under construction and the others are awaiting contractual approval. Collectively, these projects are expected to offset approximately 50,000 gallons per day of groundwater withdrawals. FARMS is also providing partial funding for two regional projects that are being coordinated through the FDACS — one will help implement BMPs for citrus growers and row crop farmers, and the other is the Mini-FARMS program described below.

Table 7-3 *Active FARMS projects in the Northern Planning Region*

| Project Name/Location | Project Description | Offset (gpd) | Project Cost | District Funding |
|---|---|---|---|---|
| **Hidden Acres Ranch, Inc., Citrus Co.** | Prevents water quality impacts to Withlacoochee River by reducing use of mineralized groundwater via use of existing surface water irrigation reservoir for a 10-acre blueberry farm. One irrigation pump station, filtration and piping to connect to irrigation system. | 15,000 | $80,000 | $60,000 |
| **D & J Blueberry Farms, LLC** | Converts existing blueberry irrigation system on 12-acre farm from overhead sprinkler to single row drip tape. Installation of irrigation zone timer and soil moisture sensors. Expected to improve irrigation efficiency by at least 35 percent. | 6,895 | $45,868 | $18,531 |
| **Blueberry Hill, LLC, Lake Co.** | Expands existing pond for use as a surface water reservoir for 20-acre blueberry farm. Pond will be designed to capture/reuse stormwater/tailwater for daily irrigation and cold protection needs. | 21,000 | $349,518 | $63,762 |
| **Splendid Blue Farms, LLC, Sumter Co.** | Improves irrigation efficiency on 10 acres of blueberries by at least 35 percent through use of drip tape for daily irrigation. | 7,200 | $75,000 | $21,000 |
| **Totals** | | **50,095** | **$550,386** | **$163,293** |

**(b) Mini-FARMS Program.** In 2005, the FDACS and the District agreed to co-fund the Mini-FARMS Program, which assists small acreage growers (less than 100 acres) in establishing BMPs for water resources improvements within the District. Mini-FARMS is administered by the FDACS and participating soil and water conservation districts and authorizes maximum reimbursements of $8,000 per project or 85 percent of program-eligible costs. It is estimated that the Mini-FARMS Program can offset up to 2 mgd of groundwater use by 2025, primarily through increased irrigation efficiencies and updated technologies. In 2007, the District co-funded FDACS with $75,000 toward implementation of this program. The FDACS is the primary funding source for the Mini-FARMS Program. The District has previously funded this program, although no funding is budgeted in 2010. Future projects are a priority with the FDACS and the District in the Upper Myakka and SPJC watersheds.

# Chapter 8: Overview of Funding Mechanisms

This chapter provides an overview of mechanisms available to generate the necessary funds to implement the water supply and water resource projects proposed by the District and its cooperators to meet the water supply demand projected through 2030 and restore minimum flows and levels (MFLs) to impacted natural systems. The chapter includes:

*The District has provided hundreds of millions of dollars in matching funds to local governments to develop water supply infrastructure such as this reclaimed water pump station.*

- A discussion of the District's statutory responsibilities for funding water supply and water resource development projects.
- Identification of utility, water management district, state and federal funding mechanisms.
- A discussion of public-private partnerships and private investment.
- A comparison of demand to water supply projects by state of development and funding.
- A projection of the amount of funding that is expected to be generated or available from the various funding mechanisms from 2011 through 2030.
- A comparison of the cost of proposed large-scale water supply and water resource development projects to the amount of funding to be generated or made available through 2030.

Table 8-1 shows the demand projections for each planning region for the 2005–2030 planning period. The table shows that approximately 431.0 mgd of new water supply will need to be developed in the District during the planning period to meet demand for all users and restore natural systems.

Table 8-1. *Demand projections (mgd) by planning region (2005–2030)*

| Planning Region | Projected Demand |
|---|---|
| **Southern** | **84.1** |
| **Heartland** | **129.6** |
| **Tampa Bay** | **126.9** |
| **Northern** | **90.4** |
| **Total** | **431.0** |

As of the December 2010 release date of this RWSP, it is estimated that 169 mgd, or 39 percent of the demand, has either been met or will be met by projects that are under development. Projects under development are those the District is co-funding that have either been (1) completed since the year 2005 (the base year for the 2010 RWSP); (2) are in the planning, design or construction phase; or (3) are not yet in the planning phase but have been at least partially funded through fiscal year (FY) 2010.

To begin developing an estimate of the capital cost of the projects that will be needed to meet the portion of the 2030 demand that is not yet under development, the District has compiled a list of large-scale water supply development projects (Table 8-4). The water supply produced from these large-scale water supply development projects, combined with the water supply to be produced from numerous water supply and water conservation projects currently under development, will meet more than one-half of the projected demand. The District anticipates that a large portion of the remaining half of the demand will be met through projects that users will select from the water supply options listed in Chapter 5 of this RWSP. Finally, a significant portion of this remaining demand is in the Northern Planning Region, where more than half will be met with fresh groundwater from the Upper Floridan aquifer. To determine the availability of funding to cover the cost of developing projects needed to meet the portion of the 2030 demand that is not yet under development, the capital cost of the potential large-scale projects discussed in Table 8-4 is compared to the amount of funding that will be generated through 2030 by the various utility, District, state and federal funding mechanisms.

## Part A. Statutory Responsibility for Funding

Section 373.0831, F.S., describes the responsibilities of the WMDs in regard to funding water resource and water supply development projects:

> *(1)(a) The proper role of the WMDs in water supply is primarily planning and water resource development, but this does not preclude them from providing assistance with water supply development.*
>
> *(1)(b) The proper role of local government, regional water supply authorities and government-owned and privately owned water utilities in water supply is primarily water supply development, but this does not preclude them from providing assistance with water resource development.*
>
> *(2)(b) WMDs take the lead in identifying and implementing water resource development projects, and they are responsible for securing necessary funding for regionally significant water resource development projects.*
>
> *(2)(c) Local governments, regional water supply authorities and government-owned and privately owned utilities take the lead in securing funds for and implementing water supply development projects. Generally, direct beneficiaries of water supply development projects should pay the costs of the projects from which they benefit, and water supply development projects should continue to be paid for through local funding sources.*

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

> *(2)(c) Funding for the development of alternative water supplies shall be a shared responsibility of water suppliers and users, the state of Florida and the WMDs, with water suppliers and users having the primary responsibility and the state of Florida and the WMDs being responsible for providing funding assistance.*

In accordance with the intent of the legislation and the promotion of efficient use of water, direct beneficiaries of water supply development projects should generally bear the costs of projects from which they benefit. However, affordability and equity are also valid considerations.

Currently, the District funds both water supply and water resource development projects. In general, as discussed in Chapter 7, the District considers its water resource development activities to include resource data collection and analysis and water resource development projects. In terms of water supply development, the District has typically funded the development, storage and transmission of non-traditional sources of water, including reclaimed water and conservation. Potential sources of funding for water supply and water resource development projects are addressed below.

## Part B. Funding Mechanisms

### *Section 1. Water Utilities*

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

Community development districts (CDDs) and special water supply and/or sewer districts may also develop non-ad valorem assessments for system improvements to be paid at the same time as property taxes. CDDs and special district utilities generally occur in developed areas not served by a government-run utility and generally serve a planned development. Regional water supply authorities, such as Tampa Bay Water, are also special water supply districts but do not have retail customers. Facilities are funded through fixed and variable charges to the utilities they supply which are, in the end, paid by the retail customers of the utilities. All the above-mentioned types of utilities and regional water supply authorities have the ability to issue secure construction bonds backed by revenues from fees, rates and charges.

A survey of water and sewer utility fees and charges in the District was conducted in October 2008 to estimate revenues that contribute to source development, treatment and transmission capital projects. The 2010 projected water use of the surveyed utilities constitutes 76 percent of 2010 projected utility-supplied water use in the District, so estimates developed from survey results should be fairly representative. Distribution system impact fees, when applicable, and connection and tap fees were excluded from the calculations (developers are typically required to supply on-site distribution lines and may be required to contribute to off-site infrastructure as well, in addition to impact fees). Impact, base and volume charges from surveyed utilities were weighted by the projected share in population growth of the utilities to form weighted average charges that were applied to the region’s future customers and water use. Revenue estimates exclude projected use by domestic self-supply populations and the additional use of private wells by public supply customers. Estimated revenues are based on rates and charges in effect as of October 2008 and are expressed in 2008 dollars.

Between 2010 and 2030, new public water supply demand in the District will generate approximately $7.5 billion in one-time impact fees and recurring base and volumetric charges. Table 8-2 breaks down the projected new customer revenues into water and wastewater revenues and then into one-time impact fees, recurring base/minimum charges and recurring volume-based charges. Although wastewater revenues support sewer system development, treatment and transmission projects, these revenues may also be used to support capital expenditures on reclaimed water system development.

Table 8-2. *Cumulative projected water and wastewater revenues from new customers in the District (2010–2030)*[1]

| Revenue Source | Water (Millions) | Wastewater (Millions) |
|---|---|---|
| **New Base Charges** | $710 | $1,166 |
| **New Volume Charges** | $1,445 | $2,092 |
| **New Impact Fees** | $800 | $1,249 |
| **Total** | **$2,955** | **$4,507** |

[1]Estimated in 2008 nominal dollars using FY2009 rates and charges.

While some of these revenues will go to pay existing facility debt service, most of that service will be retired in various stages over the next 20 years and debt service for new projects added. Projects built late in the 20-year planning period will continue to generate revenues for debt service for many years after 2030, the end of the planning period.

Financing through volume-related charges, to the extent practical, is the most economically efficient means to finance new water supply development. Volume charge financing provides consumers and businesses the greatest degree of direct control over water-related costs and a direct incentive to conserve. Such financing increases utility revenue stream variability, but such variability may be reduced through the development of rate stabilization or reserve funds.

If volume charges are utilized to fund higher cost alternative water sources, the impact on rate-payers can be mitigated through existing and innovative rate structures and charges. High-usage rate blocks can be set to reflect the full marginal cost of the next source of supply. Usage by conserving customers can be set at the existing average embedded cost, as they are not driving the need for additional supply development (or below existing cost if a lifeline rate is necessary). If the rate change to implement this pricing is designed to exceed current revenue requirements, the additional revenue can be dedicated to new source development. Such pricing both encourages conservation and reduces the need for steeper increases in future rates. Additional conservation delays the need for new facilities and may reduce their required size.

The increased conservation, in combination with collecting some construction revenues in advance of construction distributes price increases more evenly over time and smoothes out the "lumpy" nature of price increases inherent in common water-pricing practices. This allows customers to adjust water use practices and technology over time. If the change in rates were revenue-neutral, additional conservation would still occur as the difference between average price and marginal price for larger water users increases. Indexing of prices is another means of distributing price increases over time.

There are a number of additional means available to mitigate the impact of higher cost sources to customers. Many of these are addressed in the American Water Works Association's publications *Avoiding Rate Shock: Making the Case for Water Rates* (AWWA, 2004) and *Thinking Outside the Bill: A Utility Manager's Guide to Assisting Low-Income Water Customers* (AWWA, 2005).

### *Section 2. Water Management District*

The District's Governing Board and the seven Basin Boards provide significant financial assistance for conservation and alternative source projects through the Cooperative Funding Initiative, which includes (1) Basin Board's cooperative funding program, (2) water supply and resource development (WSRD) program and (3) District initiatives. Financial assistance is provided primarily to governmental entities, but private entities are also eligible to participate in these programs. For example, financial assistance has been provided to private agricultural concerns such as Falkner Farms and Pacific Tomato Growers, both located in Manatee County, through the District's WSRD program. WSRD funding assistance was provided for these projects developed through the District's Facilitating Agricultural Resource Management Systems (FARMS) Program to offset groundwater withdrawals for agricultural irrigation with excess surface water from the Flatford Swamp. Financial assistance has also been provided through the FARMS Program to more than 30 private agricultural operations in the Shell Creek, Prairie Creek and Joshua Creek watersheds to offset groundwater withdrawals and enhance surface water quality by reducing pumping of highly mineralized groundwater that can run off into creeks and rivers. In total, the FARMS Program has initiated 87 projects Districtwide to expedite the implementation of production-scale agricultural BMPs that provide water resource benefits.

#### 1.0 Cooperative Funding Initiative (CFI)

The CFI is a basin-local matching grant program. The Basin Boards jointly participate with local governments and other entities in funding water management programs and projects of mutual benefit. The goal is to ensure proper development, use and protection of the regional water resources of the District. Projects are generally funded 50 percent by the Basin Boards, with the local cooperators funding the remaining 50 percent. The CFI has been highly successful since its inception in 1988, with the Basin Boards providing project funding totaling $539 million from FY1988 through FY2010, which was matched by local cooperators.

#### 2.0 Water Supply and Resource Development (WSRD) Program

The District's WSRD program was established in 2000 to provide funding for projects of regional significance on a matching, flexible basis to complement the District's New Water Sources Initiative (NWSI) and cooperative funding programs. The NWSI was funded from FY1994 through FY2007 and was combined with the WSRD budget with the completion of the Partnership Agreement funding obligation. Through the annual budget, the Governing and Basin Boards have jointly provided funds to develop alternative supplies and restore historic flows and levels. These funds are generally matched by a partnering entity that benefits from the projects. Projects funded to date include reclaimed water, aquifer storage and recovery (ASR), agricultural conservation and hydrologic restoration projects. From FY1994 through FY2010, the Governing and Basin Boards have provided cumulative project funding totaling $708 million ($384 million WSRD and $324 million NWSI) for WSRD/NWSI projects that have been completed or are in the process of being completed. These funds were matched when a partnering entity was involved.

It is anticipated that the Governing and Basin Boards will collectively contribute at least $20 million annually for the WSRD program from 2011 through 2030 (Governing Board $10 million and Basin Boards $10 million). This analysis assumes that 50 percent of future annual $20 million-WSRD budgets will be set aside for projects to be funded completely by the District. This is because certain projects, such as the upper Peace River water resource development projects, may not have local cooperators and may be funded entirely by the District. The remaining 50 percent will be matched on an equal cost basis.

3.0 District Initiatives

District initiatives are funded in cases where a project is of great importance or priority to a region. The Governing and Basin Boards can increase their percentage match and in some cases provide total funding for the project. Examples of these initiatives include: (1) Quality of Water Improvement Program (QWIP) — an initiative to plug deteriorated, free-flowing wells that waste water and cause inter-aquifer contamination, (2) the leak detection program — an initiative to conserve water by having District staff inspect and detect leaks in public water system pipelines, (3) data collection and analysis to support major District initiatives such as the MFLs program and 4) various agricultural research projects designed to increase the water use efficiency of agricultural operations.

### *Section 3. State Funding*

1.0 State of Florida Water Protection and Sustainability Program

The state of Florida Water Protection and Sustainability Program was created in the 2005 legislative session through Senate Bill 444. The program provides matching funds for the District's CFI and WSRD programs for alternative water supply development assistance. For 2006, the first year of funding, the Legislature allocated $100 million for alternative water supply development assistance, with $25 million allocated for the District. The District was allocated $15 million in FY2007 and $13 million in FY2008. In FY2009, the District was allocated $750,000 for two specific projects. The reduced funding was related to the state's budget constraints resulting from the economic downturn and the declining real estate industry. In FY2010, the state did not allocate funding for the program. During the 2009 legislative session, the Legislature passed Senate Bill 1740, which re-created the Water Protection and Sustainability Program Trust Fund as part of Chapter 373, F.S., indicating the state's continued support for the program. It is anticipated that the state will resume its funding for the program when economic conditions improve.

The state funds will be applied toward the maximum 20 percent of the construction costs of eligible projects. In addition, the Legislature has established a goal for each WMD to annually contribute funding equal to 100 percent of the state funding for alternative water supply development assistance, which the District has exceeded annually. If funding is continued by the Legislature, the state's Water Protection and Sustainability Program could serve as a significant source of matching funds to assist in the development of alternative water supplies.

## 2.0 Florida Forever Program

The Florida Forever Act, passed in 1999, was a $10 billion, 10-year, statewide program. A bill to extend the Florida Forever Program was passed by the Legislature during the 2008 legislative session, continuing the Florida Forever program for 10 more years at $300 million annually and reducing the annual allocation to WMDs from $105 million to $90 million, with $22.5 million (25 percent) to be allocated to the District, subject to annual appropriation. For FY2010, the Legislature did not appropriate funding for the Florida Forever program, other than for the state's debt service. For FY2011, the 2010 Legislature appropriated $15 million in total, with $1.125 million allocated to the District. Future funding for the Florida Forever program will depend on improvement in the economy and stabilization of the documentary stamp tax funding source.

The District has expended $95 million ($81.6 million for land acquisition and $13.4 million for water body restoration) of Florida Forever funding in support of water resource development. A "water resource development project" is defined as a project eligible for funding pursuant to Section 259.105 (Florida Forever) that increases the amount of water available to meet the needs of natural systems and the citizens of the state by enhancing or restoring aquifer recharge, facilitating the capture and storage of excess flows in surface waters, or promoting reuse. Implementation of eligible projects under the Florida Forever program includes land acquisition, land and water body restoration, ASR facilities, surface water reservoirs and other capital improvements. An example of how the funds were used for water resource development was the purchase of lands around Lake Hancock within the Peace River watershed as the first step in restoring minimum flows to the upper Peace River. In addition, the District Governing Board has allocated $79 million ($28.5 million expended to date) in ad valorem-based funding to complete the acquisition of lands associated with the Lake Hancock project, which were acquired on a voluntary basis and through eminent domain proceedings.

## 3.0 State Funding for the Facilitating Agricultural Resource Management Systems (FARMS) Program

Now operating under Rule 40D-26, the FARMS Program, through the District, seeks additional funding annually. Since the inception of the program, the District has received $6.4 million in state appropriations and $1.3 million from the Florida Department of Agriculture and Consumer Services (FDACS). No funding was provided for FY2010 or FY2011. Future state funding for the program will likely depend on improvement in the economy.

## 4.0 West-Central Florida Water Restoration Action Plan (WRAP)

The WRAP is an implementation plan for components of the Southern Water Use Caution Area (SWUCA) recovery strategy adopted by the District. The document outlines the District's strategy for ensuring that adequate water supplies are available to meet growing demands, while at the same time protecting and restoring the water and related natural resources of the area. The WRAP prescribes measures to implement the recovery strategy and quantifies the funds necessary, making it easier for the District to seek funding for the initiative from state and federal sources. In 2009, the Legislature officially recognized the WRAP through Senate Bill 2080, creating Section 373.0363, F.S., as the District's regional environmental restoration and water resource sustainability program for the SWUCA. In FY2009, the District received $15 million in funding for the WRAP. Again, due to economic conditions, no new funding was provided for fiscal year 2010 or fiscal year 2011. It is anticipated that the state will again provide funding for the WRAP as the economy stabilizes.

### *Section 4. Federal Funding*

In 1994, the District began an initiative to seek federal matching funds for water projects. Since that time, the Office of the Governor, the FDEP, other WMDs and local government and regional water supply authority sponsors have joined with the District to secure federal funding. Through a cooperative effort with members of Florida's Congressional Delegation, the federal initiative has grown substantially. In 1999, the effort was expanded to seek funding for the development of alternative source projects and, in 2001, the state of Florida and the WMDs expanded a list of projects in order to seek all available resources to develop an environmentally sustainable water supply strategy that would meet the demands of growth throughout the state. The projects include the use of alternative water supply technologies as well as stormwater retention and filtering and wastewater treatment. Each WMD certifies that the projects submitted for funding are regional in scope and that matching funds are available either from the district's budget or from a local government sponsor.

A total of $95.5 million has been received by local cooperators. Federal matching funds from this initiative helped fund the construction of Tampa Bay Water's C. W. Bill Young Regional Reservoir and the Peace River Manasota Regional Water Supply Authority's reservoir and plant expansion. Further, authorization through the Water Resources and Development Act aids in the efforts to secure funding for the Peace River and Myakka River watersheds restoration initiative. District staff considers funding for water supply projects to be a top priority and continues to work with the Office of the Governor, the Florida Department of Environmental Protection (FDEP) and the members of the Florida Congressional Delegation to secure federal funding.

1.0 U.S. Department of Agriculture–Natural Resources Conservation Service (NRCS) Environmental Quality Incentive Program (EQIP)

The EQIP provides technical, educational and financial assistance to eligible farmers and ranchers to address soil, water and related natural resource concerns on their lands. The program provides assistance to farmers and ranchers to comply with federal, state of Florida and tribal environmental laws that encourage environmental enhancement. The purpose of the program is achieved through the implementation of a conservation plan, which includes structural, vegetative and land management practices. The program is carried out primarily in priority areas that may be watersheds, regions and/or multistate areas where significant resource concerns exist. Water supply and nutrient management through detention/retention or tailwater recovery ponds can be pursued through this program.

The District's FARMS Program works cooperatively with the NRCS EQIP program on both financial and technical levels. In this effort, FARMS staff has coordinated dual cost-share projects whenever possible. By an agreement between the District, FDACS and the NRCS, the maximum funding for using both FARMS and EQIP is 75 percent of total project cost. To date, 12 FARMS projects have involved some level of dual cost-share with EQIP, with several additional cooperative projects expected in the near future. On a technical level, agency interaction includes using the NRCS mobile irrigation lab to investigate using FARMS cost-share for improvements to overall irrigation system efficiency, using NRCS engineering designs for regulatory agricultural exemptions whenever possible, and coordinating cost-share on specific project-related infrastructure. As an example, FARMS may assist with an alternative source of irrigation water and EQIP assists with an upgrade to an irrigation delivery system. The relationship is mutually beneficial, extends cost-share dollars and provides more technical assistance to participants in both programs.

In addition to EQIP, the FARMS Program is partnering with NRCS in 2010, through the Agriculture Water Enhancement Program (AWEP), to bring additional NRCS cost-share funding to the SWUCA. The AWEP was created by the 2008 Farm Bill with similar goals as EQIP, including conserving and/or improving the quality of groundwater and surface water. By entering into a partnership agreement, the District and NRCS can leverage existing cost-share funds toward mutual water conservation goals and provide project funding to more producers in the SWUCA.

## *Section 5. Public-Private Partnerships and Private Investment*

As lower-cost, traditional water sources become scarce, more expensive alternative sources that involve more technical expertise and financial risk must be developed. This expertise and risk may be beyond the level of expertise and risk tolerance of many utilities and water supply authorities. A range of public/private partnership and risk options is available to provide this expertise and shift risk. These options range from all-public ownership, design, construction and operation to all-private ownership, design, construction and operation. Aside from financial risk reduction, competition among private firms desiring to fund, build or operate water supply development projects could act to reduce project costs, potentially resulting in lower customer charges.

In addition to investor-owned public supply utilities, private risk sharing could be undertaken by three distinct forms of water supply entities: (1) government-owned utilities, the District or regional water supply authorities contracting with private entities to design, build or operate facilities (public-private partnerships) (2) cooperative institutions such as irrigation districts contracting with private entities and (3) private entities, which could identify a customer base and become water supplier to one or more water use types.

### 1.0 Public-Private Utility Partnerships

The two major advantages of this type of arrangement are that (1) competition and economies of scale enjoyed by regional or national construction/operation firms may reduce costs and (2) some of the risk may be shifted to the private firms providing goods and services. As an example, Tampa Bay Water undertook a public-private partnership with Veolia Water, formerly USFilter, to design, build and operate its surface water treatment plant that has been in operation since 2002. Veolia assumed all risks for cost, schedule and facility performance, building the plant, construction management, equipment supply and startup services and operating and maintaining the facility. The cost savings over the life cycle of the contract is expected to be significant[1].

Public-private partnerships are becoming more common because the water environment is becoming increasingly complex (see *www.ncppp.org* for case studies). Increasing numbers of regulated pollutants and new higher-risk technologies drive privatization of some public water

[1] http://www.ncppp.org/cases/tampabay.shtml downloaded October 20, 2009 (NCPPP, 2009).

supply responsibilities. Partnerships work best where (Kulakowski, 2005) risks are beyond public sector tolerance, a project is new and standalone, construction and long-term operation are combined, there are clearly defined performance specifications and there are clearly defined payment obligations.

Other government-owned utilities and the District could enter into such public-private arrangements. A significant issue is that small utilities may not have the resources or project sizes sufficient to attract private interest. This could, however, be remedied through multi-utility agreements or participation in a regional water supply authority. A significant benefit of cooperation in larger projects is the economies of scale common in the water supply industry.

2.0 Cooperatives

Under this second type of arrangement, multiple self-supplied water users pool their resources to construct water facilities that they could not technically or economically undertake on their own. They also share the risks. Such private or public/private cooperative institutions are more common where water is not typically available at the user's site, such as in the western U.S. The most familiar forms are irrigation or water districts that use surface water as a source. Water is usually obtained from a supplier at a cost and then distributed among members by the district. Members cooperatively fund the construction of transmission and distribution facilities from the purchase point and pay for the purchased water. If groundwater sources become limited in a given area and, in particular, if the groundwater cannot be moved to where it is needed, the same type of economic forces that created irrigation and water districts in the west could develop in the District and the rest of Florida. They also could shift risk by entering into design, build and operate arrangements with contractors. Various forms of cooperative institutions in Florida, such as drainage districts and grower cooperatives, are addressed in a publication of the Office of Program Policy Analysis and Governmental Accountability (OPPAGA) of the Florida Legislature (OPPAGA, 1999).

3.0 Private Supply Investment (Aside from Investor-Owned Public Supply)

The third type of water supply entity is where investors identify an unserved customer base and develop water resource/supply facilities to meet those needs. Many look to this type of investment as a means to facilitate the development of alternative water supplies. Such private investment will not likely occur unless regulatory measures to protect water resources and related environmental features place firm limits on further development of traditional, lower-cost sources. The financial risks are too high if low-cost sources are still available. Although the purpose of the regulatory measures is resource protection, they indirectly create a customer base for alternative source developers. The cost of the alternative sources developed and the extent of public participation and funding will determine the likely customers of such an enterprise. To date, it appears that this form of pure private investment in alternative water supply development has not taken hold in Florida.

## *Section 6. Summary of Funding Mechanisms*

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

## Part C. Comparison of the 2030 Projected Demand to the Amount of Funding Anticipated to Be Generated or Made Available Through District and State Funding Programs and Cooperators

### *Section 1. Projection of Potentially Available Funding*

Table 8-3 is a projection of the amount of funding that could be generated by the District and state funding programs that were discussed above. An explanation follows as to how the funding amounts in the table were calculated.

- Cooperative Funding Initiative. If the Basin Boards maintain their current levels of funding for water supply and water resource development projects, it is estimated that an additional $300 million could be generated from 2011 through 2030. If cooperators match all these funds, an additional $300 million could be leveraged. If the Basin Boards elect to increase program funding for their other areas of responsibility (i.e., flood protection, water quality and natural systems), the funding projection for water supply and water resource development could be significantly impacted.

- Water Supply and Resource Development (WSRD) Program. If the Governing and Basin Boards maintain a combined funding commitment of $20 million per year through 2030, it is estimated that $400 million could be generated from 2011 through 2030. If local cooperators match half of these funds, an additional $200 million could be leveraged.

- Water Protection and Sustainability Trust Fund (WPSTF). The amount of future state funding for the WPSTF cannot be determined at this time. As economic conditions improve and the state resumes funding for the WPSTF, any funding allocated for this District will be used as matching funds for the development of alternative water supply projects.

- Florida Forever Trust Fund. The amount of future state funding for the Florida Forever Trust Fund cannot be determined at this time. Any funding allocated for this District will be used for land acquisition, including land in support of water resource development.

Table 8-3 shows that a minimum of $1.2 billion could potentially be generated or made available to fund the water supply and water resource development projects necessary to meet the water supply demand through 2030 and to restore MFLs for impacted natural systems. This figure may be conservative since it is not possible to determine the amount of funding that may be available in the future from the federal government and state of Florida legislative appropriations.

Table 8-3. *Projection of the amount of funding that could be generated or made available by District funding programs from 2011 through 2030*

| Funding Projection | |
|---|---|
| **Source** | **Amount (millions)** |
| **Basin Board Cooperative Funding Initiative (CFI)** | $300 |
| **Funding provided assuming all Basin Board CFI water supply funds are used for projects that would be matched by a partner on an equal cost-share basis** | $300 |
| **District WSRD program funding** | $400 |
| **Funding provided assuming one-half of the WSRD funds are used for projects that would be matched by a partner on an equal cost-share basis** | $200 |
| **State of Florida, Water Protection & Sustainability Trust Fund** | TBD |
| **State of Florida, Florida Forever Trust Fund** | TBD |
| **State of Florida Legislative Appropriations** | TBD |
| **State of Florida Legislative Appropriations for FARMS** | TBD |
| **West-Central Florida Water Restoration Action Plan (WRAP)** | TBD |
| **Federal Funds** | TBD |
| **Total** | **$1,200** |

## *Section 2. Evaluation of Project Costs to Meet Projected Demand*

Of the 431.0 mgd of new water supply that will need to be developed during the 2005–2030 planning period to meet the demand for all users and to restore MFLs for impacted natural systems, it is estimated that 169 mgd, or 39 percent of the demand, has either been met or will be met by projects that are under development as of Dec. 30, 2010. Projects under development are those the District is co-funding that have either been (1) completed since the year 2005 — the base year for the 2010 RWSP, (2) are in the planning, design or construction phase or (3) are not yet in the planning phase but have been at least partially funded through FY2010. The total cost for the projects currently under development is $1.02 billion. Of this amount, $889 million has been funded through FY2010, leaving $131 million to be funded beginning in FY2011. When cooperating on projects, the District typically contributes to land and capital costs.

To develop an estimate of the capital cost of projects that will need to be developed to meet the 262 mgd of demand that is not yet under development, the District compiled a list of large-scale water supply development projects that have been proposed by the PRMRWSA, Tampa Electric Company, Mosaic and Polk County that will produce an additional 36 mgd of water supply. These projects, their estimated costs and quantity of water they will produce are listed in Table 8-4. The table shows the estimated total cost of the 36 mgd of water supply that will be produced by these projects is $534 million.

Table 8-4. *Proposed large-scale water supply and water resource development projects by 2030 (millions of $)*

| Project | Entity Responsible For Implementation | Quantities (mgd) | Capital Costs | Land Costs | Potentially Eligible Land Costs | Total Costs (Capital + Land) |
|---|---|---|---|---|---|---|
| **Regional Resource Development** | PRMRWSA | 8 | $117 | $4 | - | **$121** |
| **Regional Loop System** | PRMRWSA | N/A | $104 | $3 | - | **$107** |
| **Polk County Water Supply Development** | Polk County and Potentially Municipalities | 10 | $143 | $7 | - | **$150** |
| **Flatford Swamp Hydrologic Restoration** | Mosaic | 12 | $82 | $4 | - | **$86** |
| **Southwest Polk County/Tampa Electric RW (Phase 2)** | Tampa Electric Co. | 6 | $70 | - | - | **$70** |
| **Subtotal Southern and Heartland Planning Regions** | | **36** | **$516** | **$18** | **-** | **$534** |
| **Total – Southern, Heartland and Tampa Bay Planning Regions** | | **36** | **$516** | **$18** | **-** | **$534** |

Of the remaining demand of 226 mgd (262 mgd minus 36 mgd), the demand in the Northern Planning Region of 89 mgd will potentially be met by 46 mgd of fresh groundwater and 43 mgd of reclaimed water and conservation projects. Because the District does not fund fresh groundwater projects, matching financial resources may only need to be generated by the District for the 43 mgd of reclaimed water and conservation projects in the Northern Planning Region. The remaining demand the District will provide co-funding for is 180 mgd (226 mgd minus 46 mgd). This demand will be met through the development of alternative water source and conservation projects chosen by users from the list of potential options in Chapter 5.

### *Section 3. Evaluation of Potential Available Funding to Assist With the Cost of Meeting Projected Demand*

The $1.2 billion in cooperator and District financial resources that will be generated through 2030 (Table 8-3) will be sufficient to fund the $534-million total cost of the projects listed in Table 8-4 and the $131 million portion of the cost of the projects under development that has not yet been funded. The remaining $535 million will be available to assist with the cost of alternative water source projects and water conservation measures that will be required to meet the remaining demand of 180 mgd that is not under development or will not be met by fresh groundwater. It may also serve as a reserve for the development of projects to replace water supplies that may be reduced as the result of the establishment or revision of MFLs. If current economic conditions worsen, resulting in District ad valorem tax revenue continuing to decline and federal and state funding continuing to be unavailable, the funding plan levels and timelines will need to be adjusted through 2030.

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