2010
Regional Water Supply Plan
Tampa Bay 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.

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Tampa Bay Planning Region

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These appendices are located on the District's web site: *www.watermatters.org*

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 Practice
CCI	Construction Cost Index
CFI	Cooperative Funding Initiative
CFRSF	Celery Field Regional Storage Facility
CFS	Cubic Feet per Second
CWCFGWB	Central West-Central Florida Groundwater Basin
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
I/C	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 Flows and Levels
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 and Monitor-well Program
RTS	Regional Transmission System
RWSP	Regional Water Supply Plan
SA	Surficial Aquifer
SCADA	Supervisory Control and Data Acquisition
SPJC	Shell, Prairie and Joshua Creeks
SWCFGWB	Southern West-Central Florida Groundwater Basin
SWFWMD	Southwest Florida Water Management District
SWIMAL	Saltwater Intrusion Minimum Aquifer Level
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 Area
WUP	Water Use Permit
WWTF	Wastewater Treatment Facility
WWTP	Wastewater Treatment Plant
ZLD	Zero Liquid Discharge

Chapter 1: Introduction

Tampa Bay Water's C. W. Bill Young Regional Reservoir in southern Hillsborough County. The reservoir has a 15-billion-gallon capacity and receives water from the Alafia and Hillsborough rivers and the Tampa Bypass Canal.

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 Tampa Bay Planning Region, which includes Hillsborough, Pasco and Pinellas counties. This document is the 2010 RWSP update for the Tampa Bay Planning Region. The District previously completed RWSPs that included the Tampa Bay Planning Region in 2001 and 2006. The purpose of the RWSP is to provide the framework for future water management decisions in the District. The RWSP shows that sufficient alternative water sources for the Tampa Bay Planning Region (sources other than fresh groundwater from the Upper Floridan aquifer) exist to meet future demands and replace some of the current withdrawals causing hydrologic stress. The RWSP also identifies 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 development. They are, however, provided as reasonable concepts that water users in the planning region can pursue to meet their water supply needs. Water users can select a water supply option in the RWSP or combine elements of different options that better 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 construct 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

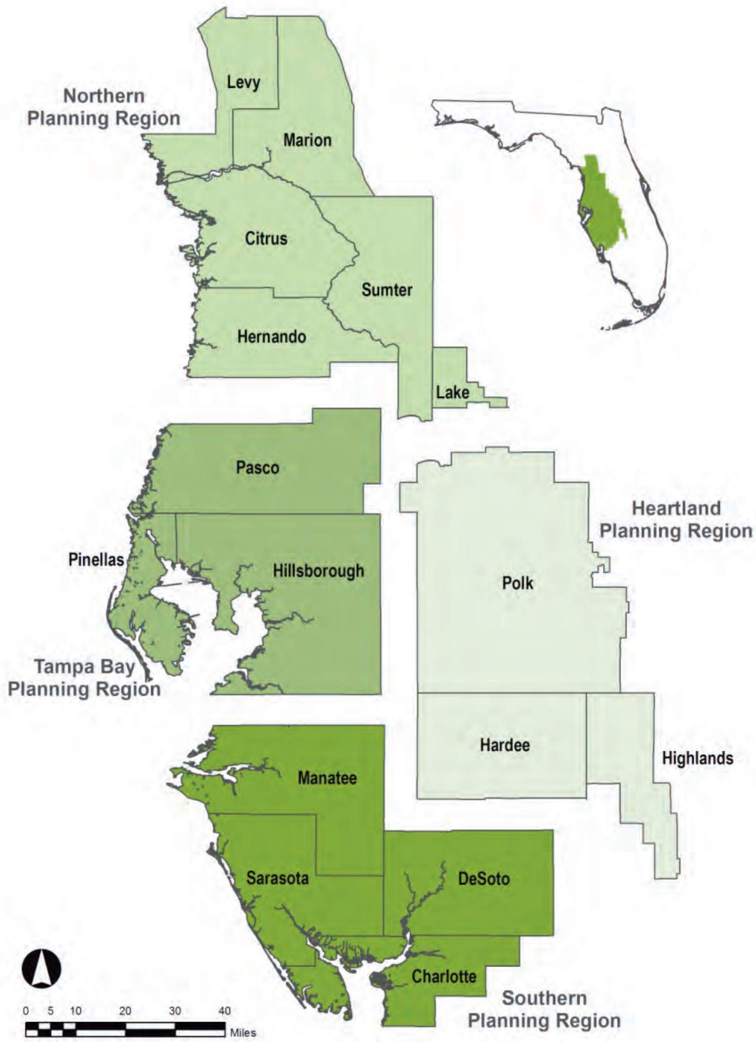


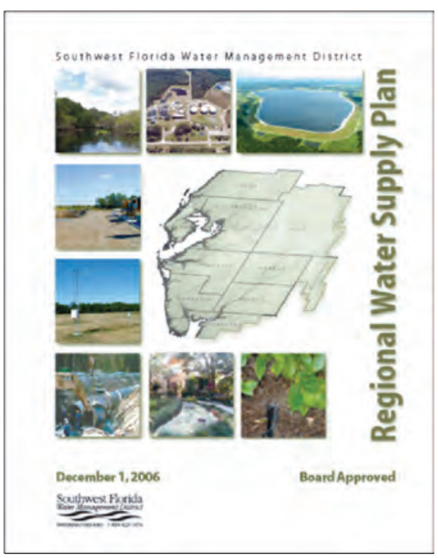
Figure 1-1. *Location of the District's four water supply planning regions*

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 permitted 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.

Part A. Introduction to the Tampa Bay Planning Region RWSP

The following describes the content of the Tampa Bay Planning Region RWSP: Chapter 1 is an introduction to the RWSP, which contains an overview of the District's accomplishments in implementing the water supply planning objectives of the 2006 RWSP; a description of the land use, population, physical characteristics, hydrology and geology/hydrogeology of the area; 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 minimum flows and levels (MFLs) program. Chapter 3, Demand Estimates and Projections, is a quantification of existing and 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 alternative water supply development options for local governments and utilities, including surface water 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, 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



The following is a summary of the District's major accomplishments in implementing the objectives of the RWSP in the planning region since the 2006 update was approved in December 2006.

Section 1. Alternative Water Supply Development, Conservation and Reuse

1.0 Alternative Water Supply

As part of the Partnership Agreement between the District and Tampa Bay Water (TBW) and its member governments in 1998, the District provided partial funding for the development of alternative water supplies to offset a reduction in groundwater withdrawals and to meet growing demands. One of the funded projects was a seawater desalination facility in Hillsborough County on Tampa Bay. Originally completed in 2003, the facility experienced a number of technical problems. In 2004, TBW retained a consultant to remediate the plant. In 2007, the remediation work was completed and TBW officially accepted the facility. It produced an average of 20 mgd for the regional system in 2008. Additional repairs and modifications have periodically reduced the output of the facility, but in October 2009, TBW began to operate the facility at its full capacity of 25 mgd as part of a four-month performance test to qualify for final payment of District funds.

To increase the reliability of TBW's regional system and improve rotational capacity, the District provided funding assistance for a major interconnect between the regional system and the Starkey wellfield, which serves areas of western Pasco County and the City of New Port Richey. This recently completed project provides additional operational flexibility for TBW that will help to reduce the environmental impacts of groundwater withdrawals in the Starkey wellfield.

The District is providing funding assistance for TBW's System Configuration II project that is currently under development. The project will expand the capacity of TBW's surface water treatment plant and improve infrastructure within the regional system, which will result in a 25 mgd increase in capacity of TBW's enhanced surface water system. As of January 2010, one of ten project components is complete and nine are under construction. Completion is anticipated in 2011.

Finally, the District is providing funding for the cities of Tarpon Springs, Oldsmar and Clearwater to augment water supplies by developing brackish groundwater wellfields and reverse osmosis membrane treatment facilities.

2.0 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 rebates, rain sensor device rebates, water-efficient landscape and irrigation evaluations, soil moisture sensor device rebates, and pre-rinse spray valve rebates. Cumulatively, these projects have saved more than 14 mgd Districtwide as of Oct. 1, 2009. In the planning region since 2006, District-funded conservation projects have been undertaken with Pasco and Pinellas counties and the cities of Tampa and St. Petersburg.

For the agricultural water use sector, 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 to reduce groundwater use and improve water quality. To date, more than 40 operational projects Districtwide are providing a groundwater offset of more than 6 mgd. Additional projects in the planning, design or construction phases are expected to produce another 8 mgd of offset.

3.0 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 of potable-quality water Districtwide. Since 2006 in the planning region, reclaimed water projects have been jointly undertaken with Hillsborough, Pasco and Pinellas counties and the cities of Clearwater, Dade City, Dunedin, Oldsmar, St. Petersburg and Zephyrhills.

The District recently completed a research study to examine new options for maximizing beneficial reuse of reclaimed water. The study evaluated the potential to recharge the Upper

Floridan aquifer with reclaimed water, either in coastal areas or farther inland to provide opportunities for additional groundwater withdrawals in areas where they might not otherwise be permittable. In addition, site-specific research is being considered in cooperation with TBW, the City of Clearwater and Polk County to refine the concept and determine whether specific projects can be included in water supply planning.

Section 2. Support for Water Supply Planning

The District has been actively 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 Department of Community Affairs and the Department of Environmental Protection and the other WMDs to develop a guidance document for preparing the Work 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 for the upper and lower segments of the Hillsborough River, the Tampa Bypass Canal (TBC) and Sulphur and Crystal springs. Minimum levels were established for three lakes in Pasco County. In 2009, minimum flows were established for the lower segment of the Alafia River and Lithia and Buckhorn springs. In 2010, MFLs scheduled to be established include minimum flows for the Anclote River, the Little Manatee River and the upper and middle Withlacoochee River, and minimum levels for four lakes in Hillsborough County. In addition, MFLs will be revisited for the Northern Tampa Bay Water Use Caution Area (NTBWUCA) during the next decade as recovery of water resources in the area is evaluated. This could result in changes to established levels for numerous wetlands and lakes in the NTBWUCA.

The City of Tampa's dam on the Hillsborough River creates a small reservoir that provides the majority of the city's potable water supply.

2.0 Minimum Flows and Levels Recovery Initiatives

The recovery strategy for lakes and wetlands in the NTBWUCA is primarily to reduce withdrawals from TBW's central system wellfields to 90 mgd on a 12-month running average basis as required in their water use permit. With the development of the enhanced surface water system and the seawater desalination plant, this has largely been achieved, although there was a temporary exceedance in 2009 due to the severe drought, the need for repairs to the surface water reservoir, and maintenance issues with the desalination plant.

The District established minimum flows for the lower Hillsborough River in 2007 along with a recovery strategy for bringing flows up to the minimums within a decade. The District has entered into a joint funding agreement with the City of Tampa to implement a number of projects to divert water from various sources to meet the minimum flows. One of these involved the installation of pumps and pipes to move water from the TBC to the Hillsborough River Reservoir, which enables the release of water from the city's dam to support flows in the lower river. This infrastructure was completed in 2008.

Section 4. Quality of Water Improvement Program (QWIP) and Well Back-Plugging

Artesian conditions in the Upper Floridan aquifer in the southern portion of the planning region can cause wells to flow at high rates.

Since the 1970s, the QWIP has prevented waste and contamination of water resources (both groundwater and surface water) by plugging abandoned, improperly constructed artesian wells. The program focuses on the southern portion of the District where the Upper Floridan aquifer is under artesian conditions, creating the potential for mineralized water to migrate upward and contaminate other aquifers or surface waters. The program plugs approximately 200 wells per year and more than 4,000 wells have been plugged since inception.

A related effort, now part of the FARMS Program, involves the rehabilitation (or back-plugging) of agricultural irrigation wells to improve water quality in groundwater and surface waters and improve crop yields. The program initially targeted the Shell Creek, Prairie Creek and Joshua Creek watersheds to decrease the discharge of highly mineralized water into Shell Creek, the City of Punta Gorda's municipal water supply. The program has retrofitted 63 wells as of September 2009, with 46 of these in the target watersheds.

Section 5. Regulatory and Other Initiatives

The District approved enhancements to the water conservation provisions of its water use permitting rules in 2009. These changes include applying certain requirements in WUCAs Districtwide, adding new requirements and enhancing others. Key provisions include reporting requirements, limits on distribution losses and requirements for conservation plans for all use sectors. 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).

Part C. Description of the Tampa Bay Planning Region

Section 1. Land Use and Population

The Tampa Bay Planning Region encompasses approximately 2,120 square miles, covering all of Hillsborough, Pasco and Pinellas counties, in west-central Florida. This area is bounded on the west by the Gulf of Mexico, on the north by Hernando County, on the east by Polk County and on the south by Manatee County. Major cities within the area include Tampa, St. Petersburg and Clearwater. Tampa Bay is the major surface water feature in the region. The region is characterized by a diversity of land-use types (Table 1-1), ranging from urban/built-up areas such as the cities of St. Petersburg, Clearwater, Tampa, Plant City, New Port Richey and Zephyrhills to predominantly agricultural land uses in the inland portions of Hillsborough and Pasco counties.

Table 1-1. *Land use/land cover in the planning region (2007)*

Land Use/Land Cover Types (2007)	Acres	Percent
Urban and Built-up	509,902	37.58
Agriculture	268,955	19.82
Rangeland	33,883	2.50
Upland Forest	155,096	11.43
Water	47,696	3.52
Wetlands	238,876	17.61
Barren Land	3,384	0.25
Transportation, Communication and Utilities	37,394	2.76
Industrial and Mining	61,514	4.53
Total	**1,346,700**	**100.0**

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

In southeastern Hillsborough County, the phosphate industry maintains significant processing operations and is in the process of restoring large tracts of mined lands. However, mining operations have moved southward as phosphate reserves at existing mines were depleted. The population of the planning region is projected to increase from approximately 2.5 million in 2005 to more than 3.1 million in 2030. This is an increase of approximately 600,000 new residents, a 24 percent increase over the 25-year planning period. The majority of this population growth will be due to net migration.

Section 2. Physical Characteristics

The topography of the Tampa Bay Planning Region is largely a result of limestone dissolution and sediment deposition. Numerous closed depressions and sinkholes throughout the area reflect active solution of the underlying limestone. These sink features are especially prevalent in Hillsborough and Pasco counties and are the primary source of recharge to the underlying aquifers. Land surface elevations gradually increase from sea level at the gulf coast to a high of about 150 feet in eastern Pasco and Hillsborough counties. Pinellas County is largely characterized by hilly to flat uplands and level lowlands. The maximum elevation in Pinellas County is approximately 100 feet in the vicinity of Clearwater and Safety Harbor where a lineament of sandy ridges extends from Oakhurst northward to Tarpon Springs. Another rounded, 50-foot topographic high exists between Pinellas Park and St. Petersburg, with a diameter of five miles.

Section 3. Hydrology

Figure 1-2 shows the major hydrologic features in the planning region including rivers, lakes and springs.

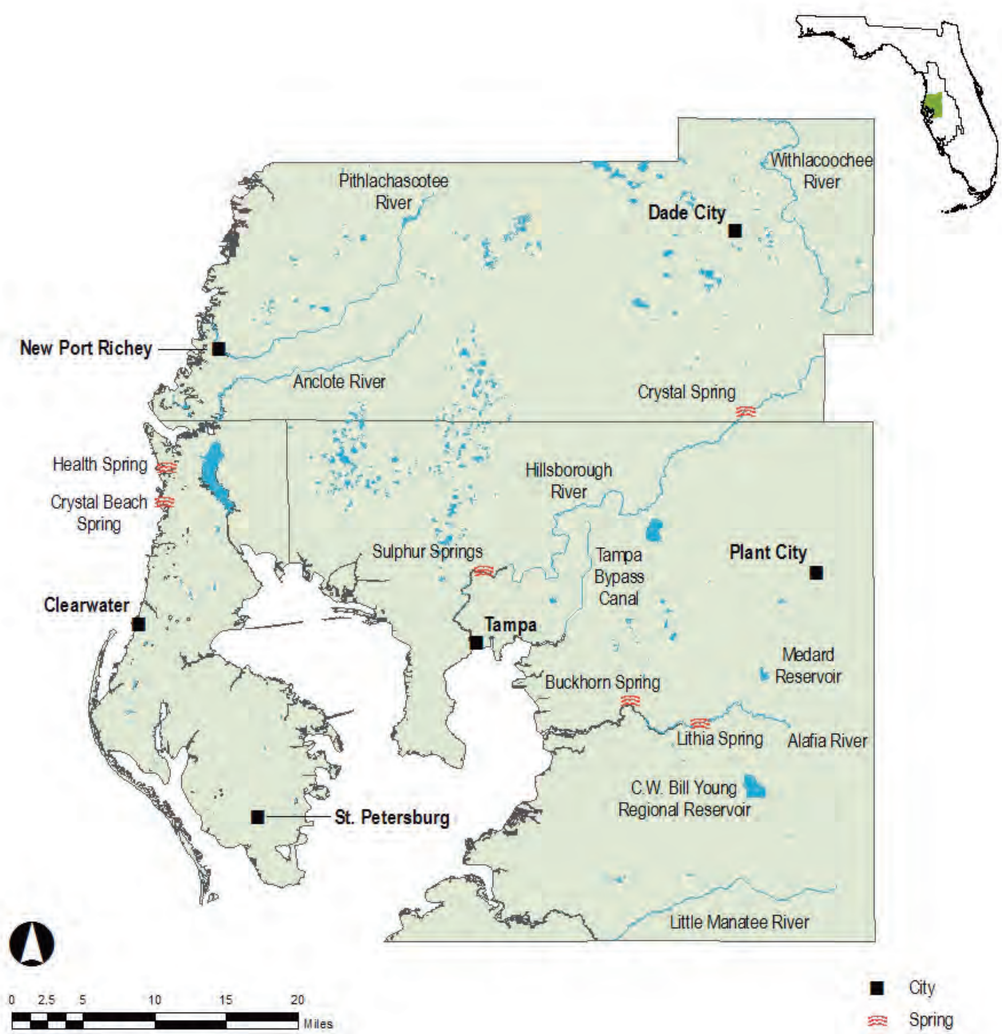


Figure 1-2. *Major hydrologic features in the Tampa Bay Planning Region*

1.0 Rivers

The upper Hillsborough River.

The planning region contains six major rivers and the Tampa Bypass Canal. The TBC is the former Six Mile Creek/Palm River that was extensively altered by construction of the canal. The canal is designed to divert floodwaters from the Hillsborough River away from the cities of Tampa and Temple Terrace and into McKay Bay and is an important water source for the City of Tampa and TBW. The rivers include the Alafia, Little Manatee and Hillsborough, which discharge to Tampa Bay, and the Withlacoochee, Anclote and Pithlachascotee, which discharge to the Gulf of Mexico. There are many smaller tributaries to these systems as well as several coastal watersheds drained by small tidally influenced or intermittent streams.

2.0 Lakes

There are more than 150 named lakes with extensive water-level data in the planning region. Lakes greater than 20 acres in size are included in Figure 1-2. Many lakes were formed by sinkhole activity and retain a hydraulic connection to the Upper Floridan aquifer. Others are surface depressions perched on relatively impermeable materials that may isolate their levels from the local water table. Many of the lake systems are internally drained, while others are connected to river systems through natural streams or man-made canals. Many lakes have been altered by drainage and development with water-level control structures commonly present. About 50 lakes have been or are currently augmented with groundwater from the Upper Floridan aquifer.

3.0 Springs

Several second-magnitude springs (discharge between 10 and 100 cubic feet per second [cfs]) are located in the planning region. These include the Crystal Springs group in Pasco County, Wall (Health) and Crystal Beach springs in Pinellas County, and Sulphur, Lithia and Buckhorn springs in Hillsborough County. Crystal Springs is one of the principal sources of the Hillsborough River, though an appreciable decline in flow due to climatic and human causes has been noted over the past 40 years.

Crystal Spring in southern Pasco County provides most of the flow of the upper Hillsborough River in the dry season.

Discharge of the spring group averaged 54 cfs (34.9 mgd) for the period of record (1923 to 2009); however, due to the difficulty of determining spring discharge during high-river stages, there is a large degree of uncertainty associated with the data collected prior to 1965.

Sulphur Springs is located on the Hillsborough River several miles north of downtown Tampa. During the dry season when the entire flow of the Hillsborough River is captured for water supply at the City of Tampa's dam, Sulphur Springs has been the only input of water to the lower Hillsborough River, although this will change with the recent establishment of a minimum flow for the river and implementation of the associated recovery strategy. The average flow of Sulphur Springs during the past five years is approximately 31 cfs (SWFWMD, 2009). Wall (Health) and Crystal Beach springs are located on the gulf coast in northern Pinellas County. Limited data indicate that the springs discharge brackish water and are strongly tidally influenced. Wall Springs was formerly a private recreation area that was purchased by Pinellas County and included in a county park. Although no flow data are available, it is probably a second-magnitude spring. Crystal Beach Spring is located in the Gulf of Mexico about 500 feet west of the shoreline.

Lithia and Buckhorn springs are located on the Alafia River, south of Brandon in southeastern Hillsborough County. Lithia Springs is composed of two vents: Lithia Major and Lithia Minor. Periodic measurements of Lithia Springs since the early 1930s indicate an average discharge of between 30 and 40 cfs. Buckhorn Springs, composed of a number of vents spread over several acres, is located at the head of a short run that enters the Alafia River several miles downstream of Lithia Springs. Periodic measurements made by District and TBW staff in the early 1990s indicated that the combined average flow from four significant vents was approximately 17.6 cfs. This included the water diverted from the spring for industrial purposes (Jones et al., 1994). An industrial operation is permitted to divert an average of 6.0 mgd from Lithia and Buckhorn springs. The majority of this diversion is pumped from Lithia Major.

The District is periodically questioned about freshwater springs in the Gulf of Mexico and the possibility of utilizing them for water supply. In response to these inquiries, the District conducted a two-year study of submarine springs in the Gulf of Mexico and Tampa Bay (Dewitt et al., 2003). The water quality and quantity of discharge were investigated at a number of submarine spring and karst features. Although some of the features discharged significant quantities of water, the quality of water in all cases was highly saline. This result was expected because the saltwater/freshwater interface (the boundary between fresh and saline groundwater in the Upper Floridan aquifer) is located onshore in much of the planning region. Therefore, it is highly unlikely that fresh groundwater could be discharging offshore through springs.

4.0 Wetlands

Prior to significant development, approximately 54 percent of Florida was covered by wetlands. However, due to drainage and development, only about 30 percent of the state currently remains covered by wetlands. Wetlands can be grouped into saltwater and freshwater types. Saltwater wetlands are found bordering estuaries, which are coastal wetlands influenced by the mixing of freshwater and seawater. Saltmarsh grasses and mangroves are common estuarine plants. Tampa Bay is a large estuary in the southern portion of the planning region, along the west-central Florida coast. Freshwater wetlands are common in inland areas of Florida. 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 ground for a considerable portion of the year. Marshes are typically shallower systems vegetated by herbaceous plants rather than trees. Wet prairies, also present in interior Florida, 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 Hillsborough River watershed. Other less extensive swamps, as well as isolated wetlands, occur throughout the planning region.

Section 4. Geology/Hydrogeology

Three principal aquifer systems, the surficial, intermediate and Upper Floridan, are present in the planning region and are used as water supply sources. The surficial and Upper Floridan aquifers are present throughout the region, while the intermediate aquifer is present only in the south. Figure 1-3 is a generalized north-south cross section of the hydrogeology of the District.

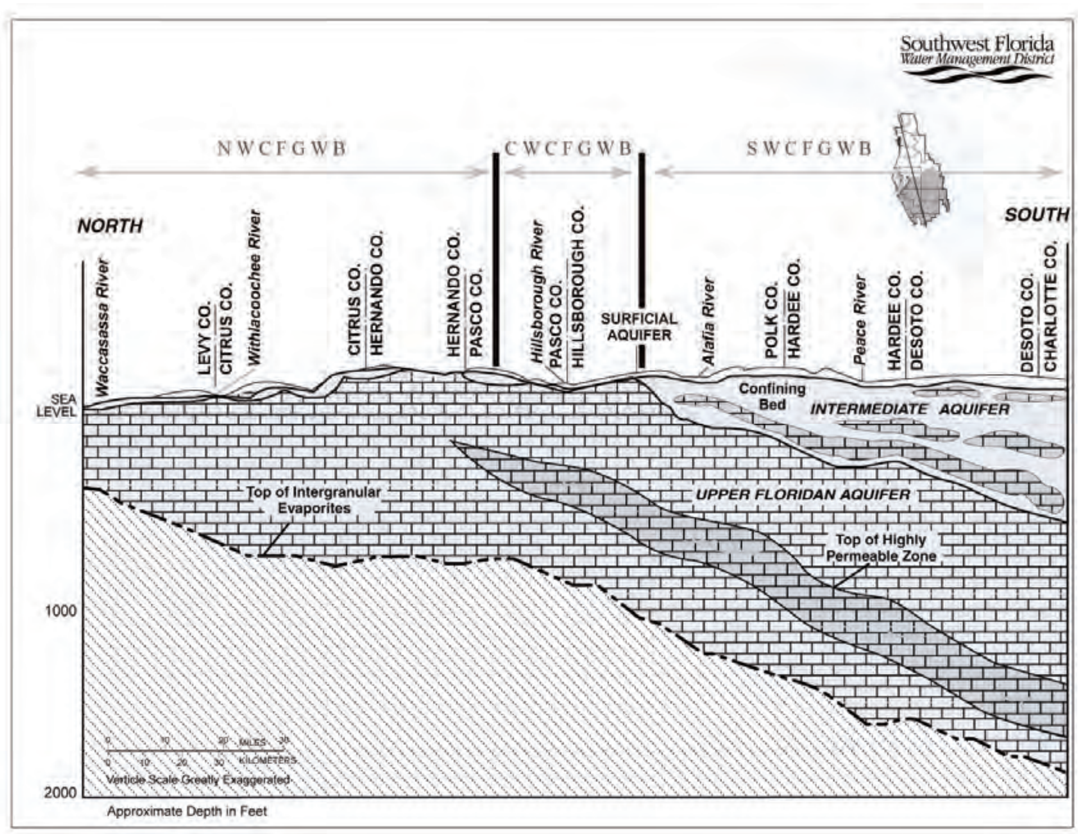


Figure 1-3. *Generalized north-south geologic cross section through the District*

As seen in the figure, the planning region is primarily located in the Central West-Central Florida Groundwater Basin, which is a hydrogeologic transition zone between the southern and northern parts of the District. The Southern West-Central Florida Groundwater Basin encompasses the southern portion of the District where the intermediate aquifer and its confining units separate the surficial and Upper Floridan aquifers. A small portion of the planning region is located in the North West-Central Florida Groundwater Basin where the confining unit is thin and discontinuous and eventually disappears further to the north.

The surficial aquifer system is composed primarily of unconsolidated sediments made up of fine-grained sand, silt and clayey sands, with an average thickness of 30 feet. The aquifer is present throughout most of the region, except for limited portions of coastal Pasco County, and produces relatively small quantities of water, which are generally used for low-volume irrigation or domestic water supply.

Underlying the surficial aquifer system is the intermediate aquifer system and its associated confining units. The aquifer consists predominantly of discontinuous sand, gravel, shell, limestone and dolomite beds of the Hawthorn Group. In the southeastern portion of Hillsborough County, it contains a distinct permeable zone (FGS, 2006) that is confined by overlying low permeability sandy clays and clays. The aquifer exists throughout the southern portion of the region, reaching a thickness of more than 100 feet in southern Hillsborough County, but it thins and becomes a single, intermediate confining unit in the northern portion of the region. In Pasco and northern Hillsborough counties, the confining unit is thin and extensively breached or absent altogether.

Underlying the intermediate aquifer system is the Upper Floridan aquifer system. The aquifer consists of a continuous series of carbonate units that include (in order of increasing geologic age and depth) portions of the Tampa Member of the Hawthorn Group, Suwannee Limestone, Ocala Limestone and Avon Park Formation. The aquifer is generally under semi-confined conditions in most of the region due to the presence of the intermediate confining unit (ICU). The aquifer can be separated into upper and lower flow zones. The Tampa Member of the Hawthorn Group and the Suwannee Limestone form the upper flow zone. The lower zone is the highly transmissive portion of the Avon Park Formation. The two zones are separated by the lower permeability Ocala Limestone, which acts as a semi-confining layer. The two flow zones are connected through the Ocala by diffuse leakage, vertical solution openings along fractures, or other zones of preferential flow (Menke et al., 1961). The middle confining unit of the Floridan aquifer lies near the base of the Avon Park Formation. It is composed of evaporite minerals such as gypsum and anhydrite, which occur as thin beds or as nodules within dolomitic limestone that overall has very low permeability. The middle confining unit is generally considered to be the base of the freshwater production zone of the aquifer. Water quality and yield of the Upper Floridan aquifer are generally good, except where brackish groundwater occurs in close proximity to the coast. Groundwater from the aquifer is widely used for municipal and private water supplies in the planning region.

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 District staff 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 of this investment 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 water 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 detailed water resource assessment projects (WRAPs) of the Eastern Tampa Bay (ETB) and Northern Tampa Bay (NTB) areas to determine causes of water level declines and to address water supply availability. Resource concerns in these areas included lowered lake and wetland levels in the NTB area and saltwater intrusion in the Upper Floridan aquifer in the ETB area.

In 1989, based on the findings of the WRAP studies and continued concern about water resource impacts, the District established the NTB and ETB WUCAs 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 ETB and NTB WUCAs. These meetings are summarized in the Eastern Tampa Bay Work Group Report (SWFWMD, 1990) and Management Plan (SWFWMD, 1990b) and Northern Tampa Bay Work Group Report (SWFWMD, 1990c) and Management Plan (SWFWMD, 1990d). These deliberations led to major revisions to the District's water use permitting rules as special conditions were added that applied to the ETB, NTB and other WUCAs. It was also during these deliberations that the original concept of the Southern Water Use Caution Area (SWUCA) emerged. The ETB Work Group had lengthy discussions on the connectivity of the groundwater basin and how withdrawals throughout the basin were contributing to saltwater intrusion. A significant finding of the ETB WRAP was that the lowering of the potentiometric surface within the area was due to groundwater withdrawals from beyond as well as within the area. Additionally, the ETB WRAP concluded that there was a need for a basinwide approach to the management of the water resources. Based on results of these studies and work group discussions, in October 1992, the District established the SWUCA to encompass both the ETB area and the remainder of the southwest-central Florida groundwater basin.

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 Tampa Bay 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 Site
	Hydrogeologic Characterization of the Intermediate Aquifer System
Surface Water	Hydrologic Assessment of the Alafia River
	Statistical Characterization of Lake-Level Fluctuations
	Lake-Stage Statistics Assessment to Enhance Lake Minimum Level Establishment
	Lake Augmentation Impacts
Groundwater and Surface Water	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
	Relation of Geology, Hydrology and Hydrologic Changes to Sinkhole Development in the Lake Grady 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 of 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

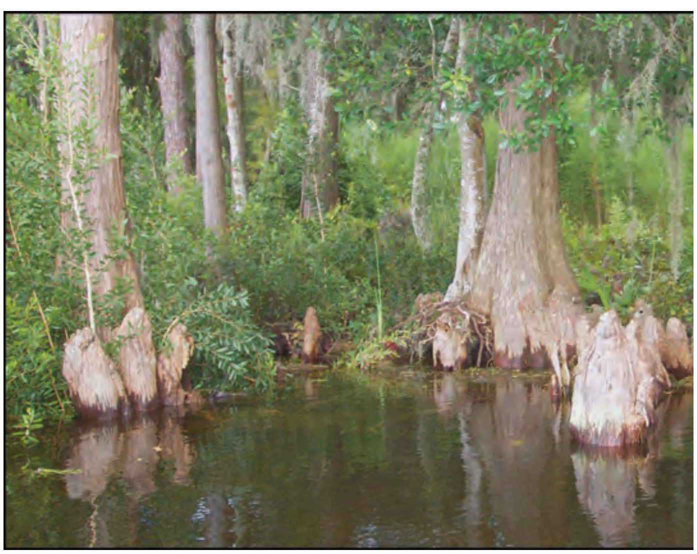
Section 3. Water Supply Investigations

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 utilized 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 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, 1992a). One of the 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 resource management to provide for all reasonable and beneficial uses without causing unacceptable impacts to the water resource, 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 outcome of the water supply assessment, the District initiated preparation of an RWSP for its southern 10 counties. This area encompassed the NTB WUCA and the 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 and the planning period extended to 2025. The 2006 RWSP (SWFWMD, 2006) concluded that fresh groundwater from the Upper Floridan aquifer would be available to meet future demands on a limited basis only and that sufficient alternative sources existed in the 10-county planning 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.



One of the District's first MFL methodologies was developed for cypress wetlands.

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 of 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

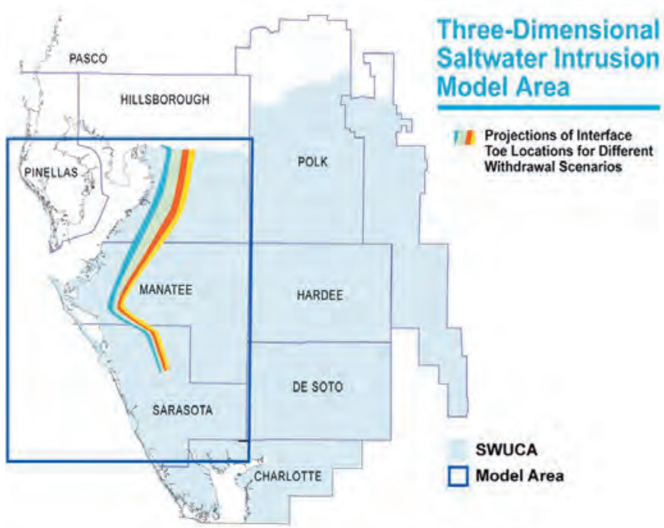
Beginning in the late 1970s, the USGS, with cooperative funding from the District, created several models of the NTB area that were generally used to evaluate effects of withdrawals for specific wellfield areas. Using information from these models, the District (Bengtsson, 1987) developed a transient groundwater model of the NTB 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 (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 TBW to support requests for surface water and groundwater withdrawals.

The Southern District Model Version 1.0 simulates groundwater flow in the entire District south of Hernando County (Beach and Chan, 2003). However, the model is primarily designed to simulate conditions throughout the District south of the Hillsborough River and Green Swamp. The Southern District Model Version 1.0 has replaced the Eastern Tampa Bay model as the principal tool for resource assessment and resource management. The model was updated as the Southern District Model Version 2.0 (Beach, 2006).

The northern District groundwater flow model (NDM) covers the northern half of the District and portions of the St. Johns 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 ICU, Suwannee Limestone, Ocala Limestone, Avon Park Formation, MCU and Lower Floridan aquifer. The NDM has served as an important tool in examining 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 establish MFLs.

2.0 Saltwater Intrusion Models

There have been three major models developed to simulate historical and future saltwater intrusion in the SWUCA. The first of these models was a series of three, two-dimensional cross-sectional models capable of simulating density-dependent flow known as the Eastern Tampa Bay Cross-Section Models (HydroGeoLogic, Inc., 1994). Each model was designed as a geologic cross section located along flow paths to the Gulf of Mexico or Tampa Bay. These models were used to make the initial estimates of movement of the saltwater-freshwater interface in the ETBWUCA. To address the three-dimensional nature of the interface, a sharp interface code, SIMLAS, was developed by HydroGeoLogic, Inc. (1993) for the District. The code was applied to the ETB area, creating a sharp interface model of saltwater intrusion. Subsequent to this, the cross-sectional models were refined (HydroGeoLogic, Inc. 1994b) and the results were compared to those of the sharp interface model (HydroGeoLogic, Inc. 1994a). The cross-sectional models compared well with the sharp interface model.



Graphical representation of modeled projections of the distance salt water will move inland in the Upper Floridan aquifer in the Southern Water Use Caution Area over the next 50 years under various pumping scenarios.

In support of establishing a minimum aquifer level to protect against saltwater intrusion in the most impacted area (MIA) of the SWUCA, a fully three-dimensional, solute transport model of the ETB area was developed in 2002 by HydroGeoLogic, Inc. The model encompasses all of Manatee and Sarasota counties, the southern half of Hillsborough and Pinellas counties and extends about 25 miles offshore. The model only simulates flow and transport in the Upper Floridan aquifer. Estimates of the number of wells and amount of water supply at risk to future saltwater intrusion under different pumping scenarios were derived using this model.

Although regional saltwater intrusion in the NTB area is not as major of a 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), HydroGeoLogic, Inc. (1994) 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 NDM.

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 of the Tampa Bay region. 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. The model has been used in MFL water resource investigations of the Anclote River, Crystal Springs 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 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 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 salt water interface and movement of documented groundwater contamination on an individual and cumulative basis. This groundwater flow model 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 (FTRM), 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 increases 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.

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

Many lakes in the planning region have experienced low levels during the past two decades that have resulted from excessive groundwater pumping combined with 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. One significant change that occurred as a result of the implementation of the management plans was the designation of the most impacted area (MIA) within the ETBWUCA, where any entity proposing groundwater withdrawals that would lower the Upper Floridan aquifer potentiometric

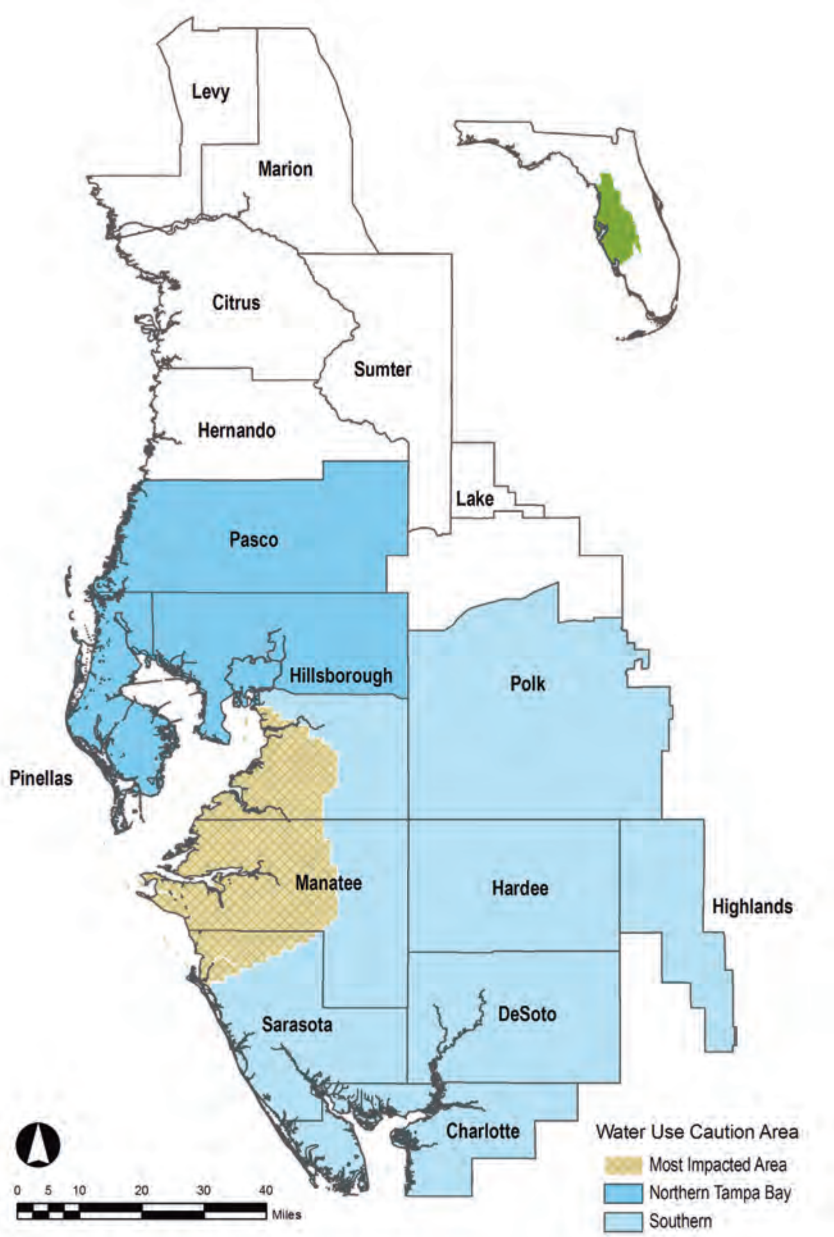


Figure 2-1. *Location of the District's water use caution areas*

surface within the MIA would be required to implement a net benefit that mitigates the predicted withdrawal impacts.

1.0 Northern Tampa Bay Water Use Caution Area (NTBWUCA)

In 1989, the District established the NTBWUCA, an area encompassing parts of Hillsborough and Pasco counties and all of Pinellas County. In 2007, the NTBWUCA was expanded to include an additional portion of northeastern Hillsborough County and the remainder of Pasco County. The District took these actions based on growing concerns about hydrologic impacts to wetlands, lakes and rivers resulting from groundwater withdrawals and concerns regarding rapid growth and development pressures in the region. Because the majority of groundwater use in the NTBWUCA is for public supply, most of the water resource impacts were located in areas surrounding the major public supply wellfields.

To address the effects of these water resource impacts, the District has taken several important actions, including the implementation of an enhanced MFLs program. Beginning in October 1998, the District established MFLs in the NTB area for cypress wetlands, lakes, rivers, springs and the Upper Floridan aquifer. Additionally, the District has committed to collect additional data to support the refinement and improvement of its MFLs' methodologies and to study the benefits of using other management methods, such as augmentation, to achieve adopted MFLs. To facilitate this data collection, the District established the Northern Tampa Bay Phase II Local Technical Peer Review Group (LTPRG) to coordinate with local governments, agencies and other stakeholders to review hydrologic, biologic and geologic studies being performed in the NTBWUCA.

Concurrent with the District's efforts to establish and refine MFLs in the region, TBW and its member governments entered into an agreement in 1998 with the District to significantly reduce groundwater withdrawals from its regional wellfields and work toward recovery in areas where water resources had been impacted. This agreement, commonly referred to as the Partnership Agreement, established that groundwater withdrawals from TBW's 11 central system wellfields would be reduced from a high of 158 mgd to 90 mgd (12-month moving average) by Jan. 1, 2008. The Partnership Agreement is one part of a plan adopted by rule (40D-80, F.A.C.) for environmental recovery in the NTBWUCA. As part of the Partnership Agreement, the District combined all the permits for TBW's central system wellfields into one permit. Known as the consolidated permit, the permit requires an extensive water resource monitoring network around the individual wellfields, along with many other data reporting and planning requirements. It is anticipated that TBW's monitoring network will address most of the data collection needs in and around major withdrawal centers, while the District's efforts will focus on the areas between and beyond TBW's withdrawal centers.

2.0 Southern Water Use Caution Area (SWUCA)

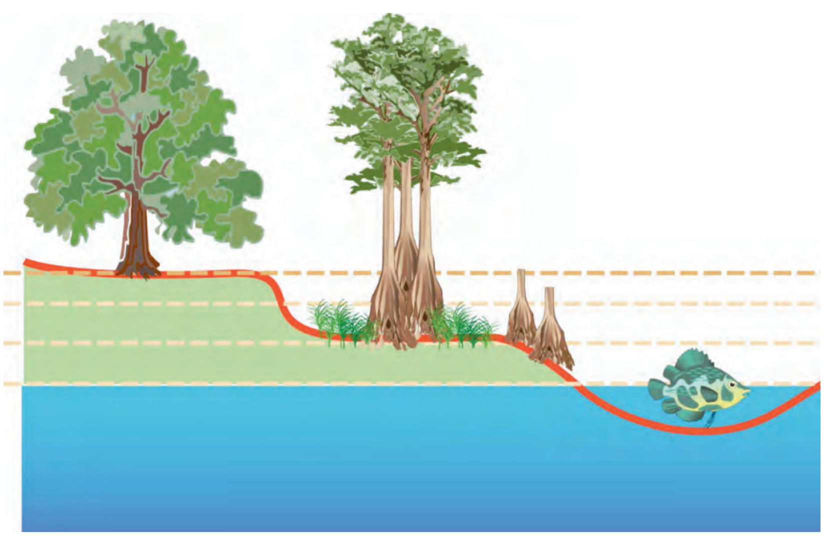
Beginning in the 1930s, groundwater withdrawals steadily increased in the Southern West-Central Florida Groundwater Basin (Figure 1-3) in response to growing demands for water from the mining and agricultural industries and later from public supply, power generation and recreational uses. Before peaking in the mid 1970s, these withdrawals resulted in declines in Upper Floridan aquifer levels that exceeded 50 feet in some areas of the groundwater basin. The result of the depressed aquifer levels was saltwater intrusion in the coastal portions of the Upper Floridan aquifer, reduced flows in the upper Peace River and lowered lake levels in the Lake Wales Ridge of Polk and Highland counties. In response to these resource concerns, the District established the SWUCA in 1992. The SWUCA encompasses the entire southern portion of the District, including the areas previously included in the ETB and HR WUCAs. Although groundwater withdrawals have since stabilized as a result of management efforts, water resources of the area continue to be impacted by the historic decline in aquifer water levels.

In 1994, the District initiated rule making to modify its water use permitting rules to better manage water resources in the SWUCA. The main objectives of the rules were to (1) significantly slow saltwater intrusion into the confined Upper Floridan aquifer along the coast, (2) stabilize lake levels in Polk and Highlands counties, and (3) limit regulatory impacts on the region's economy and existing legal users. The principal intent of the rules was to establish a minimum aquifer level and to allow renewal of existing permits while gradually reducing permitted quantities as a means to recover aquifer levels to the established minimum. A number of parties filed objections to parts of the rule and an administrative hearing was conducted. In March 1997, the District received a Final Order upholding the minimum aquifer level (and the science used to establish it) and the phasing in of conservation. However, the rule provisions relating to voluntary reallocation of used water quantities and preferential treatment of existing users were not upheld.

In 1998, the District initiated a reevaluation of the SWUCA management strategy. In March 2006, to slow the rate of saltwater intrusion, the District established minimum flows for the upper Peace River and minimum levels for eight lakes along the Lake Wales Ridge in Polk and Highlands counties and the Upper Floridan aquifer in the MIA of the SWUCA. Since most, if not all, of these water resources were not meeting their established MFLs, the District adopted a recovery strategy for the SWUCA.

Part B. Minimum Flows and Levels

Section 1. Definitions and History



An MFL is that 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 bodies. 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.

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 the *Consolidated Annual Report*, and it is posted on the District's web site at *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 groundwater and surface waters for which MFLs will be set. As part of determining the priority list and schedule, the following factors 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 bodies in areas with many water bodies.
- Proximity of MFLs already established for nearby water bodies.
- Possibility that the water body 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 small withdrawals that have no measurable effect on the historic regime to large withdrawals that could 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

A District scientist collecting data that was used to establish a minimum flow for one of the rivers in the planning region.

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 Priority List and Schedule. Refinement and development of new methodologies is also ongoing. In accordance with state law, MFLs are established based on 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

Section 373.042(4), F.S., permits affected parties to request independent scientific peer review of the scientific data and methodologies used to determine MFLs. As part of the MFLs' rules, the District has committed to pursuing independent peer review as part of future efforts. The District voluntarily seeks independent peer review of MFL methodologies that are developed for all priority water resources. Since the RWSP was last updated in 2006, the District has sought and obtained the review of methodologies for the following water resources in the planning region: (1) Anclote River system, (2) lower Alafia River estuary, (3) lower and upper segments of the Hillsborough River, including Crystal Springs, (4) TBC and Sulphur Springs, and (5) proposed methodological revisions to establish minimum lake levels.

3.0 Methodology

The District's methodology for establishing MFLs for lakes, wetlands, rivers, aquifers and springs 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 in the District is provided in the Chapter 2 Appendix. Water resources with established MFLs in the region include the following:

- 41 palustrine cypress wetlands in Hillsborough and Pasco counties
- 63 Category 1, 2 and 3 lakes in Hillsborough and Pasco counties
- Seven Upper Floridan aquifer wells for saltwater intrusion in the NTBWUCA
- SWIMAL for the MIA of the SWUCA
- Lower Hillsborough, upper Hillsborough, and Alafia rivers and TBC
- Crystal Springs
- Alafia River Estuary (includes Lithia and Buckhorn springs)
- Sulphur Springs
- Four Category 3 lakes in Hillsborough County

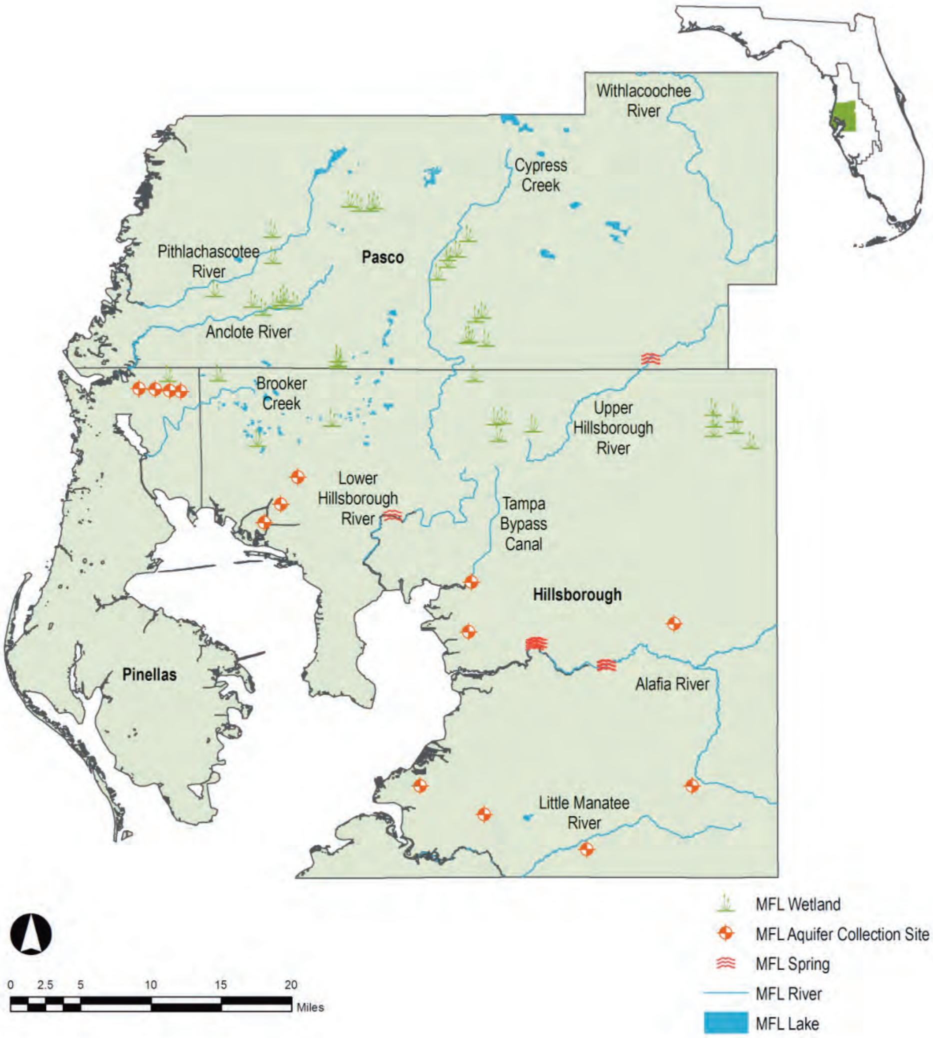


Figure 2-2. *MFL priority water resources in the Tampa Bay Planning Region*

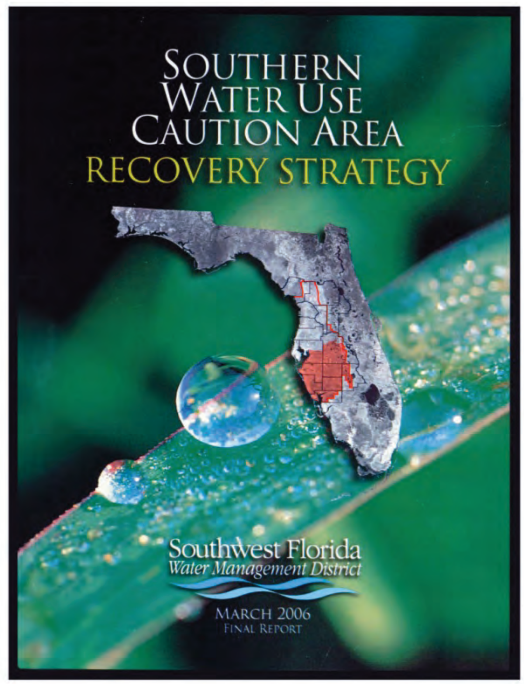
Priority water resources located in the planning region for which MFLs have not yet been established include the following:

- Anclote River System
- Little Manatee River
- Upper and Middle Withlacoochee River System (Green Swamp)
- Northern Tampa Bay (NTB) Phase II
- Pithlachascotee River System
- Brooker Creek
- North Prong Alafia River
- South Prong Alafia River

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 water supply planning activities initiated by the District, other entities in the planning region are involved in planning efforts in cooperation with those of the District. The goal is to ensure that future water supply demands will be met without adversely impacting proposed or established MFLs. The following is an example of an additional water supply planning activity in the planning region.

1.0 Tampa Bay Water Long-Term Water Supply Master Plan

The purpose of TBW's long-term water supply planning is to ensure that water supplies are sufficient to meet current and future demands through reduced reliance on groundwater and increased development of alternative supplies in order to allow recovery of natural systems within TBW's service area. In 2007, TBW began the most recent cycle of its long-term water supply planning program, which concluded in 2008 with the second update to their Master Water Plan. This document analyzes current and future water supplies and demands to determine when new supplies will be required. The current Master Water Plan consists of projects that have been approved by TBW's board for further implementation. As part of System Configuration II, TBW has prioritized phases A and B of the Downstream Enhancement Project and four system interconnect projects to meet demands through 2019. This effort is described in detail in Chapter 5.

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 MFL 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

The District has developed several recovery plans for achieving compliance with adopted MFLs. Regional plans have been developed for the NTBWUCA and SWUCA. Recovery strategies have also been developed for the lower Hillsborough and lower Alafia rivers. Regulatory components of the recovery strategies for water resources in these areas have been incorporated into District rules (Chapter 40D-80, F.A.C.) and outlined in District reports.

1.0 NTBWUCA

The first phase of the NTBWUCA Recovery Strategy was approved by the District in 1999 and required that new withdrawals not violate established MFLs unless the withdrawal was part of the NTBWUCA Recovery Strategy. The strategy included the establishment of MFLs, reductions in groundwater withdrawals and the development of alternative water supplies as required in the Partnership Agreement. Executed in 1998, the Partnership Agreement required a reduction in groundwater withdrawals from TBW's 11 central system wellfields from 158 mgd to 90 mgd (12-month moving average) by Jan. 1, 2008. As part of the Partnership Agreement, the District also committed to provide funding assistance to TBW for the development of alternative water supply projects designed to replace the reductions in groundwater withdrawals. The first phase of the strategy extends through 2010 and is based on the current knowledge of the state of the water resources of the area, the technology for water supply development including alternative sources and conservation, and existing and future reasonable-beneficial uses. The District has begun evaluating the degree of recovery that has occurred in the region and has determined that a second phase of recovery will be necessary. This is based largely on the need for additional time to evaluate the full hydrologic and biologic effects of the reduction in groundwater withdrawals that took place during the first phase of recovery, as well as the need for further assessment of the optimized distribution of the 90 mgd of withdrawals.

In December 2009, the District approved the second phase of the recovery strategy for the NTBWUCA for implementation through 2020. Major components of the rule include: (1) TBW's consolidated permit is to be renewed for 90 mgd for 10 years; (2) TBW will continue to conduct withdrawals pursuant to the Operations Plan; (3) TBW will continue expansive environmental data collection and analysis; (4) TBW will continue to evaluate and implement environmental mitigation; (5) TBW's member governments will continue water conservation activities; (6) further impacts caused by other water use permittees will continue to be limited; and (7) a "reservoir renovation exception period" that would allow a temporary exceedance of the 90 mgd permit limit during the period when the C. W. Bill Young Regional Reservoir will be repaired, if there is a significant drought and other sources are unable to replace the temporarily lost reservoir storage.

2.0 Lower Hillsborough River

The District established minimum flows for the lower Hillsborough River, Sulphur Springs and the TBC in 2007 and these have been incorporated as amendments to Chapter 40D-8, F.A.C. Because the actual flow of the lower Hillsborough River is below the proposed minimum flow, a recovery strategy was needed. In 2007, the District incorporated a recovery strategy for the river into Chapter 40D-80, F.A.C., which outlined several proposed projects and a timeline for their implementation. To implement and provide partial funding for a number of proposed projects, the District approved a joint funding agreement with the City of Tampa. As outlined in the funding agreement, project costs are expected to be allocated on a 50/50 cost-share basis with the city.

A schematic of the Hillsborough River and the Tampa Bypass Canal showing water supply withdrawal points and proposed infrastructure to achieve the river's established minimum flow.

Implementation of specific projects to achieve recovery is subject to applicable diagnostic/feasibility studies and contingent on whether required permits can be obtained. Although the city may propose alternative or additional projects to the District for funding consideration, a number of projects were explicitly outlined in the recovery strategy. These projects, with estimated costs and timeline for implementation, are shown in Table 2-1.

Table 2-1. *Lower Hillsborough River recovery strategy projects*

Project	Cost	Completion Date
Sulphur Spring Weir Modification and Pump Station	$2.5 million.	October 1, 2010
Blue Sink	$11 million	October 1, 2011
Investigation of Storage Options	$5 million	October 1, 2016

In addition to these projects, the District has constructed three temporary pump stations to transfer water from the TBC to the base of the Hillsborough River Dam and is also exploring the feasibility of a project to install the infrastructure necessary to pump water from the Morris Bridge Sink into the TBC.

3.0 SWUCA

The purpose of the SWUCA recovery strategy is to provide a plan for reducing the rate of saltwater intrusion and restoring low flows to the upper Peace River and lake levels by 2025, while ensuring sufficient water supplies and protecting the investments of existing water use permittees. The strategy has six basic components: conservation, alternative water supply development, resource recovery projects, land-use transitions, permitting, and monitoring and reporting. Promoting conservation and alternative supply development is a continuation of long-standing District programs that, along with the District's permitting program, have contributed to a stabilization of groundwater withdrawals in the region over the past 30 years. Resource recovery projects, such as the project to raise the levels of Lake Hancock for release to the upper Peace River during the dry season, are actively being pursued. Whereas coastal areas will generally meet their future demands through development of alternative supplies, some new uses in inland areas can be met with groundwater from the Upper Floridan aquifer that will use groundwater quantities from displaced non-residential uses (i.e., land-use transitions) as mitigation for the impacts of the new groundwater withdrawals.

The success of the recovery strategy will be determined through continued monitoring of the resource. The District uses an extensive monitoring network to assess actual versus anticipated trends in water levels, flows and saltwater intrusion. Additionally, the District conducts an assessment of the cumulative impacts of the factors affecting recovery. Information developed as part of this monitoring effort is provided to the Governing Board on an annual basis. The water resource and water supply development components of the strategy simply require "staying the course," which is how the District has addressed these issues for the past decade.

Regarding the financial component of the recovery strategy, the District has developed a funding strategy that outlines how the alternative water supplies and demand management measures needed to meet demand in the SWUCA (and the remainder of the District) during the planning period can be funded. The funding strategy also includes water resource restoration projects in areas such as the upper Peace River. An overview of the strategy is included in Chapter 8, Overview of Funding Mechanisms.

The management approaches outlined in the recovery strategy will be reevaluated and updated over time. The five-year updates to the RWSP include revisiting demand projections as well as reevaluation of potential sources, using the best available information. In addition, monitoring of recovery in terms of both resource trends and trends in permitted and used quantities of water is an essential component of this recovery strategy. The monitoring will provide the information necessary to determine progress in achieving recovery and protection goals and will enable the District to take an adaptive management approach to the resource concerns in the SWUCA to ensure the goals and objectives are ultimately achieved.

4.0 Lower Alafia River System

The District has established minimum flows for the Lower Alafia River System, which are set forth in paragraph 40D-8.041(13), F.A.C. In establishing the minimum flows, the District determined that under certain conditions the actual flow rates are below the minimum flows due to withdrawals from Lithia and Buckhorn springs by Mosaic Fertilizer, LLC ("Mosaic") for use at its Riverview plant. The District has developed a phased recovery strategy under which Mosaic will augment the South Prong of the Alafia River with groundwater so that by Jan. 1, 2017, withdrawals by Mosaic do not cause the minimum flows to be violated. Through Dec. 31, 2016, Mosaic will augment the South Prong of the Alafia River with up to 1.3 mgd of groundwater when flow at the Lithia gage falls below 67 cfs, provided the augmentation is not to exceed the quantity of water withdrawn by Mosaic from the Lower Alafia River System on the previous day.

Beginning Jan. 1, 2017, Mosaic will augment the South Prong of the Alafia River with up to 4.5 mgd of groundwater when flow at the Lithia gage falls below 67 cfs, provided the augmentation will be equal to but does not exceed the quantity of water withdrawn by Mosaic from the Lower Alafia River System on the previous day.

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 adopted 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. For example, in the upper Peace River, actual flows are below the minimum flow established by the District. The District is implementing MFL projects as described in the SWUCA recovery strategy. The District is currently undertaking a project to raise water levels on Lake Hancock to provide a significant portion of the additional flows needed to meet the minimum low flows in the upper Peace River. Following implementation of the Lake Hancock project, the District will monitor flows and determine if additional projects are needed to achieve the minimum low flow for the upper Peace River. The District initiated rule making in May 2009 with the intent of reserving from permitting the quantity of water that will provide the flow necessary to meet the minimum low flows in the upper Peace River. When a reservation is established and incorporated into Rule 40D-2.302, F.A.C., only those water use withdrawals that do not reduce the reserved quantity can be evaluated for permitting. Also, as part of the recovery strategy for the lower Hillsborough River, the District established that "all available water from the Morris Bridge Sink, but not greater than 3.9 mgd on any given day, is reserved to be used to contribute to achieving or maintaining the minimum flow for the lower Hillsborough River…" (40D2.302, F.A.C.).

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).

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 gauge 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 our region as the effects of climate change become evident.

Changes to our 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 — amenities our population has enjoyed for many decades. 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 our region.

Chapter 3: Demand Estimates and Projections

Demand for water for irrigation of recreational/aesthetic amenities such as golf courses is a significant component of projected demand in the planning region.

This chapter is a comprehensive analysis of the demand for water for all use categories in the Tampa Bay Planning Region for the 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 minimum flows and levels (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. 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 environmental restoration goals.

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 consists 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

This following is a summary of the data sources, methods and assumptions considered in projecting water demand. Demand projections were developed for public supply, agriculture, commercial/industrial, mining/dewatering and power generation, recreational/aesthetic, and environmental restoration. The categorization provides for the projection of demand for similar water uses under similar assumptions, methods and reporting conditions.

Section 1. Public Supply

The Increase in public supply water demand for the planning period is projected to be much larger than all other uses combined.

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 described in detail 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 categorized as any current and future functional population parcel projections developed using the District's GIS population projection model (GIS Associates, Inc., 2008 and GIS Associates, Inc., 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 is projected to increase by 91.3 mgd for the 5-in-10 condition. The projections are generally consistent with those of the District's 2006 RWSP. However, there are significant differences, some of which can be attributed to utilities that submitted alternative projections as part of the water use permit renewal process that were justifiable, based on historical regression data and long-term trends, and supported by complete documentation. 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.

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

Southwest Florida Water Management District

Table 3-1. *Projected increase in public supply demand including public supply, domestic self-supply and private irrigation wells in the Tampa Bay Planning Region (5-in-10 and 1-in-10) (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
Hillsborough	**139.3**	**147.7**	14.1	14.9	9.4	10.0	8.4	8.9	9.5	10.1	8.8	9.3	**50.2**	**53.2**	**36.0%**	**36.0%**
Pasco	**51.9**	**55.0**	7.9	8.4	6.1	6.4	6.2	6.6	6.0	6.4	5.6	6.0	**31.8**	**33.8**	**61.3%**	**61.4%**
Pinellas	**108.0**	**114.5**	4.1	4.4	1.9	2.0	2.0	2.1	1.3	1.4	-	-	**9.3**	**9.9**	**8.6%**	**8.6%**
Incremental Increase	**n/a**	**n/a**	**26.1**	**27.7**	**17.4**	**18.4**	**16.6**	**17.6**	**16.8**	**17.9**	**14.4**	**15.3**	**91.3**	**96.9**	**30.5%**	**30.6%**

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

Section 2. Agriculture

1.0 Description of the Agricultural Water Use Category

Agricultural water demand in the planning region is projected to increase by more than 5 mgd during the planning period.

Agriculture represents the second largest category of water use in the District after public supply. Included in this category are irrigated crops and other miscellaneous water uses associated with agricultural commodity production within the District. Irrigated acreage was determined and reported in the RWSP for each of 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) pasture, (6) sod, (7) blueberries, and (8) 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.

Table 3-2a is the projected increase in agricultural irrigation demand for the 5-in-10 and 2-in-10 conditions for the planning period. For the 5-in-10 condition, demand is projected to increase from 61.4 mgd in 2005 to 68.1 mgd in 2030, an increase of 6.7 mgd or 10.9 percent. 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 1.3 mgd is projected.

Table 3-2a. *Projected increase in agricultural irrigation demand in the Tampa Bay 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
Hillsborough	**48.0**	**72.8**	2.7	5.3	-	-	1.1	1.9	1.1	1.8	1.8	3.1	**6.7**	**12.1**	**14.0%**	**16.6%**
Pasco	**13.0**	**18.3**	-	-	-	-	-	-	-	-	-	-	**0.0**	**0.0**	**0.0%**	**0.0%**
Pinellas	**0.4**	**0.5**	-	-	-	-	-	-	-	-	-	-	**0.0**	**0.0**	**0.0%**	**0.0%**
Incremental Increase	**n/a**	**n/a**	**2.7**	**5.3**	**-**	**-**	**1.1**	**1.9**	**1.1**	**1.8**	**1.8**	**3.1**	**6.7**	**12.1**	**10.9%**	**13.2%**

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

County	2005 Base		2005–2010		2010–2015		2015–2020		2020–2025		2025–2030		Total Decrease		% Decrease	
	5-10	1-10	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
Hillsborough	**48.0**	**72.8**	-	-	-0.82	-0.68	-	-	-	-	-	-	**-0.82**	**-0.68**	**1.7%**	**0.9%**
Pasco	**13.0**	**18.3**	-0.21	-0.3	-0.04	-0.05	-0.04	-0.05	-0.04	-0.06	-0.03	-0.05	**-0.36**	**-0.51**	**2.8%**	**2.8%**
Pinellas	**0.4**	**0.5**	-0.02	-0.03	-0.02	-0.04	-0.02	-0.03	-0.02	-0.03	-0.02	-0.02	**-0.1**	**-0.15**	**25.0%**	**30.0%**
Incremental Decrease	**n/a**	**n/a**	**-0.2**	**-0.3**	**-0.9**	**-0.8**	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-1.3**	**-1.3**	**2.1%**	**1.4%**

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 environmental restoration goals.

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, 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)

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

Industrial/commercial, mining/dewatering and power generation water demand in the planning region is projected to experience a small net decrease during the planning period.

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

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 plant data was not available, the Districtwide average use for PG was used.

When the 2001 RWSP was completed, it was noted that the District had experienced a tremendous amount of volatility 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 increase in I/C,M/D,PG water demand for the planning period. The table shows an increase in demand for the planning period of approximately 1.7 mgd. Permitted quantities for this category are 52 mgd lower than when the demand projections were formulated for the 2006 RWSP. Some of this reduction results from downward revision of permitted quantities and some from the cessation of permitted operations. In one instance, permitted quantities were reduced for a citrus processing operation from 15.5 mgd to 3.5 mgd. Even though the permitted quantity may be substantially reduced, water use does not necessarily decline proportionally. Demand is calculated using the percent of permitted quantity historically used on a county-by-county basis. Much of the permitted quantity in the planning region has historically not been used. Due to the projection method used, the quantity permitted is a key factor in calculating future demand. For several years, the permitted quantity in the I/C and M/D sectors has been declining. Much of this reduction is due to revisions in the way permitted quantities for M/D are allocated by the District's water use permitting departments. 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 demand for the 2010 RWSP was calculated based on a Districtwide permitted quantity of 273.2 mgd, a reduction of 123.6 mgd, or 31 percent. As a result, projected demand for the 2010

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

County	2005 Base	2005–2010	2010–2015	2015–2020	2020–2025	2025–2030	Total Increase	% Increase
Hillsborough	**15.2**	-	0.4	0.3	0.4	0.4	**1.5**	**9.9%**
Pasco	**2.3**	-	-	0.1	0.1	-	**0.2**	**8.7%**
Pinellas	**0.1**	-	-	-	-	-	**0.0**	**0.0%**
Incremental Increase	**n/a**	**-**	**0.4**	**0.4**	**0.5**	**0.4**	**1.7**	**9.7%**

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

RWSP is lower than was projected for the 2006 RWSP, even though the 2010 projections include all 16 counties. The 2005 projections only included the 10 southern counties. Additionally, mining quantities permitted for product entrainment were not included in the 2010 demand projections because the District considers such quantities incidental to the mining process and not part of the actual water demand, i.e., the quantities necessary to conduct the mining operation. Eliminating entrainment quantities reduced projected demand through the planning period by approximately 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 3.5 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 environmental restoration goals.

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

County	2005 Base	2005–2010	2010–2015	2015–2020	2020–2025	2025–2030	Total Decrease	% Decrease
Hillsborough	**15.2**	-3.1	-	-	-	-	**-3.1**	**20.4%**
Pasco	**2.3**	-0.4	-	-	-	-	**-0.4**	**17.4%**
Pinellas	**0.1**	-	-	-	-	-	**0.0**	**0.0%**
Incremental Decrease	**n/a**	**-3.5**	**-**	**-**	**-**	**-**	**-3.5**	**19.9%**

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

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.

Recreational/aesthetic water demand in the planning region is projected to increase by more than 12 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 through 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 12.3 mgd for the 5-in-10 condition. The recreational/aesthetic irrigation demand in the region seems to have been affected by high land cost and low water availability. Pinellas County is the most densely populated county in the District. There has been no increase in the number of golf courses in the county since 1998. Pasco County and

Table 3-4. *Projected increase in recreational/aesthetic demand in the Tampa Bay Planning Region (5-in-10 and 1-in-10) (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
Pasco	**7.3**	**9.4**	0.6	0.7	0.8	1.2	0.9	1.1	0.9	1.1	0.9	1.2	**4.1**	**5.3**	**56.2%**	**56.4%**
Pinellas	**12.2**	**15.8**	0.2	0.2	-	0.1	0.6	0.7	0.5	0.6	0.5	0.7	**1.8**	**2.3**	**14.7%**	**14.6%**
Hillsborough	**17.4**	**22.3**	1.5	1.9	1.2	1.5	1.2	1.5	1.3	1.6	1.3	1.6	**6.5**	**8.1**	**37.4%**	**36.3%**
Incremental Increase	**n/a**	**n/a**	**2.2**	**2.8**	**2.0**	**2.8**	**2.7**	**3.3**	**2.7**	**3.2**	**2.7**	**3.5**	**12.3**	**15.6**	**33.3%**	**32.8%**

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

Hillsborough County's golf course growth has slowed significantly since the late 1990s with only 10 new golf courses. The use of reclaimed water on golf courses significantly reduces the demand for potable water in the planning region. More than 1,100 golf course holes are being irrigated with reclaimed water. Pinellas has the largest golf course reclaimed water use with more than 660 holes irrigated. This equates to more than 16 mgd of reclaimed water used on golf courses in the region, which offsets 12 mgd of potable water use. Aesthetic demand is also significantly reduced by reclaimed water use in the region. The use of more than 21 mgd of reclaimed water for aesthetic purposes offsets 13 mgd of potable water use.

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

The establishment of a minimum flow for the lower Hillsborough River ensures that the current situation where flow does not occur below the City of Tampa's dam for much of the year will be eliminated.

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. Table 3-5 summarizes environmental restoration quantities that will be required for the planning region through 2030.

2.0 Water Resources to Be Recovered

2.1 SWUCA Saltwater Intrusion Minimum Aquifer Level (SWIMAL)

One of the requirements of the District's SWUCA Recovery Strategy is a 50 mgd reduction in groundwater withdrawals that is expected to result in achievement of the SWIMAL in the Upper Floridan aquifer. It is anticipated that this demand will be met between 2005 and 2025, primarily by a gradual reduction in agricultural groundwater use resulting from water conservation efforts and as agricultural lands are replaced by urban land uses that will be supplied by alternative sources. If reductions in groundwater withdrawals are optimally distributed throughout the SWUCA, the SWIMAL may be achieved with less than 50 mgd in reductions. The 50 mgd SWIMAL environmental restoration demand was allocated to the planning regions based on the percentage of estimated groundwater use in the SWUCA in each region over the 2000–2007 period. The required reduction in groundwater withdrawals for the portion of the SWUCA in Hillsborough County is 5.2 mgd. By of the end of 2010, it is estimated that a reduction of 2.5 mgd will have occurred in the region, leaving

Table 3-5. *Projected increase in environmental restoration demand for the Tampa Bay Planning Region (mgd)*

Water Resource to be Recovered	2005–2010	2010–2015	2015–2020	2020–2025	2025–2030	Total Increase
SWIMAL (SWUCA)[1,2]	2.5	0.9	0.9	0.9	-	**5.2**
NTBWUCA	-	-	-	TBD	TBD	**TBD**
Lower Hillsborough River[3]	-	-	8.8	-	-	**8.8**
Lower Alafia River	-	-	0.86	-	-	**0.86**
Incremental Increase	**2.5**	**0.9**	**10.6**	**0.9**	**-**	**14.9**

[1]SWIMAL demand in the Tampa Bay Planning Region includes only the portion of Hillsborough County that is in the SWUCA.
[2]Of the 50 mgd demand anticipated to be needed for recovery, a reduction of 13.7 mgd was accomplished by the end of 2008. Additional demand reductions should be achieved by the end of 2010 and are included in the 2010 column. The remainder of the demand was divided over five-year increments, starting in 2015 and ending in 2025.
[3]Minimum flows must be met by 2017. Recovery will be accomplished with multiple sources that will be used in priority order to reduce reliance on the TBC. As new sources are implemented and when the minimum flow for Sulphur Springs goes into effect in 2012, the priority order will change.

a reduction of 2.7 mgd to be achieved by 2025. In Table 3-5, the demand is distributed over five-year increments, starting in 2015 and ending in 2025.

2.2 Northern Tampa Bay Water Use Caution Area (NTBWUCA)

The overuse of groundwater by multiple users in the NTBWUCA resulted in the area being designated a WUCA in 1989. The most significant environmental impacts in the NTBWUCA resulted from the West Coast Regional Water Supply Authority's (TBW's predecessor agency) groundwater withdrawals from their central wellfield system. To reduce groundwater withdrawals and mitigate impacts, the District entered into the Partnership Agreement with TBW and its member governments in 1998. Key objectives of the Partnership Agreement were to develop new water supplies from sources other than groundwater, the ending of litigation, financial assistance from the District for development of alternative water supplies, and conservation. Since the early 2000s, the development of new water sources has allowed for the phased reduction of groundwater withdrawals from 158 mgd to 90 mgd (12-month moving average) from TBW's central wellfield system. In 2010, Phase II of the recovery plan will be implemented to monitor the environmental impacts of 90 mgd of withdrawals over a 10-year period. At the end of the period, it will be determined whether additional reductions in groundwater withdrawals will be required. If additional reductions prove necessary, these will be considered an environmental restoration demand.

2.3 Lower Hillsborough River

Due to diversions of water from the City of Tampa's reservoir to meet public supply demands for the city, there have been frequent periods when the Hillsborough River does not flow below the dam, especially during the dry season. In 2007, minimum flows for the lower Hillsborough River were established at 24 cfs (15.5 mgd) fresh water equivalent from April 1 through June 30 and 20 cfs (13 mgd) fresh water equivalent the remainder of the year. Flows from Sulphur Springs are not completely fresh; therefore, more than 24 and 20 cfs will be needed to meet the rule criteria. It is estimated that flows of 27 cfs (17.4 mgd) will be needed to meet the 24 cfs fresh water equivalent and flows of 23 cfs (14.9 mgd) will be needed to meet the 20 cfs fresh water equivalent. The lower river will require augmentation 200 days per year on average to meet these minimums. The environmental restoration demand was calculated based on maintaining minimum flows in the Hillsborough River at 25 cfs (16.2 mgd) (the midpoint between 23 and 27 cfs) for 200 days per year. An annual average of 8.8 mgd is expected to be needed to meet the minimum flows set for the lower Hillsborough River by 2017. It is anticipated that approximately 7.5 mgd of this quantity will be available by 2010, and 4.3 mgd will need to be developed in the 2010–2015 time frame. The contribution from Sulphur Springs will be reduced when its minimum flow becomes effective on or before Oct. 1, 2012, and additional sources to meet minimum flows will be applied in a priority order to reduce reliance on the Tampa Bypass Canal (TBC). More or less water might be needed to meet minimum flows at any given time or over an extended period of time, depending on rainfall and resulting fluctuations in river flows. The minimum flows must be met by October 2017; however, they will likely be met earlier as water transfer projects are implemented. Projects to transfer water from the TBC, Sulphur Springs, Morris Bridge Sink and Blue Sink to the river have been completed or are under development. Water from Sulphur Springs is being sent to the base of the dam, and water is being diverted from the TBC to the Hillsborough River.

2.4 Lower Alafia River

In August 2009, District staff proposed a low-flow threshold of 120 cfs (77.6 mgd) for the lower Alafia River. TBW and Mosaic Fertilizer (Mosaic) are currently permitted for surface water withdrawals that will be affected by the proposed minimum flows. TBW has agreed to modify its operations to comply with the proposed low-flow threshold. Mosaic's permit is not consistent with the minimum flow criterion because there is no low-flow threshold limitation in the permit. A proposed recovery strategy involves augmentation of the South Prong of the Alafia River with Upper Floridan aquifer groundwater to replace Mosaic's withdrawals when the flows in the lower Alafia River fall below the 120 cfs low-flow threshold. Based on the proposed recovery strategy, an annual average of 0.25 mgd will be needed to meet the minimum flow through Dec. 31, 2016, and an annual average of 0.86 mgd will be needed by the final proposed deadline of Jan. 1, 2017. More or less water could be needed to meet the minimum flow at any given time or over an extended period of time, depending on fluctuations in river flows.

Section 6. Summary of Projected Increases and Reductions in Demand

Tables 3-6a and 3-6b summarize the increases and decreases in demands respectively for the 5-in-10 and 1-in-10 conditions for water use categories in the planning region. 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 environmental restoration goals. Table 3-7 summarizes the projected increase in demand by each county in the planning region for the 5-in-10 condition.

Table 3-6a shows that 126.9 mgd of additional water supply will need to be developed and/or existing use retired to meet the 5-in-10 demand in the planning region through 2030. Public supply water use will increase by 91.3 mgd during the planning period. This accounts for 72.5 percent of the projected increase and is the largest increase of all the water use categories. Environmental restoration is next at 14.9 mgd, or 11.7 percent of the projected increase. Table 3-6b shows a reduction of 4.8 mgd in agricultural and I/C,M/D,PG water use, most of which is groundwater. The 5.2 mgd reduction in groundwater withdrawals necessary to meet the

SWIMAL in the SWUCA could potentially be partially offset by the projected 4.8 mgd decrease in groundwater use.

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

There is relatively close agreement between the 2006 and 2010 RWSP demand projections for all water use categories. The only significant exception is in the public supply water use category for Hillsborough County. The 2006 RWSP projected an increase of 78.8 mgd for the 2000–2025 planning period, while the 2010 RWSP projected an increase of 50.2 mgd for the 2005–2030 planning period. The explanation for the difference is related to the fact that the 2006 RWSP was developed during the peak of the residential housing boom. The economic downturn that followed in subsequent years resulted in significantly lower population growth projections, a direct result of which was a decline in projected water demand.

Table 3-6a. *Summary of the projected increase in demand in the Tampa Bay 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	**299.2**	**317.1**	26.1	27.7	17.4	18.4	16.6	17.6	16.8	17.9	14.4	15.3	**91.3**	**96.9**	**30.5%**	**30.6%**
Agriculture	**61.4**	**91.6**	2.7	5.3	-	-	1.1	1.9	1.1	1.8	1.8	3.1	**6.7**	**12.1**	**10.9%**	**13.2%**
I/C,M/D,PG	**17.6**	**17.6**	-	-	0.4	0.4	0.4	0.4	0.5	0.5	0.4	0.4	**1.7**	**1.7**	**9.7%**	**9.7%**
Recreation	**36.9**	**47.5**	2.2	2.8	2.0	2.8	2.7	3.3	2.7	3.2	2.7	3.5	**12.3**	**15.6**	**33.3%**	**32.8%**
Restoration	n/a	n/a	2.5	2.5	0.9	0.9	10.6	10.6	0.9	0.9	-	-	**14.9**	**14.9**	**n/a**	**n/a**
Incremental Increase	**n/a**	**n/a**	**33.5**	**38.3**	**20.7**	**22.5**	**31.4**	**33.8**	**22.0**	**24.3**	**19.3**	**22.3**	**126.9**	**141.2**	**30.6%**	**29.8%**
Cumulative Increase	**415.1**	**473.8**	**448.6**	**512.1**	**469.3**	**534.6**	**500.7**	**568.4**	**522.7**	**592.7**	**542.0**	**615.0**	**126.9**	**141.2**	**30.6%**	**29.8%**

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

3-6b. *Summary of the projected decrease in demand in the Tampa Bay 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	**299.2**	**317.1**	-	-	-	-	-	-	-	-	-	-	0.0	0.0	**0.0%**	**0.0%**
Agriculture	**61.4**	**91.6**	-0.2	-0.3	-0.9	-0.8	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	**-1.3**	**-1.3**	**2.1%**	**1.4%**
I/C,M/D,PG	**17.6**	**17.6**	-3.5	-3.5	-	-	-	-	-	-	-	-	**-3.5**	**-3.5**	**19.9%**	**19.9%**
Recreation	**36.9**	**47.5**	-	-	-	-	-	-	-	-	-	-	0.0	0.0	**0.0%**	**0.0%**
Restoration	**n/a**	**n/a**	-	-	-	-	-	-	-	-	-	-	0.0	0.0	**0.0%**	**0.0%**
Incremental Decrease	**n/a**	**n/a**	**-3.7**	**-3.8**	**-0.9**	**-0.8**	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-4.8**	**-4.8**	**1.2%**	**1.1%**

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

Table 3-7. *Summary of the projected increase in demand for counties in the Tampa Bay Planning Region (5-in-10) (mgd)*

Water Use Category	Planning Period						Total Increase	
	2005 Base	2005–2010	2010–2015	2015–2020	2020–2025	2025–2030	mgd	%
Hillsborough								
Public Supply	**139.3**	14.1	9.4	8.4	9.5	8.8	**50.2**	**36.0%**
Agriculture	**48.0**	2.7	-	1.1	1.1	1.8	**6.7**	**14.0%**
I/C,M/D,PG	**15.2**	-	0.4	0.3	0.4	0.4	**1.5**	**9.9%**
Rec/Aesthetic	**17.4**	1.5	1.2	1.2	1.3	1.3	**6.5**	**37.4%**
Environmental Restoration	**n/a**	2.5	0.9	10.6	0.9	-	**14.9**	**n/a**
Incremental Increase	**n/a**	**20.8**	**11.9**	**21.6**	**13.2**	**12.3**	**79.8**	**36.3%**
Cumulative Increase	**219.9**	**240.7**	**252.6**	**274.2**	**287.4**	**299.7**	**79.8**	**36.3%**
Pasco								
Public Supply	**51.9**	7.9	6.1	6.2	6.0	5.6	**31.8**	**61.3%**
Agriculture	**13.0**	-	-	-	-	-	**0.0**	**0.0%**
I/C,M/D,PG	**2.3**	-	-	0.1	0.1	-	**0.2**	**8.7%**
Rec/Aesthetic	**7.3**	0.6	0.8	0.9	0.9	0.9	**4.1**	**56.2%**
Environmental Restoration	**n/a**	-	-	-	-	-	**0.0**	**n/a**
Incremental Increase	**n/a**	**8.5**	**6.9**	**7.2**	**7.0**	**6.5**	**36.1**	**48.5%**
Cumulative Increase	**74.5**	**83.0**	**89.9**	**97.1**	**104.1**	**110.6**	**36.1**	**48.5%**
Pinellas								
Public Supply	**108.0**	4.1	1.9	2.0	1.3	-	**9.3**	**8.6%**
Agriculture	**0.4**	-	-	-	-	-	**0.0**	**0.0%**
I/C,M/D,PG	**0.1**	-	-	-	-	-	**0.0**	**0.0%**
Rec/Aesthetic	**12.2**	0.2	-	0.6	0.5	0.5	**1.8**	**14.7%**
Environmental Restoration	**n/a**	-	-	-	-	-	**0.0**	**n/a**
Incremental Increase	**n/a**	**4.3**	**1.9**	**2.6**	**1.8**	**0.5**	**11.1**	**9.2%**
Cumulative Increase	**120.7**	**125.0**	**126.9**	**129.5**	**131.3**	**131.8**	**11.1**	**9.2%**

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. Aquifer storage and recovery (ASR) is also discussed as a storage option with great potential to maximize the utilization of surface water and reclaimed water. 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 upper Hillsborough River in Pasco County.

Part A. Evaluation of Water Sources

For the 2010 Regional Water Supply Plan (RWSP), as was the case for the 2006 and 2001 RWSPs, it is assumed that the majority of new water supply needed to meet projected demands during the planning period will come from sources other than fresh groundwater. This assumption is based largely on the impacts of groundwater withdrawals on water resources in the planning region, discussed in Chapter 2, and previous direction from the Governing Board. Limited additional fresh groundwater supplies will be available from the surficial and intermediate aquifers and possibly from the Upper Floridan aquifer, subject to a rigorous, case-by-case permitting review.

Water users throughout the region are increasingly implementing conservation measures to reduce their water demands. Such conservation measures will enable water supply systems to support more users with the same quantity of water and hydrologic stress. However, the region's continued growth will require the development of additional alternative sources such as reclaimed water, brackish groundwater, seawater and surface water with off-stream reservoirs and ASR systems for storage. To facilitate the development of these projects, the District encourages partnerships between neighboring municipalities and counties. The following discussion summarizes the status of the evaluation and development of various water supply sources and the potential for those sources to be used to meet the projected water demand in the planning region.

Section 1. Surface Water/Stormwater

The Hillsborough River in Hillsborough County at the up-stream end of the City of Tampa's reservoir.

The major river systems in the planning region include the Anclote, Hillsborough (including the Tampa Bypass Canal), Alafia and Little Manatee. Major public utilities use the, Alafia and Hillsborough rivers and the Tampa Bypass Canal (TBC) for water supply. The Hillsborough River has an in-stream dam that forms a reservoir for storage. The potential yield for all rivers will ultimately be determined by their established minimum flows. However, yields associated with rivers that have in-stream dams also depend on the degree of structural alteration that has occurred and the habitat that is supported by the flows. The City of Tampa, which relies on the Hillsborough River and the TBC for most of its water needs, currently withdraws an annual average quantity of 83.1 mgd from these sources. TBW also uses the Hillsborough River and the TBC. From January 2003 to December 2007, TBW supplied an average of 36.1 mgd from the TBC (including withdrawals from the TBC Middle Pool, which is augmented by the Hillsborough River, and the Lower Pool). Water from these withdrawals is treated at TBW's regional water treatment plant and conveyed to the regional distribution system.

1.0 Criteria for Determining Potential Water Availability

The available yield for each river was calculated using its established minimum flow and/or hydrodynamic modeling (if available) and its current permitted allocation. If the minimum flow for the river was not yet established or a hydrodynamic model was not available, a planning-level minimum flow criteria was utilized. A five-step process was used to estimate potential surface water availability that included (1) estimation of unimpacted flow, (2) selection of the period used to quantify available yield, (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 detailed explanation of this methodology is located in the Appendix for Chapter 4.

2.0 Overview of River Systems

2.1 Anclote River

The Anclote River originates in south-central Pasco County and discharges to the Gulf of Mexico at Tarpon Springs. The headwaters are poorly defined and consist mostly of agricultural and natural lands. The lower portion of the watershed is urbanized. The watershed area is about 120 square miles and contains several gauging stations with long-term flow data. The annual average discharge from 1965 to 2003 at the most downstream gauging station is 43 mgd (67 cfs). The Anclote Power Station, owned by Progress Energy

Corporation, withdraws water from the river near the confluence with the Gulf of Mexico; however, there are no permitted withdrawals upstream of the gulf. According to a peer-reviewed District study (Anclote River System Recommended Minimum Flows and Levels, Heyl and others 2009), there may be little or no water available from the river. Declines in flow have occurred due to groundwater withdrawals from the five regional wellfields in the Northern Tampa Bay Area, but flows are expected to improve as a result of the recovery strategy for the Northern Tampa Bay Water Use Caution Area (NTBWUCA).

2.2 Alafia River

The Alafia River is an important source of potable water for the planning region.

The Alafia River watershed encompasses approximately 460 square miles. While most of the watershed is located in Hillsborough County, the headwaters are located in Polk County, where the land has been mined extensively for phosphate ore. The river extends 23 miles from its mouth at Hillsborough Bay near Gibsonton, eastward to the confluence of its two major tributaries (North and South prongs). Below this confluence, the river has three major tributaries: Turkey, Fishhawk and Bell creeks. The adjusted annual flow of the Alafia River is 261 mgd (404 cfs). Mosaic Fertilizer is permitted to withdraw an annual average of nearly 6.0 mgd from Lithia and Buckhorn springs, which supplies base flow to the river. TBW's withdrawals are permitted according to a flow-based withdrawal schedule. The annual average withdrawal is anticipated to be 17.5 mgd, based on an analysis of the period from 1977 to 1996 that is summarized in the permit. Over this period, average annual withdrawals ranged from 7.2 to 28.9 mgd. The schedules of withdrawals for Mosaic and TBW are not conditioned or constrained by the withdrawals of the other party. Water withdrawn by TBW can be used directly or diverted to the C. W. Bill Young Regional Reservoir for storage. Two additional minor permitted agricultural use withdrawals are located on Bell Creek and Howell Branch. The combined permitted withdrawals from the river are 23.6 mgd, and use for the period 2003 through 2007 is 15.7 mgd. Based on the Polk County Comprehensive Water Supply Plan Joint Study, Alafia River Evaluation (Royal Consulting Services, Inc., 2008) Constant Supply Option, an additional 18.5 mgd of water supply is potentially available from the river. It may be possible to develop additional water supply from the Alafia River through a surface water or downstream augmentation project on the Alafia River, as described in Chapter 5, Section 1, Option #1 and Table 5-2, List of Reclaimed Water Options for the Tampa Bay Planning Region. These projects are dependent upon establishment of estuarine minimum flows.

2.3 Hillsborough River

The Hillsborough River in the vicinity of Hillsborough River State Park.

The Hillsborough River, the most hydrologically significant river in the planning region, has a watershed area of 650 square miles. The interactions between the Hillsborough River watershed and the Upper Floridan aquifer are complex and result in large wetland areas that act as groundwater discharge points in some areas and surface water storage basins in others. Minimum flows have been established for both the freshwater and estuarine reaches.

Although most of the river systems in the northern Tampa Bay area are fed almost totally by overland flow or surficial aquifer discharge, the Hillsborough River receives significant discharge from the Upper Floridan aquifer. The river originates in the Green Swamp, but much of the base flow entering the river is discharged from the Upper Floridan and surficial aquifers along the course of the river. Several reaches of the river have direct contact with the Upper Floridan aquifer and many springs are found along the bottom and banks. The Hillsborough River corridor is heavily urbanized in its lower reaches and the river has been dammed 10 miles upstream from its mouth to create a reservoir for the City of Tampa's water supply. The greater part of the headwaters and upper reaches of the river are undeveloped. The annual average discharge from 1965 to 2003 was 255 mgd (395 cfs) as measured at the dam. This is net discharge after withdrawals. The annual average flow for the other rivers in the District included in the RWSP for each planning region is calculated after all upstream withdrawals have been added back to reproduce the unimpacted flow. The transfer of water to and from the Hillsborough River is extremely complex, involving not only public supply use but also transfers to and from the TBC. Consequently, the reported flow in Table 4-1 is not corrected for withdrawals.

Two withdrawals are permitted on the Hillsborough River — one for the City of Tampa and one for TBW. The city is currently permitted to withdraw an annual average of 82 mgd from the Hillsborough River Reservoir for delivery to the city's water treatment plant located upstream of the dam. TBW is permitted to divert up to 194 mgd (dependent on flows over the dam) from the Hillsborough River to the TBC Middle Pool for withdrawal at TBW's pump station. The city can accept an annual average of up to 20 mgd into its reservoir from the TBC Middle Pool in accordance with TBW's water use permit. From January 2003 through December 2007, the City of Tampa's annual average withdrawal from the Hillsborough River was 76.1 mgd. TBW's annual average diversion from the Hillsborough River to the TBC Middle Pool was 15.5 mgd. The net withdrawal from the Hillsborough River was 91.6 mgd. During the same period, TBW diverted 7.0 mgd from the TBC Middle Pool to augment the Hillsborough River.

2.4 Tampa Bypass Canal

One of the large structures on the Tampa Bypass Canal.

The Tampa Bypass Canal (TBC) System was built by the U.S. Army Corps of Engineers to provide flood protection for the Tampa metropolitan area. The canal system was completed in 1984 and extends 18 miles from the Lower Hillsborough Flood Detention Area to McKay Bay. The canal breaches the Upper Floridan aquifer, which allows groundwater to discharge from the aquifer into the canal. Minimum flows have been established for the TBC Lower Pool.

TBW operates two pumping stations on the TBC. The Harney Pump Station withdraws water from Harney Canal (Middle Pool) of the TBC and delivers this water to the City of Tampa's Hillsborough River Reservoir. The purpose of this transfer of water is to augment the City's reservoir during low-flow conditions in the Hillsborough River. TBW also operates the TBC Pump Station, which is permitted to withdraw water from the Middle Pool and Lower Pool of the TBC. The withdrawal intakes are located just upstream and downstream of Structure S-162. This control structure separates the Middle and Lower pools. TBW's Harney Canal augmentation permit allows withdrawals up to an annual average of 20 mgd. TBW's Hillsborough River/TBC water use permit does not limit the annual amount of withdrawal allowed. Diversions from the Hillsborough River to the TBC are based on flow calculated at the Hillsborough River Dam. Water is diverted from the Hillsborough River through Structure S-161 into the TBC for subsequent use by TBW. TBW's withdrawals from the Lower Pool of the TBC are based on stage. The minimum flow at Structure S-160 is zero, so no flow downstream of S-160 is required. TBW is permitted to take 100% of the available water when the pool stage is at nine feet or above, up to the permit capacity of 258 mgd. TBW manages the pool stages in the Middle Pool and Lower Pool to maximize the availability of water on a day-to-day basis. TBW's long-term yield analysis estimates that 88.5 mgd of water is available for withdrawal from the TBC, including the current flow-based diversions from the Hillsborough River.

From January 2003 to December 2007, TBW withdrew an annual average of 36.1 mgd from the TBC for distribution to their regional system. About 15.5 mgd was water that had been diverted from the Hillsborough River into the canal for withdrawal and 20.6 mgd was non-augmented water from the canal. During the same period, TBW diverted 7.0 mgd from the Middle Pool to augment the Hillsborough River. Total net diversions from January 2003 through December 2007 were 27.6 mgd.

As part of the recovery strategy for the NTBWUCA, TBW developed the enhanced surface water system, which withdraws additional quantities of water for potable supply from the TBC. This water can be used directly or diverted to the C. W. Bill Young Regional Reservoir for storage.

2.5 Little Manatee River

The Little Manatee River watershed straddles the Manatee/Hillsborough county line and encompasses approximately 225 square miles. The river extends nearly 40 miles from its source in southeastern Hillsborough County, westward to its mouth at Tampa Bay near Ruskin. Tidal effects in the Little Manatee River are discernible up to 15 miles upstream from the mouth. Based on flow data collected at the USGS gage near Wimauma, average annual discharge for the Little Manatee River is approximately 98.6 mgd (153 cfs).

Florida Power and Light (FPL) withdraws water from the Little Manatee River and stores it in a 3,500-acre cooling pond (Lake Parrish) for its 1,600 megawatt power generation facility. Average annual diversions from 2003 to 2007 were 3.7 mgd. The original water use permit allowed FPL to withdraw water from the river during high-flow periods and for quantities greater than 10 percent of total flows. Under a permit revised in 2002, FPL is now allowed to withdraw up to an annual average of 8.5 mgd, with maximum daily withdrawals limited to 10 percent of the total river flow. The revised permit includes a single withdrawal schedule for normal operations and a schedule for what is termed “emergency conditions.” Emergency conditions become active when the level of the cooling pond falls below a pre-determined level. The revised permit is expected to significantly alter FPL’s withdrawal schedule. In addition, FPL installed a third generating unit in 2005 that will provide an additional 1,100 megawatts of power. FPL expects that when the plant is under full operation, withdrawals from the river will be close to permitted quantities. An additional 0.2 mgd is permitted to an agricultural operation on the Carlton Branch of the Little Manatee River. Total permitted withdrawals are 8.7 mgd. Based on permitted withdrawals and the planning level minimum flow criteria, an additional 0.2 mgd is potentially available from the river.

3.0 Summary of Surface Water Availability in the Planning Region

Table 4-1 summarizes potential surface water availability for rivers in the planning region. The estimated additional surface water that could potentially be obtained from rivers in the planning region ranges from approximately 55.7 mgd to 74.4 mgd. The lower end of the range is the amount of surface water that has been permitted but is currently unused (194.3 mgd minus 138.6 mgd) and the upper end includes permitted but unused quantities (55.7 mgd) plus the estimated remaining unpermitted available surface water (18.7 mgd). Additional factors that could affect the quantities of water that are ultimately developed for water supply include the future establishment of minimum flows, the ability to develop sufficient storage capacity, variation in discharges to the river from outside sources, and the ultimate success of adopted recovery plans.

Table 4-1. *Summary of current withdrawals and potential availability of water from rivers/creeks in the Tampa Bay Planning Region (mgd) based on planning level minimum flow criteria (P85/10 Percent) or the proposed or established minimum flow*

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
Tampa Bay Planning Region									
Anclote River[7]	No	43.4	TBD	0.0	0.0	TBD	--	--	--
Alafia River @ Bell Shoals Rd.[8]	No	261	43.0	23.6	15.7	18.5	285	124	364
Hillsborough River @ Dam[9,10]	Yes	255	25.5	113.0	91.6	TBD	TBD	TBD	TBD
Tampa Bypass Canal @ S-160[10,11]	Yes	n/a	0	88.5	27.6	TBD	TBD	TBD	TBD
Little Manatee River @ FPL Reservoir	No	98.6	9.9	8.7	3.7	0.2	71	6	148
Total				**233.8**	**138.6**	**18.7**			

[1]Mean flow based on recorded USGS flow plus reported WUP withdrawals added back when applicable. Maximum period of record used for rivers in the region is 1965–2003. An MFL of zero has been established for TBC S-160; therefore, adjusted annual average flow is indicated as not applicable (n/a).
[2]Based on 10% of mean flow for Little Manatee River. MFLs were established and applied to calculate potentially available quantities for Alafia River. Adopted MFL for TBC at S-160 is zero.
[3]Based on individual WUP conditions, which may or may not follow current 10% diversion limitation guidelines.
[4]Based on average reported withdrawals from 2003–2007.
[5]Equal to remainder of 10% of total flow after permitted uses allocated, with minimum flow cutoff for new withdrawals of P85 and max system diversion capacity of twice median flow (P50) with this exception: for Alafia River, based on lower limit of the actual supply range for constant supply option in the Polk County Comprehensive Water Supply Plan, Alafia River Evaluation (Royal Consulting Services, Inc., 2008).
[6]Based on estimated number of days that additional withdrawal is available considering current permitted quantities and withdrawal restrictions. Min and max are the estimated range of days that additional withdrawals would have been available in any particular year.
[7]A study currently under peer review (Heyl et al., 2009) indicates Anclote River may be in recovery, and permitted withdrawal quantities may be affected. Available quantities will be determined when MFL is approved.
[8]Permitted Alafia River withdrawals are sum of TBW's long-term annual yield based on WUP withdrawal schedule, Mosaic Fertilizer withdrawals from Lithia and Buckhorn springs, and two small agricultural permitted withdrawals. Current use for TBW withdrawals is water sent to regional distribution system and was 11.9 mgd, based on average pumping from 2003–2007. May be possible to develop additional supply from these sources by expanding current WUP withdrawal limits. Additional work necessary to ensure additional withdrawals do not cause impacts.
[9]Adjusted annual average flow not corrected for withdrawals due to complex transfer of water to/from Hills. River involving public supply use and transfers to/from TBC. TBW's permitted withdrawals from Hills. River based on their WUP flow schedule, as described in Footnote 11. Annual average withdrawals are estimated by TBW to be 45 mgd. City of Tampa's permitted withdrawals from Hills. River are 82 mgd, which is quantity permitted for public supply. Availability of the 82 mgd is dependent on Hills. River augmentation with water from TBC (up to 20 mgd), Sulphur Springs (up to 11 mgd), and stored Hills. River water from City of Tampa ASR that is returned to river as needed (up to 10 mgd). Current use for Jan. 2003–Dec. 2007 includes 76.1 mgd used by city and 15.5 mgd by TBW for total of 91.6 mgd. Current use does not include 7.0 mgd transferred from TBC to augment Hills. River.
[10] May be possible to develop additional water from Hills. River and TBC by expanding current WUP withdrawal limits. Additional work necessary to ensure additional withdrawals do not cause environmental impacts.
[11]TBW's permitted TBC withdrawals are flow schedule-based; annual average withdrawals expected to be 29 mgd, based on analysis of 1975–1995. TBW's permitted withdrawals from TBC Middle Pool to augment Hills. River Reservoir are 20 mgd. Total permitted withdrawals from TBC are 49 mgd. Current augmentation use for Jan. 2003-Dec. 2007 from TBC Middle Pool to Hills. River is 7.0 mgd. Current use based on Jan. 2003–Dec. 2007 is difference between 36.1 mgd withdrawn by TBW from Lower and Middle Pools and 15.5 mgd transferred from Hills. River to augment TBC Middle Pool. Net withdrawal from TBC is 20.6 mgd. Total current use for TBC is 27.6 mgd. TBW's permitted TBC withdrawals based on stage levels in Lower Pool and a flow-based diversion schedule from Hills. River through S-161. Permitted withdrawal capacity from TBC is 258 mgd. TBW is permitted for 100% of water in Lower Pool when stage is above 9.0 feet. Long-term yield from TBC estimated by TBW to be 88.5 mgd, including diversion from Hills. River through S-161 with estimated long-term yield of 45 mgd.

Section 2. Reclaimed Water

A 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. Pinellas County has one of the largest reclaimed water systems in the nation. As of 2005, Pinellas County Utilities utilized an average daily flow of nearly 19 mgd of reclaimed water for residential irrigation, golf course irrigation and industrial/commercial use. Since 1987, the District has provided more than $214 million in cost-share funding in the planning region for 167 reclaimed water projects.

The benefit that can be obtained from the use of reclaimed water is governed by the concepts of utilization and offset. Utilization rate is the percent of treated wastewater from a WWTP that is beneficially used 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 average annual 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 ASR 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 also 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 plant 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 storage, water-conserving rates, and efficient irrigation design and irrigation restrictions.

The District's goal is to achieve a 75 percent utilization rate of all WWTP flows and offset efficiency of all reclaimed water used of 75 percent by the year 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 47 WWTP in Hillsborough, Pasco and Pinellas counties that collectively produced 225 mgd of reclaimed water. Of that quantity, 95 mgd was beneficially used to offset 62 mgd of traditional water supplies. Therefore, only 42 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 wastewater available in the planning region will be utilized, and 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, storage and education. As a result, by 2030 it is estimated that 198 (approximately 75 percent) of the 257 mgd of wastewater produced will be beneficially reused and 148 mgd of traditional water supplies will be offset (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 161.7 mgd. Based on an overall 75 percent utilization and offset, 101.0 mgd will be used and 75.8 mgd of potable-quality water supplies will be offset by this quantity

Table 4-2. *2005 actual versus 2030 potential reclaimed water availability, utilization and offset (mgd) in the Tampa Bay 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]
Hillsborough	15	96.5	31.1	20.2	120.82	89.71	59.62	44.72
Pasco	16	23.6	13.2	8.6	37.71	24.51	15.08	11.31
Pinellas	16	105.3	50.9	33.0	98.41	47.49	26.34	19.76
Total	**47**	**225.3**	**95.2**	**61.8**	**256.94**	**161.71**	**101.04**	**75.78**

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

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.

Section 3. Seawater Desalination

An interior view of the Tampa Bay Seawater Desalination facility.

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 in which fresh water is produced as pressurized seawater is passed through a semi-permeable membrane. The process results in fresh product water (permeate) and a mineralized concentrate byproduct. There are five principal elements to a 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 (Water Resource Associates, Inc., 2007). Energy recovery systems reduce electrical demands of the facility, alleviate redundant pumping capacities and lower operational 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 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 The Tampa Bay Seawater Desalination Facility

This discussion is included as a case study that illustrates the challenges inherent in developing such a facility in the region. TBW's desalination facility is the only existing seawater desalination facility in the District and is currently the largest operating seawater desalination facility in North America. The facility is co-located with Tampa Electric Company's Big Bend Power Plant on Tampa Bay and has a capacity of 25 mgd. Plans to expand the facility to 35 mgd are included in Chapter 5 as a project option. The West Coast Regional Water Supply Authority first requested proposals for the desalination facility in 1997, and a development contract was awarded in 1999. The project was an ambitious endeavor at the time and two developers went bankrupt as they attempted to meet the contractual goals of the project. TBW took ownership of the facility in 2002 to continue its development. Upon initial completion in 2003, it was determined that the pretreatment system could not adequately remove organic and other particulate matter in the source water, which resulted in rapid fouling of the RO membranes. Over the next two years, a more robust pretreatment system was designed and built and the plant was declared fully operational in December 2007. During its first year of operation, the plant produced an average of 20 mgd that helped offset fresh groundwater withdrawals from TBW's regional wellfields.

Tampa Bay Water's facility on Tampa Bay is the largest seawater desalination facility currently in operation in North America.

During the extensive pilot testing and refinements to the pretreatment system, there was ample time to monitor the ecological effects of the concentrate disposal. The facility dilutes the concentrate in the same discharge pipe and discharge canal that returns the cooling water from the power plant to the bay. The concentrated seawater is diluted at a 70-to-1 ratio with up to 1.4 billion gallons per day of power plant cooling water. The discharge water is diluted to within approximately 1.5 percent of the ambient bay water quality, which is less than natural seasonal salinity fluctuations. Monitoring during the plant's first year of operations showed no measurable changes in salinity in the bay, even when the plant was operating at maximum capacity.

The District allocated $85 million to the desalination facility's capital cost, which has reached $157.5 million. The current operation and maintenance costs for producing potable water has averaged $3.54 per thousand gallons. Desalinated water can now contribute up to 10 percent of the required supply for TBW's regional system. While the development of this project has faced numerous challenges, the facility is now considered a prototype for other treatment facilities.

2.0 Potential for Water Supply from Seawater Desalination

Two options for large-scale seawater desalination facilities in the planning region have been developed as part of the water supply planning efforts of the District and TBW. The options include a 25 mgd facility co-located with the Anclote River Power Station near the Gulf of Mexico in Pasco County and a 10 mgd expansion of TBW's existing facility on Tampa Bay in Hillsborough County. Additional information on these options is presented in Chapter 5.

Section 4. Brackish Groundwater Desalination

The pre-filtration system of a brackish groundwater desalination facility.

Brackish groundwater in the planning region is found in coastal areas in the Upper Floridan and intermediate aquifers as a depth-variable transition between fresh and saline waters. Figure 4-1 depicts the generalized location of the freshwater/saltwater interface (as defined by the 1,000 mg/L isochlor) in the high production zone of the Upper Floridan aquifer. Generally, water quality declines to the south and west in the District in both the Upper Floridan aquifer and lower portion of the intermediate aquifer.

Brackish groundwater is defined as groundwater having impurity concentrations greater than drinking water standards (TDS concentration greater than 500 mg/L) but less than seawater (TDS equal to or greater than 35,000 mg/L) (SWFWMD, 2001). 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 10,000 mg/L typically require high-pressure RO membranes. This water quality threshold generally distinguishes the upper limit of brackish groundwater source

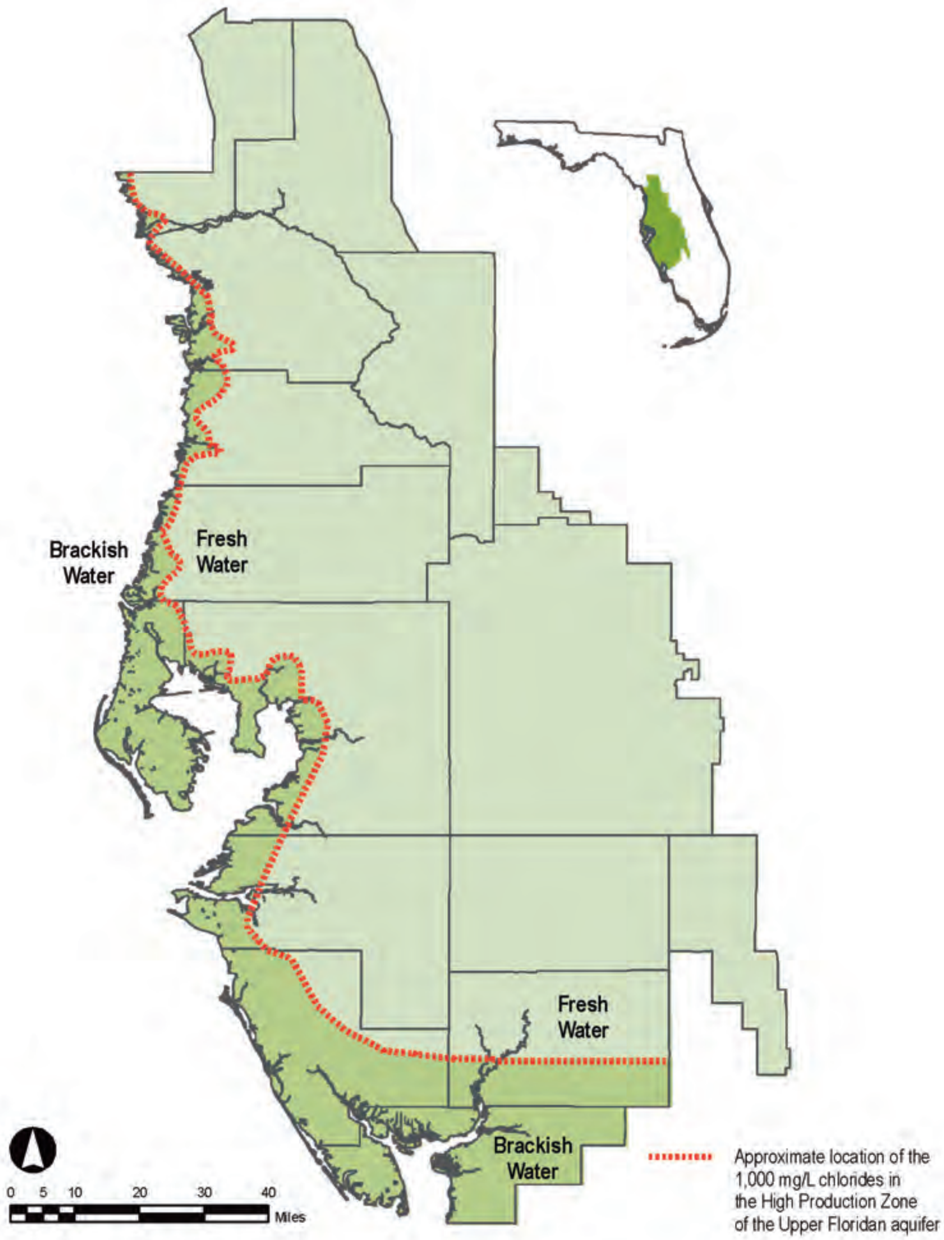


Figure 4-1. *Generalized location of the freshwater/saltwater interface*

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. Depending on the TDS concentration of raw water, 15 to 50 percent of the water used in the RO process becomes concentrate byproduct 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 research 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

Impacts from excessive withdrawals of groundwater from the Upper Floridan aquifer in the Northern Tampa Bay Water Use Caution Area (NTBWUCA) have significantly lowered water levels in lakes and wetlands throughout the region. Though there are instances where groundwater withdrawals have resulted in a degradation of water quality in wells, these effects have been associated with localized withdrawals and not the combined effects of withdrawals in the region. Though withdrawals from TBW's wellfields create a regional drawdown effect, it does not extend to coastal areas. Because there is no evidence of saltwater intrusion in the NTBWUCA, it is possible for utilities to obtain permits to withdraw brackish groundwater from the Upper Floridan aquifer in coastal areas. TBW has completed multiple studies to evaluate potential brackish groundwater development in coastal Pasco and Pinellas counties, targeting areas where TDS concentrations are in the range of 500 to 10,000 milligrams per liter (mg/L). Issues identified for potential sites in Pasco County included surficial aquifer drawdown, localized saltwater intrusion and conflicts with other groundwater users. Seven potential sites in Pinellas County were evaluated using a withdrawal rate of 6 mgd. Results of modeling simulations indicated the potential to develop a brackish groundwater source at the sites for at least a 20-year period without exceeding target TDS levels. A similar approach was taken to evaluate the potential for brackish groundwater development at four sites in Hillsborough

County. However, the area where brackish groundwater exists in Hillsborough County is within the most impacted area (MIA) of the SWUCA.

TBW's 5 mgd mid-Pinellas brackish groundwater desalination option was evaluated for development in 2001. A 4.5-acre site near Lake Seminole was acquired for the project in 2002. Groundwater modeling predicted a drawdown in the Upper Floridan aquifer in the vicinity of the Bridgeway Acres Landfill, which raised mitigation concerns. Additionally, easement acquisitions for a dispersed wellfield appeared problematic due to dense development surrounding the site. The project concept is not expected to be reevaluated over the next several years. Four additional sites were identified in 2003 by TBW for small RO facilities capable of producing 5 mgd. Three of the sites would utilize brackish groundwater while the fourth would use bay water. The cities of Tarpon Springs and Oldsmar are currently developing brackish groundwater desalination facilities. These are the first brackish groundwater projects approved for funding by the District. In 1998, the City of Oldsmar and the District completed a feasibility analysis for developing a brackish groundwater supply for the city and concluded that the development of a brackish wellfield and RO facility was feasible. The city received a water use permit in 2006 to supply 2 mgd of potable water and an injection-well permit for RO concentrate in 2007. In 2005, the City of Tarpon Springs and the District conducted a feasibility analysis, which concluded that brackish groundwater production was viable, although withdrawals may be restricted due to potential minimum-flow impacts to the Anclote River. The city is pursuing development of a wellfield and a 5.0 mgd brackish groundwater RO facility. The location of these facilities and all other existing and potential brackish groundwater and seawater desalination facilities in the District is shown in Figure 4-2.

The ultimate availability of brackish groundwater in the planning region for water supply, whether through the development of new facilities or expansion of existing ones, must be determined on a case-by-case basis through the permitting process. Because of this approach, an analysis to determine the total amount of brackish groundwater available for future water supply in the planning region has not been undertaken. As an alternative, the availability of brackish groundwater for planning purposes is the quantity of finished water that will be developed from the unused permitted capacities of existing facilities plus the finished water capacities of facilities that are planned or actively being developed. Regarding existing facilities, there are two brackish groundwater RO facilities in Pinellas County that are not using their entire permitted allocation of groundwater from the Upper Floridan aquifer. The City of Clearwater's facility is permitted to withdraw 6.3 mgd of brackish groundwater. The city withdrew an average of 3.0 mgd in 2008, leaving an unused quantity of 3.3 mgd. Assuming a treatment efficiency of 70 percent, the facility has the potential to produce an additional 2.3 mgd of finished water. The City of Dunedin's facility is permitted to withdraw 6.6 mgd of brackish groundwater. The city withdrew an average of 4.7 mgd in 2008, leaving an unused quantity of 1.9 mgd. Assuming 70 percent treatment efficiency, the city has the potential to produce an additional 1.3 mgd of finished water. The combined permitted but unused finished water supply capacity from these two facilities equals 3.6 mgd. Regarding facilities that are planned or under development, the City of Oldsmar is developing a 2-mgd facility and the City of Tarpon Springs is developing a 5-mgd facility. The combined quantity from these facilities is 7 mgd. Adding the quantities from existing facilities to the quantities from facilities that are planned or under development results in a total additional supply of brackish groundwater in the planning region of 10.6 mgd. Table 4-3 is a list of the existing and planned brackish desalination facilities in the planning region.

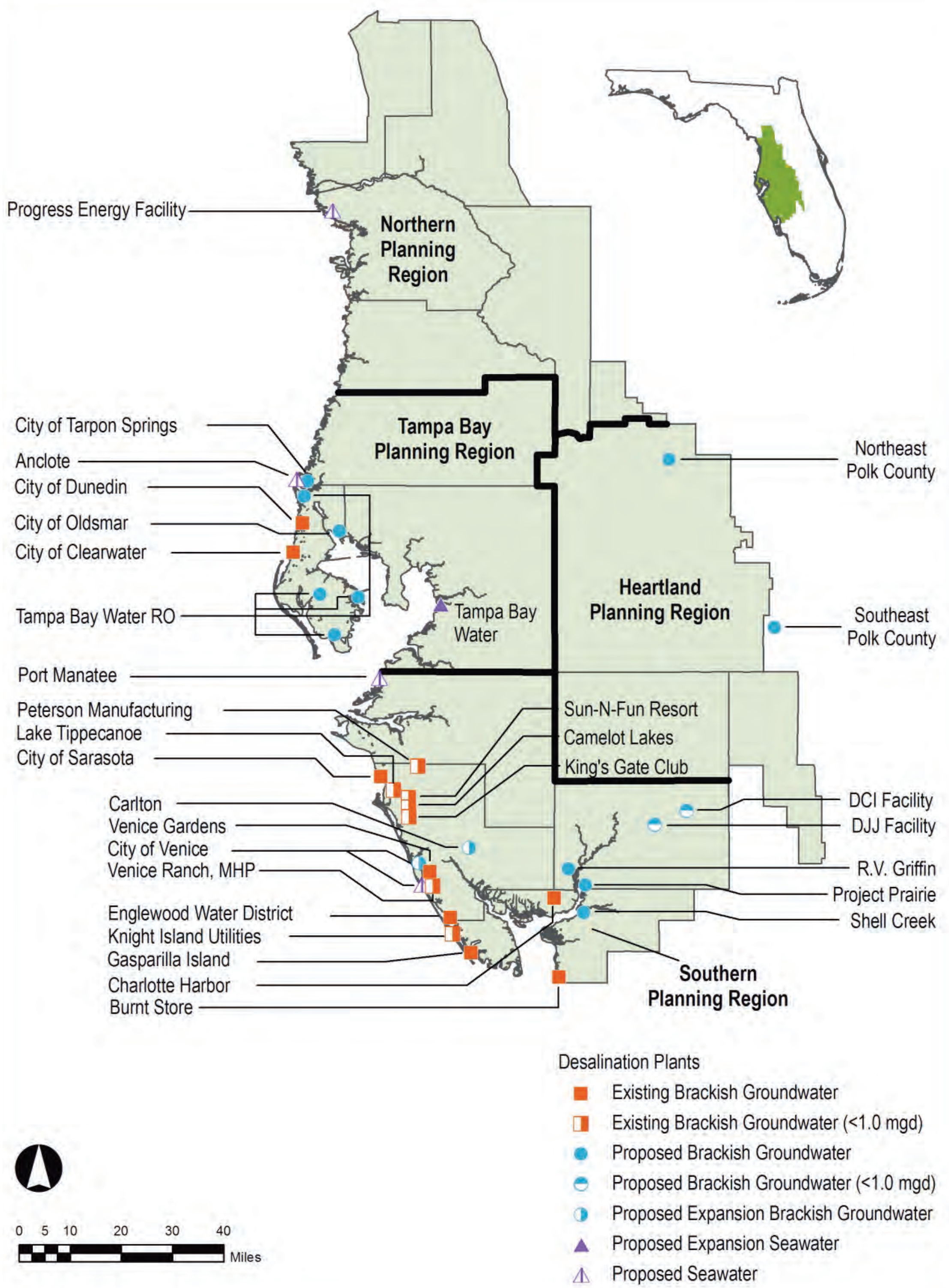


Figure 4-2. *Existing and potential brackish groundwater and seawater desalination facilities*

Table 4-3. *Existing and potential brackish groundwater desalination facilities in the Tampa Bay Planning Region*

Name of Utility	County	Treatment Capacity	Annual Average Permitted Withdrawal	2008 Average Withdrawals	2008 Finished Supply	Available Supply[1]	Source Aquifer	Raw Water Quality TDS (mg/L)	Concentrate Discharge Type[2]
Existing Facilities									
Dunedin	Pinellas	9.5	6.62	4.72	3.30	1.33	UFA	250 - 990	WWTP
City of Clearwater	Pinellas	3.0	6.25	2.96	2.07	2.30	UFA	300-1,100	WWTP
Planned Facilities									
City of Tarpon Springs	Pinellas			n/a		5.0	UFA		
City of Oldsmar	Pinellas			n/a		2.0	UFA		DIW
Total		**12.5**	**12.87**	**7.68**	**5.37**	**10.6**			

[1]Available supply represents the sum of difference between annual average permitted withdrawal and 5-year average withdrawal, multiplied by the efficiency of desalination. Efficiency of 70% was used.
[2]WWTP: waste water treatment plant, DIW: deep injection well.
[3]Withdrawals based on finished water reported to DOH, with treatment efficiency estimated at 70%.

Section 5. Fresh Groundwater


The construction of a groundwater production well.

Fresh groundwater from the Upper Floridan aquifer is the principal source of water supply for all use categories in the planning region. In 2006, approximately 59 percent (307 mgd) of the 522 mgd of water used in the planning region was from groundwater sources. Approximately 62 percent (191 mgd) of the fresh groundwater used was for public supply. Fresh groundwater is also withdrawn from the surficial and intermediate aquifers for water supply but in much smaller quantities. The following is an assessment of the availability of fresh groundwater in the surficial, intermediate and Upper Floridan aquifers in the planning region.

1.0 Surficial Aquifer

Due to the karst geologic setting of the region, the thickness of the surficial aquifer is highly variable, ranging from less than 5 to more than 90 feet. The aquifer is generally low in permeability due to the presence of fine-grained sediments, has limited saturated thickness and is suitable mostly for lawn irrigation and watering livestock. The surficial aquifer in the northern half of Hillsborough County and all of Pasco County provides very little water for water supply and is not anticipated to supply a significant amount in the future. Because the clay-confining layer between the surficial and Upper Floridan aquifers is thin and leaky in this area, groundwater withdrawals from the Upper Floridan aquifer can significantly affect water levels within the surficial aquifer, thereby impacting surface features such as wetlands and lakes. Decades of large-scale groundwater withdrawals from the Upper Floridan aquifer for public supply have lowered surficial aquifer water levels near wellfields. Although there are no permitted withdrawals from the surficial aquifer in Pinellas County, the aquifer is used as a source of supply for irrigation of residential turf and landscaping. A shallow well reimbursement program has been implemented in Pinellas County to encourage homeowners to install wells into the surficial aquifer for lawn irrigation as an alternative to utilizing potable water from their public supply connection. In 2006, the surficial aquifer yielded 0.7 mgd of unpermitted withdrawals in Pinellas County, which was mostly used for landscape irrigation. It is anticipated that an additional irrigation demand of 0.3 mgd can be met through the use of the surficial aquifer in Pinellas County. In Hillsborough County, permitted withdrawals from the surficial aquifer in 2006 were 0.17 mgd. In southern Hillsborough County, it is anticipated that an additional irrigation demand of 0.4 mgd can be met through the use of the surficial aquifer.

2.0 Intermediate Aquifer

The intermediate aquifer in the planning region exists only in central and southern Hillsborough County. Annual average water use from permitted withdrawals in the intermediate aquifer in

2006 was 0.2 mgd in Hillsborough County. There were no permitted withdrawals in Pinellas or Pasco counties. Small unpermitted quantities are also withdrawn from the aquifer for lawn watering or individual household use. The quantity of water for these uses was estimated to be a total of 0.02 mgd in Hillsborough County in 2006.

Due to its limited extent, only about one-third of projected 2030 demand for domestic self-supply, landscape irrigation and recreational water use in Hillsborough County can be met from the aquifer. Projected 2030 demand supplied through withdrawals from the surficial and intermediate aquifers in the planning region is expected to total 5.5 mgd, with 2.1 mgd allocated to recreational use and 3.4 mgd to domestic self-supply and household irrigation use (Table 4-4).

Table 4-4. *Estimated water demand to be met by fresh groundwater from the surficial and intermediate aquifers during the planning period in the Tampa Bay Planning Region*

County	Domestic Self-Supply/Irrigation	Recreation
Hillsborough	3.1[1]	2.1[1]
Pinellas	0.3	0
Pasco	0	0
Total:	**3.4**	**2.1**

[1] Reduced due to limited extent of IAS in this county.

3.0 Upper Floridan Aquifer

To reverse the extensive water resource impacts of large-scale groundwater withdrawals from wellfields in the NTBWUCA, the District and TBW agreed to phased reductions that would scale down production by 68 mgd to an annual average of 90 mgd. As a result of the development of alternative water supply projects and favorable hydrologic conditions, TBW achieved the reduction in withdrawals in 2003. In 2010, the Phase II Recovery Plan will be implemented to monitor the impacts of 90 mgd of withdrawals over a 10-year period. During this period, it will be determined whether an additional reduction in groundwater withdrawals and/or mitigation will be required. Because so much of the planning region is still in recovery, the development of additional groundwater quantities from the Upper Floridan aquifer will be very limited.

3.1 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 11.0 mgd of additional groundwater quantities are available to public supply utilities from the Upper Floridan aquifer.

Section 6. Aquifer Storage and Recovery

A typical aquifer storage and recovery well.

Aquifer storage and recovery (ASR) is the process of storing water in an aquifer when water supplies exceed demand and subsequently withdrawing the water when supplies are low and/or demands are high. The locations of ASR projects in the District are shown in figure 4-3. ASR may be used for potable, reclaimed or partially treated surface water. If water stored in the aquifer is for potable supply, when it is withdrawn from storage it is disinfected, retreated if necessary and pumped into the distribution system. District projects include storage projects that use the same well to inject and withdraw water and aquifer recharge and recovery projects that use one location for injection and another for withdrawal.

ASR offers several significant advantages over conventional water storage methods including the ability to store large volumes of water at relatively low cost with little environmental impact and no evaporative losses. The success of an ASR project is generally measured in terms of recovery efficiency, which is the percentage of the original injected water recovered from the storage zone before water quality or impacts from the recovery phase (withdrawal) become unacceptable. Since brackish aquifers (those aquifers with high TDS) may be used for storage, mixing of the injected water with native water is generally the limiting factor on recovery efficiency.

To date, the majority of ASR projects have been limited to storage and recovery of potable water. However, the Englewood Water District in Sarasota County has one reclaimed water ASR project that is fully operational and numerous others are under development throughout the southern half of the District.

1.0 ASR Hydrologic Considerations

Hydrologic conditions that maximize the recoverability of the injected water include a moderately permeable storage zone that is adequately confined above and below by lower permeability layers and that contains fairly good to moderate water quality. The permeability of the storage zone is important since low permeabilities would limit the quantity of water that could be injected, while a very high permeability would allow the injected water to migrate farther and mix more with native water. The presence of confining layers is necessary to limit or prevent the injected water from migrating upwards (a significant issue where density differences exist between the injected water and native water). Confining layers also serve to keep poorer quality

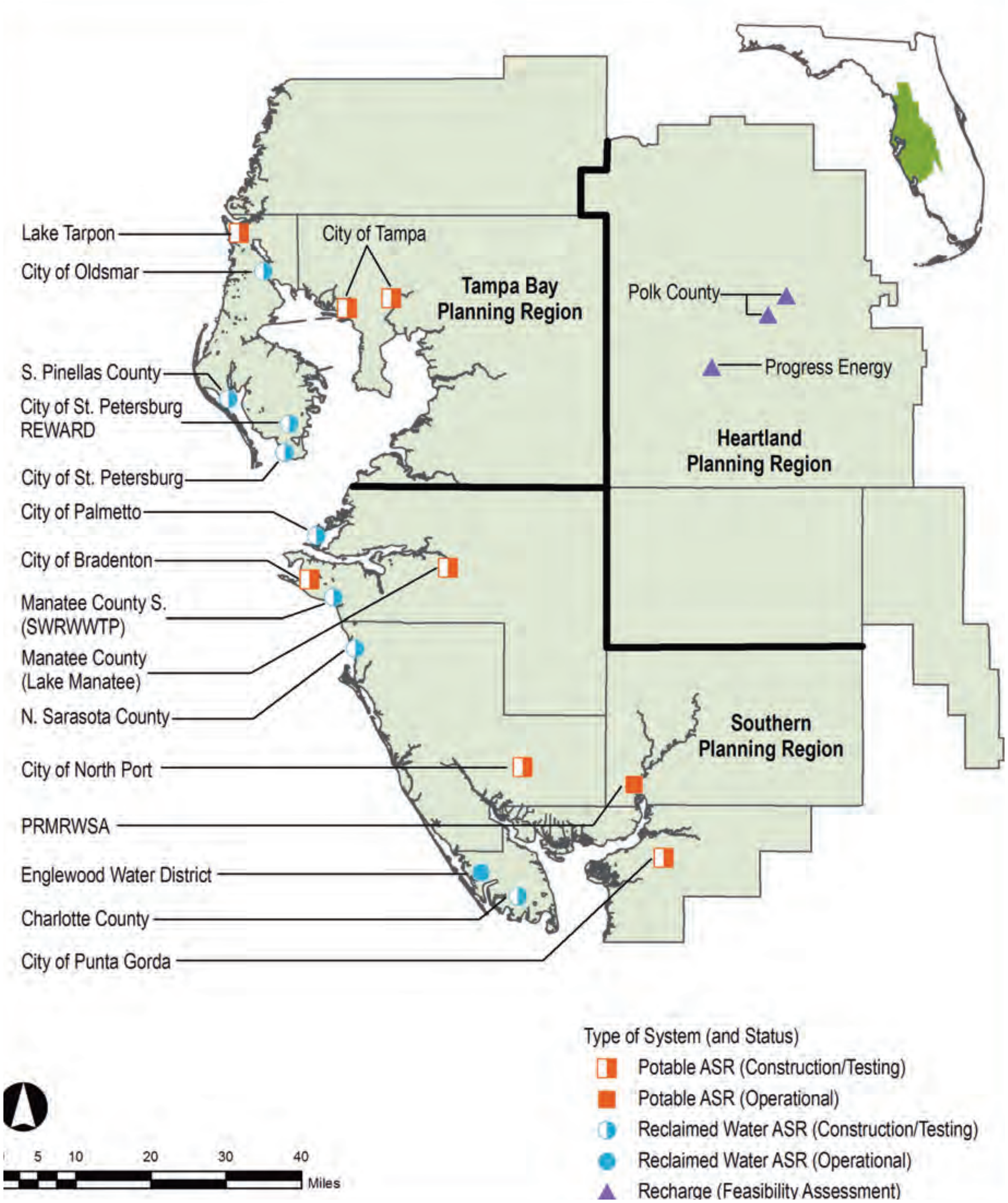


Figure 4-3. *Location of aquifer storage and recovery and aquifer recharge projects in the District that are operational or under development*

water in adjacent zones from being captured during recovery. Poor native water quality in the storage zone will limit the percentage of usable water by degrading the injected water faster as a result of mixing processes. Additionally, the higher density of poor-quality water in the aquifer tends to cause the lower density injected water to migrate upwards and "float" in the upper portions of the storage zone.

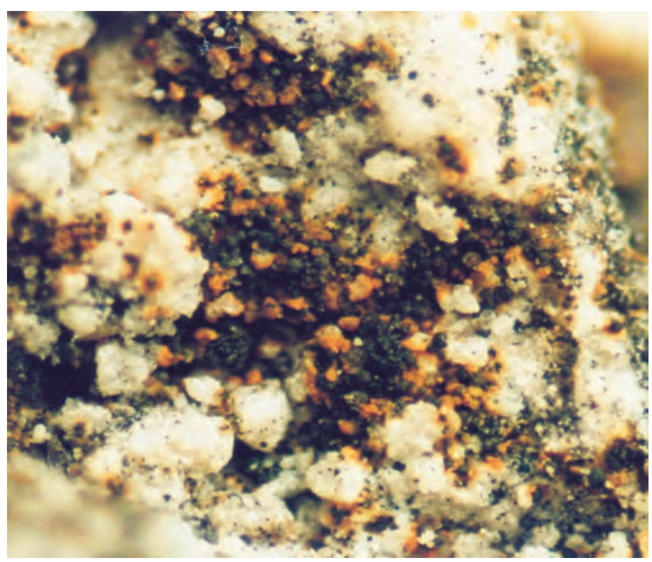
In the District, the recoverable percentage of injected water is typically 70 to nearly 100 percent when the TDS concentration of native groundwater in the ASR storage zone is less than 1,000 mg/L. Recovery can be less when the TDS concentration of native groundwater is higher. It is possible, depending on the hydrologic conditions, for the recoverable volume of water to be greater than the volume originally stored. This generally results when the native water quality is good to fairly good and mixing of the injected water and native water provides additional water of acceptable quality. In some cases, it may be desirable to leave behind a portion of injected water to restore depleted groundwater reserves. This also forms a buffer zone between the stored water and surrounding brackish or poor quality native water to increase recovery percentage and minimize adverse geochemical reactions between waters with different chemistries. Buffer zones are considered an investment of water that improves performance and results in reserves for future recovery during extreme droughts or emergencies.

2.0 ASR Permitting Requirements

Permits to develop ASR systems must be obtained from the District, Florida Department of Environmental Protection (FDEP), Department of Health (DOH) and possibly the Environmental Protection Agency (EPA) if an aquifer exemption is requested. The District is responsible for the quantity and rate of recovery, including potential impacts to existing legal users (e.g., domestic wells), off-site land uses and environmental features. The FDEP is responsible for the injection and storage portion of the project, and the DOH is responsible for the quality of the water delivered to the public.

2.1 ASR and Arsenic

The regulatory requirements associated with ASR have been evolving over the past 20 years in response to new issues discovered during the operation and testing of ASR systems. One issue in particular is the mobilization of naturally occurring arsenic in the aquifer by the interaction of the injected water with the aquifer's limestone matrix. Initially, operational ASR systems appeared capable of eventually meeting the drinking water standard of 50 micrograms/liter (µg/L) as the aquifer was flushed with water during the testing phase. However, in 2006, the standard was lowered to 10 µg/L, and many sites are now having difficulty meeting this standard.



A close-up view of pyrite crystals in limestone of the Upper Floridan aquifer that contain minute quantities of naturally occurring arsenic.

Most ASR projects in the District are located in coastal areas where water in the Upper Floridan aquifer is brackish. In much of this area, the aquifer is not utilized for potable supply and the recovered water from ASR systems is treated to remove arsenic prior to distribution. Therefore, there has been no known exposure to arsenic above the current drinking water standard from water injected into the aquifer as a result of ASR operations. The primary issue regarding the mobilization of arsenic in the aquifer is in FDEP's interpretation of the rules related to underground injection. Currently, all drinking water standards must be met prior to water being injected into the ground, and injection of water and withdrawal of stored water cannot cause water quality in the aquifer to exceed drinking water standards.

Because the introduction of a fluid into a drinking water aquifer that causes a violation of any primary drinking water standard is prohibited, FDEP has initiated a process to allow for the continuation of ASR projects while a solution to the arsenic issue is being developed. According to FDEP rules, an Administrative Order will be issued with a permit or upon permit renewal for those facilities that were permitted or operating under a Letter of Authorization to Use prior to Jan. 26, 2006, and that exceed the current arsenic standard of 10 µg/L but have not exceeded the previous standard of 50 µg/L. A Consent Order will be issued for any facility that has exceeded the 50 µg/L concentration prior to Jan. 26, 2006, or was permitted on or after Jan. 26, 2006, and has exceeded the 10 µg/L standard.

The District has funded several research projects to evaluate and resolve the arsenic issue. The research has shown that the arsenic is being released from pyrite (which naturally occurs in the limestone and dolomite of the Upper Floridan aquifer) due to the chemical differences between the injected water and the native aquifer water (USF 2005). A 2007 study (ASR Systems) noted that arsenic mobilization was not detected at distances greater than 200 feet in the 41 wells evaluated in the study and arsenic concentrations decreased with each successive cycle of use. Monitor wells cooperatively funded by the District at ASR sites owned or operated by the PRMRWSA and the City of Tampa have demonstrated that arsenic mobilization is rarely detected at monitor wells 350 feet away from ASR wells (CH2M Hill, 2007). The District has also co-funded additional monitor wells to further evaluate and constrain arsenic mobilization at the City of Tampa's Rome Avenue Park ASR wellfield. Additional cycle testing will be needed before it can be determined whether the 10 µg/L drinking water standard for arsenic can be achieved.

Studies have also demonstrated that elevated dissolved oxygen concentrations in injection water oxidize more pyrite per cycle, which releases more arsenic into groundwater. Therefore, removing DO from recharge water should ameliorate high arsenic concentrations during ASR cycle testing (CH2M Hill, Inc., 2007). To further evaluate the effects of removing DO from injection water, the District has funded the construction of a degasification system at an ASR site in the City of Bradenton. The system is currently operational and performance testing is under way. The effectiveness of the degasification system will be evaluated in 2010. In addition to this process, the District is working with the FDEP and other WMDs to determine whether the current regulatory framework is appropriate for ASR systems and whether modification of the rules may be necessary.

Section 7. 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.

Landscaping designed to minimize turf areas can significantly reduce the quantity of water used for outdoor irrigation.

- Infrastructure and Operating Cost. The conservation of water allows utilities to defer expensive expansions of the potable water and wastewater systems and limit operation and maintenance 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 total maximum daily load (TMDL) restrictions within their local water bodies.

Since the 1990s, the District has provided financial and technical assistance to water users and suppliers in the planning region for the implementation of local and regional water conservation efforts. 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 of successful 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 structure, 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℠, Water CHAMP℠ and Water PRO℠, 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 (DSS), recreational/aesthetic, and industrial/commercial, mining/dewatering, power generation (I/C,M/D,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 considered to be too costly to recommend 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 agencies and non-variable costs are not included. The total costs per utility, however, will vary based on size of the utility and, therefore, the number of measures implemented.

The District also considered secondary criteria that included potential number of participants, potential acceptability of the measure to participants and the implementing utility, compatibility with existing programs or those that may be implemented concurrently, functional life of the measure, short-term and long-term effectiveness of a measure, level of ease with which a measure can be implemented, and potential for implementation on a regional basis.

After considering the criteria above, 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, Section 6.

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

Industrial/Commercial ,Mining, Power Generation
- Pre-Rinse Spray Valve Rebate
- Ultra Low-Flow Toilet (ULFT)Rebate
- Industrial, Commercial and Institutional (ICI) Facility Assessment

- Water-Efficient Landscape and Irrigation Evaluation (for parcels less than one acre)
- Rain Sensor Device Rebate

Recreational /Aesthetic
- Water-Efficient Landscape and 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 Table 4-5 at the end of this section.

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,M/D,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 Appendix for Chapter 4.

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

The quantity of water that could be saved through 2030 by maximizing water conservation measures for the public supply and domestic self-supply water use categories in the Planning Region is 18.8 mgd.

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 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, 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 18.52 mgd by 2030 if all water conservation programs presented above are implemented (Table 4-5). The average cost-effectiveness for all planned measures is $0.41/1,000 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 conserve 7.0 mgd after 20 years at a cost of $5.6 million. 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 pre-rinse spray valve rebates, with an estimated water savings of 4.26 mgd by 2030 at a total cost of $1.9 million.

1.4.1.a Domestic Self-Supply (DSS)

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 measureable 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 0.27 mgd by 2030 if all water conservation programs are implemented (Table 4-5). The average cost-effectiveness across all planned measures is $0.47/1,000 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 conserve 0.16 mgd after 20 years at a cost of $128,000. 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 0.05 mgd by 2030 at a cost of $161,000.

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

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

Through the development of a sophisticated water recirculation system, the mining industry has greatly reduced the quantity of water consumptively used in the mining and processing of phosphate ore.

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 0.1 mgd by 2030 (Table 4-5). 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 is ICI facility assessments, which is estimated to conserve 0.08 mgd after 20 years at a cost of $120,060. The average cost-effectiveness 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 0.04 mgd by 2030 (Table 4-5). 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 conserve 0.02 mgd after 20 years at a cost of $33,338. 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

Table 4-5 summarizes the potential non-agricultural water conservation savings in the planning region. The table shows that 18.92 mgd could be saved by 2030 at a total projected cost of $32.8 million.

Table 4-5. *Potential non-agricultural water conservation savings in the Tampa Bay Planning Region*

Use Category	Water Conserved in 2030 (mgd)	Cost-Effectiveness ($/1,000 gal.)
Public Supply	18.52	$0.41
Domestic Self-Supply	0.27	$0.47
I/C,M/D,PG	0.10	$0.37
Recreational/Aesthetic	0.04	$0.39
Total	**18.92**	**$0.41**

2.0 Agricultural Water Conservation

The agricultural industry has greatly increased water use efficiency through the widespread implementation of water-saving irrigation technologies.

The District uses the model farms concept to estimate potential water savings through agricultural conservation. The concept is a tool to determine the potential for water savings for scenarios of irrigation system conversions and/or BMPs that are specific to different commodities and water use factors such as soil type, climate, crop type, etc. The District also achieves agricultural water savings through the Facilitating Agricultural Resource Management Systems (FARMS) Program. FARMS is categorized as water resource development. Water savings achieved through the program are assigned to water resource development quantities rather than water conservation.

There are 20 model farms 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 farms options were reviewed and three that represent BMPs for irrigation of citrus, nurseries and tomatoes were selected as being the most applicable in the planning region (HSW 2004). Information on these model farms is contained in Table 4-6a and 4-6b. 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 farms chosen 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 summarized in Table 4-6a and 4-6b for the 5-in-10 and 1-in-10 conditions respectively. The data in these tables represents the maximum potential savings if all growers were to install the most efficient irrigation systems and implement appropriate BMPs for their respective commodities.

Table 4-6a. *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	Microjet	No, other BMPs only	1.67	1.41	1.32	1.24	1.16	1.06	100 percent implementation, maximum improvement
3	Tomatoes	Semi-closed seepage	Drip and other BMPs	0.56	0.65	0.72	0.78	0.85	0.94	100 percent implementation, maximum improvement
8	Nurseries, container	Sprinkler	Line source emitter and other BMPs	2.68	2.79	2.97	3.15	3.34	3.55	100 percent implementation, maximum improvement

Model farm potential savings adjusted to be consistent with demand projections. Model Farm 1 (Citrus–flatwoods): existing microjet system is sufficient and no system conversion required, implement other BMPs only to achieve water savings. Model Farm 3 (Tomatoes): assumes drip system added to semi-closed seep, implement other BMPs only to achieve savings. Model Farm 8 (Nurseries, container): replacement of sprinkler system with line source emitter system assumed, implement other BMPs only to achieve savings. Data in table is max potential savings if all growers install the most efficient irrigation systems and implement BMPs. 100% grower participation assumed Source: SWFWMD (2008a), Hazen and Sawyer (2009).

Table 4-6b. *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	Microjet	No, other BMPs only	0.95	0.80	0.75	0.71	0.67	0.61	100 percent implementation, maximum improvement
3	Tomatoes	Semi-closed seepage	Drip and other BMPs	0.73	0.85	0.94	1.03	1.11	1.24	100 percent implementation, maximum improvement
8	Nurseries, container	Sprinkler	Line source emitter and other BMPs	0.41	0.42	0.45	0.47	0.50	0.53	100 percent implementation, maximum improvement

Model farm potential water savings adjusted to be consistent with demand projections. Model Farm 1 (Citrus–flatwoods): existing microjet irrigation system is sufficient and no irrigation system conversion required, implement other BMPs only to achieve water savings. Model Farm 3 (Tomatoes): replacing semi-closed seep system with fully enclosed seep assumed, implement other BMPs only to achieve savings. Model Farm 8 (Nurseries, container): replace sprinkler system with lines source emitter system assumed, implement other BMPs only to achieve savings. Data in table is max potential savings if all growers install the most efficient irrigation systems and implement BMPs and 100% grower participation assumed. Source: SWFWMD (2008a), Hazen and Sawyer (2009).

2.1 Potential Agricultural Water Conservation Savings

Table 4-7 summarizes savings by commodity for the 5-in-10 drought condition. Citrus, nurseries and strawberries are discussed individually and the remaining commodities are summarized together.

Table 4-7. *Summary of potential agricultural water conservation savings by commodity (5-in-10) for the Tampa Bay Planning Region through 2030*

Commodity	Total Estimated Savings (mgd)[1]	Total Cost ($/acre)[2]
Citrus	0.61	$105
Nurseries, container	0.53	$347
Strawberries	1.17	$172
Remaining	4.03	$100
Total	**6.34**	

[1]Based on 100 percent grower participation.
[2]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. Cost includes capital plus operation and maintenance cost, per planted acre for the first year of irrigation conversion.

Section 8. Summary of Potentially Available Water Supply

Table 4-8 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 is 237.5 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 126.9 mgd. As shown in Table 4-7, up to 237.5 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 4-8. *Potential additional water availability (mgd) in the Tampa Bay Planning Region (2010–2030)*

County	Surface Water		Reclaimed Water	Desalination		Fresh Groundwater		Water Conservation		Total
	Permitted Unused	Available Unpermitted	Offsets	Seawater	Brackish Groundwater	Surficial and Intermediate	Upper Floridan[1] Unused/Permitted	Non-Agricultural	Agricultural	
Pasco			11.3	25.0			1.6	2.0	0.95	40.8
Pinellas			19.8		10.6	0.3	4.4	7.7	0.1	42.9
Hillsborough	55.7	18.7	44.7	10.0		5.2	5.0	9.2	5.3	153.8
Total	**55.7**	**18.7**	**75.8**	**35.0**	**10.6**	**5.5**	**11.0**	18.9	**6.3**	**237.5**

[1]Groundwater that is permitted but unused for public supply. Estimated 2009 use based on a linear trend for the period 2000–2008. Permitted quantities were current as of October 2009.

Water flowing from the City of Tampa's dam during a higher-flow period.

The water supply development component of the RWSP requires the District to identify water supply options from which water users in the planning region 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, the sources of water that are potentially available to meet projected water 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.

Options to achieve outdoor water conservation could save large quantities of water in the planning region.

Statutory guidance on how water supply entities are to incorporate water supply development options in the District's 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

Preliminary technical and financial feasibility analyses were conducted for the options included in this chapter. The analyses provide reasonable estimates of the quantity of water that could be developed and associated costs of development. Cost information for the options was referenced to the appropriate document or a cost index was applied to update the value from the 2006 RWSP. In the following sections, a description of several representative options for each source is included that more fully develops the concepts and refines estimates of development costs. This is followed by a table that includes the remaining options for each source.

Some of the options included in the 2006 RWSP that continue to be viable are presented in this chapter and updated accordingly. Where applicable, water supply options developed through the work of additional regional planning efforts, such as Tampa Bay Water's (TBW) Long-Term Water Supply Plan, are incorporated into this chapter. These options are not necessarily the District's preferred options but are provided as reasonable concepts that water users in the region may pursue in their water supply planning. A number of the options are of such a scale that they would likely be implemented by either a regional water supply authority or a group of users. Other options such as those involving reclaimed water and conservation would 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.

Section 1. Surface Water/Stormwater

A schematic of the Hillsborough River and the Tampa Bypass Canal showing the City of Tampa's and Tampa Bay Water's withdrawal points.

The Hillsborough River — Tampa Bypass Canal system has been an important source of water supply for the City of Tampa. Over the past several years, TBW has also begun to utilize this system to help meet regional water demands. In 2007, the completion of the studies necessary to determine minimum flows showed that additional water was available from the system, especially at higher flows. Since 2003, TBW has utilized the Alafia River as a potable water supply source. Based on the evaluation of the Alafia River's flows, additional water supply could be developed from the river during high-flow periods. As shown in Chapter 4 Table 4-7, approximately 74.4 mgd of surface water could be available for water supply if the remaining permitted and unpermitted quantities are developed from Hillsborough County. Table 5-1 is a list of surface water/stormwater options that could be developed in the planning region. The Little Manatee River, based upon the current withdrawal schedule from Florida Power and Light's water use permit, has very little additional water available and therefore is not included in Table 5-1.

1.0 Surface Water/Stormwater Options

<u>Surface Water/Stormwater Option #1 – Surface Water and Aquifer Recharge Project</u>

- Entity Responsible for Implementation: Tampa Bay Water

This project includes options to expand TBW's enhanced surface water system using the Alafia River and Bullfrog Creek as two potential surface water sources. The Alafia expansion component of this project would include increasing the existing Alafia river pump station capacity to withdraw additional mid- to high-range flows from the river. A new withdrawal facility and pumping station on Bullfrog Creek to capture mid- to high-range flows would also be required.

Additional surface water treatment capacity could be needed to treat the raw surface water that would be brought into the regional system. This raw water could be treated at a new surface water treatment facility in Hillsborough County or at the expanded City of Tampa water treatment facility. Raw and finished water pipelines would be required to take the water to the treatment plant and to transmit the water to an appropriate location in TBW's regional transmission system. Additional storage in a potential second regional reservoir or expanded reservoir could also be included in the project.

The use of reclaimed water to mitigate additional withdrawal quantities in the future, either through aquifer recharge or downstream augmentation of the Alafia River, is included in the project. The recharge components of the project could include potential direct aquifer recharge using injection wells in southern Hillsborough County or indirect aquifer recharge using a rapid infiltration basin in south-central Pasco County. Pipelines would be required to transport the reclaimed water to the recharge or augmentation location. The additional withdrawal quantities could be achieved through the use of existing TBW facilities or expanded infrastructure in proximity to existing TBW facilities.

The planning and preliminary engineering phase of study for this project has been approved for co-funding by the District's Governing Board and Tampa Bay area Basin Boards. The study will be shared with Polk County as per an approved Memorandum of Understanding between Polk County and TBW, and opportunities will be explored to determine whether an economy of scale is achievable that may benefit both entities as they consider future alternative water supply options.

Quantity Available (mgd)	Capital Cost	Cost/mgd	Cost/1,000 Gallons	Annual O&M/1,000 gal
10-30	TBD	TBD	TBD	TBD

Issues:
- Fluoride treatment requirements or blending options may affect the overall cost, reliability and quantity of additional surface water supply from the Alafia River.
- Understanding and designing to the quantity of water available from Bullfrog Creek to be consistent with a future minimum flow for the creek will be important.
- Downstream augmentation may require high-level treatment to meet nutrient standards. Aquifer recharge locations will need to be fully evaluated to ensure that aquifer improvements can be achieved while allowing beneficial potable water offset supply.

2.0 System Interconnect/Improvement Options

TBW is developing a number of system interconnect/improvement projects that are critical components of their regional system. The projects involve the construction of pipelines and booster pumping stations. Development of these projects will facilitate the regionalization of potable water supplies by providing transmission of water from areas of supply to areas of demand. The projects will also increase the rotational and reserve capabilities and provide redundancy of water supplies during emergency conditions. Because these projects are under development, they are detailed in Chapter 6.

Table 5-1. *List of surface water/stormwater options for the Tampa Bay Planning Region*

Option Water Body and Entity Responsible for Implementation	User Group	Avg Annual Yield (mgd)	Intake Capacity (mgd)	Capital Cost ($1,000/mgd)	Unit Cost ($1,000/ gal)	Annual O&M ($1,000)	Storage Method/Level of Treatment	Distribution Method
Pasco County								
Anclote River Tampa Bay Water	Ag., Rec	2.5	10	14,923	4.60	1,077	ASR / 2	Supplement existing reuse system
Zephyr Creek City of Zephyrhills	Rec	0.2	2	22,749	6.21	73	Stormwater detention and ASR/2	Piped to reuse line for golf course irrigation
Pinellas County								
Lake Seminole Pinellas County Utilities	Urban reuse	1	9	5,291	1.94	267	Off-stream, ASR/1	Distributed to reuse system
Lake Tarpon Pinellas County Utilities	Urban reuse	3.7	37	13,145	4.63	2,181	ASR/2	Distributed to reuse system, or salinity barrier, or potable use
Hillsborough County								
S. Prong of Alafia River TBD	PS	5.8	5.8	26,793	5.90	Included in Unit Cost	Reservoir	Piped to adjacent treatment plant(s) for public supply/regional system
N. Prong of Alafia River TBD	PS	5.2	5.2	26,807	5.81	Included in Unit Cost	Reservoir	Piped to adjacent treatment plant(s) for public supply/regional system
Alafia River (Confluence of the North and South prongs) TBD	PS	13.2	13.2	27,098	5.81	Included in Unit Cost	Reservoir	Piped to adjacent treatment plant(s) for public supply, possibly in collaboration with Tampa Bay Water
Channel A Hillsborough County Water Resource Services	Urban reuse	1	9	18,942	6.18	670	Off-stream reservoir, ASR/3	Piped to Hillsborough County's reuse system

Section 2. Reclaimed Water

Reclaimed water storage tanks are part of a number of proposed options that will increase utilization of reclaimed water in the planning region.

The diversity and abundance of urban, industrial and agricultural land uses in the planning region provide opportunities to use large quantities of reclaimed water in numerous, beneficial ways. Large wetland areas and abandoned mining operations in eastern Hillsborough County provide unique opportunities to beneficially utilize reclaimed water through restoration of natural systems and storage of wet-weather flows for dry season use. Brackish aquifers in coastal Hillsborough and Pinellas counties may also be ideal for seasonal storage of reclaimed water. The reclaimed water systems in the region are generally mature and, as such, the representative project options are dominated by interconnections, efficiency studies and seasonal storage project concepts.

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
- **Aquifer Storage and Recovery:** injection of reclaimed water into an aquifer during times of excess supply and the recovery of that same water for use during high demand
- **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 others) 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:** traditional reclaimed water storage in ground storage tanks and ponds
- **Streamflow Augmentation:** introduction of reclaimed water downstream of water withdrawal points 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 mains to serve more customers

The District developed 46 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 utilize was based on an analysis of wastewater flows anticipated to be available in 2030 at a utilization rate of 75 percent (Chapter 4 Appendix, Table 4-1). 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 utilize the same reclaimed water source. An expanded description is provided for 4 of the 46 options that are representative of the types of reclaimed water 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 5-2.

Flow and capital cost data for the 95 reclaimed water projects originally identified as being under development (post-2005) in 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 $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, operation and maintenance (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 – Plant City to Zephyrhills Interconnect

- Entity Responsible for Implementation: City of Zephyrhills Utilities

This option would provide 2.0 mgd of reclaimed water from Plant City's advanced wastewater treatment facility to restore/create a wetland and offset 0.5 mgd of future withdrawals for agricultural, commercial, residential and recreational customers. The option would include design and construction of 48,000 feet of 12-inch transmission main, an automated pump station, a 2-million gallon storage tank, and a man-made wetland. The City of Plant City's reclaimed water system would be interconnected with the City of Zephyrhills reuse system. Customers in and around the City of Zephyrhills would be served by the system. The implementation time frame is expected to be 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 (1.5[1])	$6,460,000	$4,306,666	$0.85	$0.40

[1]Beneficial offset

Issues:
- Use of the reclaimed water by other options could affect the viability of the project.
- Availability of suitable land for wetland restoration/creation could prove difficult in this rapidly developing area.
- The use of reclaimed water may be constrained by total maximum daily load (TMDL) issues; however, they are anticipated to be less severe than surface water discharge.
- Additional treatment may be required.

Table 5-2. *List of reclaimed water options for the Tampa Bay Planning Region*

Option Name and Entity Responsible for Implementation	County	Type	Supply	Offset	Capital Cost	Cost/Ben	O&M/Offset
S. Hills. Intercon. and McKay Bay Restoration, Hills Co. and the District	Hills	Intercon., NSR	7.10	7.10	TBD	TBD	$0.30
Reuse Expan Country Meadows WWTP 2011–2030, CW Utilities	Hills.	Sys. Expan.	0.04	0.03	$230,680	$1.56	$0.40
Reuse Expan Pebble Creek WWTP 2011–2030, Pebble Cr. Util.	Hills.	Sys. Expan.	0.10	0.07	$576,700	$1.56	$0.40
Reuse NSR Rice Creek 2011–2030, Rice Cr. Util.	Hills.	Rehyd./Wetland/NSR	0.10	0.10	$576,700	$1.14	$0.30
Reuse Expan Windemere 2011–2030, Scarecrow Util.	Hills.	Sys. Expan	0.10	0.07	$576,700	$1.56	$0.40
N.W. Hills. Reuse Expansion, Hills. Co.	Hills.	Sys. Expan	6.00	4.50	$34,602,000	$1.56	$0.30
S. Hills. Recharge/Saltwater Intru. Bar., TBW and Member Governments	Hills.	Rech., SWB	20.00	TBD	TBD	TBD	TBD
Horizontal Well Reclaimed Sys. Aug., Hills. Co.	Hills.	Aug.	2.00	1.50	$11,534,000	$1.56	$0.40
N.W Hills./Temple Terrace Intercon., Temple Terrace	Hills.	Intercon.	2.00	1.50	$11,534,000	$1.56	$0.40
C. Hills/Plant City Intercon., Plant City	Hills.	Intercon.	1.50	1.13	$8,650,000	$1.56	$0.40
Plant City Wetland, Plant City	Hills.	Rehyd./Wetland/NSR	1.50	1.50	$8,650,500	$1.14	$0.30
Downstream Augmentation of Alafia River, TBW	Hills.	Streamflow	20.00	14.00	$75,000,000	$1.06	$0.30
Mosaic Reclaimed Exchange, TBW	Hills.	Exchange	1.00	1.00	$5,767,000	$1.14	$0.30
Reuse Expan in Hills. Co.-S. Co. Sys. 2011–2030, Hills. Co.	Hills.	Sys. Expan.	18.00	13.66	103,806,000	$1.56	$0.40
Plant City to Zephyrhills Interconnect, Zephyrhills	Hills/Pasco	Intercon.	2.00	1.50	$6,460,000	$0.85	$0.40
Reuse Expan in Plant City WWTP 2011–2030, Plant City	Hills.	Sys. Expan.	3.00	2.25	$17,301,000	$1.56	$0.40
Two Rivers Ranch Reuse 2011–2030, Plant City	Hills.	Sys. Expan.	1.00	0.75	$1,000,000	$0.26	$0.40
Reuse Expan in Plant City 2020, Plant City	Hills.	Sys. Expan.	1.80	1.35	$4,500,000	$0.66	$0.40
Reuse Expan in Plant City 2030, Plant City	Hills.	Sys. Expan.	1.80	1.35	$4,500,000	$0.66	$0.40
Reuse Expan in Tampa/Current WWTP North 2016–2030, Tampa	Hills.	Sys. Expan.	11.70	7.90	$174,000,000	$4.34	$0.45
Reuse Expan in Tampa/Current WWTP TECO Bayside 2011–2030, Tampa	Hills.	Sys. Expan.	2.10	2.10	$9,000,000	$0.84	$0.30
Reuse Expan in Tampa/Current WWTP South Res Expan. 2011–2030, Tampa	Hills.	Sys. Expan.	3.00	1.80	$52,000,000	$5.69	$0.50

Southwest Florida Water Management District

Table 5-2. *List of reclaimed water options for the Tampa Bay Planning Region (continued)*

Option Name and Entity Responsible for Implementation	County	Type	Supply	Offset	Capital Cost	Cost/Ben	O&M/Offset
Pasco Co. Reuse Efficiency Study, Pasco Co.	Pasco	Efficiency	TBD	TBD	$50,000	TBD	TBD
Reuse Expan in Dade City WWTP 2011–2030, Dade City	Pasco	Sys. Expan	1.00	0.75	$5,767,000	$1.56	$0.40
Reuse Expan in Forest Lakes Estates WWTP 2011–2030, Labrador Util.	Pasco	Sys. Expan	0.25	0.19	$1,441,750	$1.56	$0.40
Reuse Expan in Seven Springs (Aloha) WWTP 2011–2030, Aloha Util.	Pasco	Sys. Expan	0.50	0.38	$2,883,500	$1.56	$0.40
Reuse Expan in Jasmine Lakes WWTP 2011–2030, Jasmine Lakes Util.	Pasco	Sys. Expan	0.15	0.11	$865,050	$1.56	$0.40
Reuse Expan in Zephyrhills WWTP 2011–2030, City of Zephyrhills	Pasco	Sys. Expan	2.00	1.50	$11,534,000	$1.56	$0.40
Reuse Expan in Pasco/NPR System 2011–2030, Pasco Co. and City of New Port Richey	Pasco	Sys. Expan./Rehyd./Wetland	8.00	6.00	$46,136,000	$1.56	$0.40
Reuse Expan in Palm Terrace Gardens 2011–2030, Florida Water Services	Pasco	Sys. Expan.	0.09	0.07	$519,030	$1.56	$0.40
St. Leo U. Storage & Pumping 2013–2016, Pasco Co. and St. Leo U.	Pasco	Sys Expan. Storage/Pump	0.04	0.03	$900,000	$5.91	$0.40
Pinellas County Efficiency Study, Pinellas Co.	Pinellas	Efficiency	TBD	TBD	50,000	TBD	TBD
Reuse Expan in Clearwater 2011–2030, City of Clearwater	Pinellas	Sys. Expan.	5.00	3.75	$28,835,000	$1.56	$0.40
Reuse Recharge in Clearwater 2011–2030, City of Clearwater	Pinellas	Rech.	5.00	5.00	$28,835,000	$1.14	$0.30
Reuse Expan in Dunedin 2011–2030, City of Dunedin	Pinellas	Rehyd./Wetland/NSR	0.75	0.75	$4,325,250	$1.14	$0.30
Reuse Expan in Largo 2011–2030, City of Largo	Pinellas	Sys. Expan.	4.00	3.00	$23,068,000	$1.56	$0.30
Reuse Expan in Mid-County WWTP 2011–2030, Mid-County Service, Inc.	Pinellas	Sys. Expan.	0.50	0.38	$2,883,500	$1.56	$0.40
Reuse Expan in Pinellas Co. North System 2011–2030, Pinellas Co. (supplies from other systems)	Pinellas	Sys. Expan.	0.50	0.38	$2,883,500	$1.56	$0.40
Reuse Expan in Pinellas Co. South System 2011–2030, Pinellas Co.	Pinellas	Sys. Expan.	2.00	1.50	$11,534,000	$1.56	$0.40
Reuse Expan in St. Petersburg System 2011–2030, City of St. Petersburg	Pinellas	Sys. Expan.	2.50	1.88	$14,417,500	$1.56	$0.40
Reuse Expan in Puryear Park Res. 2011–2030, City of St. Petersburg	Pinellas	Sys. Expan.	0.20	0.10	$1,900,000	$3.74	$0.60

Table 5-2. *List of reclaimed water options for the Tampa Bay Planning Region (continued)*

Option Name and Entity Responsible for Implementation	County	Type	Supply	Offset	Capital Cost	Cost/Ben	O&M/Offset
Reuse Expan in Winston Park Res. 2011–2030, City of St. Petersburg	Pinellas	Sys. Expan.	0.14	0.07	$1,400,000	$3.94	*$0.60*
Reuse Expan in Park St. Res. 2011–2030, City of St. Petersburg	Pinellas	Sys. Expan.	0.07	0.04	$400,000	$1.97	*$0.60*
Reuse Expan in Sunrise Res. 2011–2030, City of St. Petersburg	Pinellas	Sys. Expan.	0.03	0.02	$200,000	$1.97	*$0.60*
Reuse Expan in Progress Energy 2011–2030, City of St. Petersburg	Pinellas	Sys. Expan., Ind Treatment	0.43	0.30	$2,000,000	$1.31	*$0.43*
Reuse Expan in Tarpon Springs System 2011–2030, City of Tarpon Springs	Pinellas	Sys. Expan	*0.50*	*0.38*	*$2,883,500*	*$1.56*	*$0.40*
Totals: 46 Options			***139.49***	***91.74***	***$725,976,860***		

The use of Italics denotes SWFWMD estimations.
Not all projects have estimated costs. Some options are contingent upon others. WWTPs with no available (unused) 2030 flows were not included.
MGD Offset = (if estimated) 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.
ASR & Intrusion Barrier Costs = (if estimated) Annualized Supply x 4 x $1,000,000 + $300,000.
Total Cost = (if estimated) = Annualized Supply x $5.77/Gallon (calc. of 96 Draft under development 2005–2015 District funded projects (@ $431.4 million for 74.8 mgd reuse supply).
Preliminary Cost Per 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 percent (rounded down) minus 2015 Reuse (existing and planned reuse projects).
Preliminary O&M cost estimates were calculated using a median O&M cost if no specific data was available (SWFWMD, 2005b).
Preliminary O&M costs per 1,000 gallons "offset" were calculated utilizing costs per 1,000 gallons "supplied" data normalized for individual project efficiency.

Reclaimed Water Option #2 – Pinellas County Reuse Efficiency Study

- Entities Responsible for Implementation: Pinellas County Utilities and City of St. Petersburg

An efficiency study of large reuse systems in Pinellas County is needed to determine ways to maximize the efficient usage of reclaimed water and increase the benefit of offsetting the use of potable water for nonpotable needs. When many of the existing reclaimed water projects were developed in Pinellas County, the primary focus was maximizing effluent disposal. Potable-water offsets were considered to be ancillary benefits. In order to encourage connection to the reclaimed water systems, incentives were offered such as free use of the water, a nominal flat monthly charge and limited or no restrictions on irrigation frequency. These incentives can promote overuse of the reclaimed water supply. It has been demonstrated that irrigation use can more than double when customers switch from using public potable water supplies to reclaimed water. Because of these inefficiencies, some utilities are limited in their ability to serve irrigation demands with reclaimed water. By promoting and implementing methods for more efficient use of reclaimed water, utilities could potentially serve more customers and increase the potable-water offset.

This option is for an evaluation of existing reclaimed water systems owned by Pinellas County and the City of St. Petersburg, including the review of operations and policies. Measures will be proposed that will maximize efficiency to make more reclaimed water available for additional users. Efficiency measures that may be examined include water conservation rate structures, metering of reclaimed water usage, water use restrictions, telemetry to control reclaimed water availability and education programs. Estimates will be made on the quantity of reclaimed water that would be available for increased reuse if the efficiency measures were implemented. The project time frame is between 2011 and 2030. Approximately 65.5 mgd of wastewater is projected to be produced at treatment facilities owned by Pinellas County and St. Petersburg by 2030. Based on existing, planned and potential projects, approximately 83 percent, or 54 mgd, can be utilized for reuse by 2030. Using current reuse practices, an efficiency rate (offset of potable-quality water) of only 65 percent, or 35 mgd, would be achieved. By implementing efficiency measures, the efficiency could potentially be increased to 75 percent, which would result in an additional 5 mgd in offsets for the same use rate.

Quantity Produced (mgd)	Capital Cost	Cost/mgd Offset	Cost/1,000 Gallons Offset	O&M/1,000 Gallons Offset
N/A	$100,000	$N/A	$N/A	$N/A

Issues:

- In the short term, increased efficiency could lead to temporary increases in reclaimed water disposal. This temporary situation could result from the need to develop infrastructure required to bring the new customers online. Disposal may occur during the planning, design and construction phases.
- New supply will not necessarily attract new customers if the benefit is not cost-effective for them.

Reclaimed Water Option #3 – South Hillsborough County Interconnect to McKay Bay Reclaimed Water Project

- Entities Responsible for Implementation: Hillsborough County Utilities and the District

This option would be an expansion of an ongoing regional reuse project that involves the restoration of the McKay Bay and Palm River estuary. This project would be in addition to, or to replace up to, 7.1 million gallons of reclaimed water that the City of Tampa has agreed to provide to the District for a restoration project. Total project cost will be determined during the feasibility and conceptual design phase. The implementation time frame is expected to be between 2013 and 2030.

Quantity Produced (mgd)	Capital Cost	Cost/mgd Offset	Cost/1,000 Gallons Offset	O&M/1,000 Gallons Offset
7.10 (7.10[1])	$TBD	$TBD	$TBD	$0.30

[1]Beneficial offset

Issues:

- Use of reclaimed water by other project options could affect the viability of the project.
- The project would necessitate the development of a master agreement to coordinate funding, ownership and O&M.
- The use of Hillsborough County reclaimed water (currently discharged below S-160 structure) for the project may face TMDL issues; however, they are anticipated to be less severe than the utilization of the City of Tampa reclaimed water due to existing discharge locations.
- Additional treatment may be required.

Reclaimed Water Option #4 – South Hillsborough County Recharge/Saltwater Intrusion Barrier

- Entities Responsible for Implementation: Tampa Bay Water and member governments

This option would provide up to 20 mgd of groundwater recharge to create a saltwater intrusion barrier along the eastern shore of Tampa Bay in Hillsborough County. The barrier would enable the permitting of additional quantities of fresh groundwater from the Upper Floridan aquifer in the SWUCA. Reclaimed water from the City of Tampa and possibly from Hillsborough County would be injected into the Upper Floridan aquifer during the wet season when demand for reclaimed water is relatively low. The District previously investigated the recharge concept to explore opportunities for additional potable groundwater withdrawals in the SWUCA through direct or indirect recharge of reclaimed water into the Upper Floridan aquifer in southern Hillsborough County and/or western Polk County. Option phases could include: (1) construction of initial recharge wells in the Big Bend, Alafia River or other areas, (2) interconnection of pipelines and (3) construction of conveyance facilities from reclaimed water sources. The project costs would be estimated during the initial project design. The option is one element of a larger recharge concept that also includes indirect recharge via rapid infiltration basins (RIBs) in other counties. 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
20 (TBD[1])	$TBD	$TBD	$TBD	$TBD

[1]Beneficial offset

Issues:

- Use of the reclaimed water by other project options could affect the viability of the project.
- The permittability of aquifer recharge with reclaimed water is a major factor in determining whether the project is implemented.
- Permitting may be an issue due to the proximity of other withdrawals in the area.

- The issue of arsenic levels of arsenic created in the vicinity of recharge wells must be considered.
- Ownership and operational issues will be a critical component of the option.
- Feasibility currently being evaluated as part of an existing funded study.

Section 3. Brackish Groundwater Desalination

Brackish groundwater is considered to be a viable source of water supply that can be obtained from the Upper Floridan aquifer in certain areas in the planning region. Requests for brackish groundwater withdrawals will be evaluated similarly to requests for fresh groundwater withdrawals because all withdrawals, regardless of quality, cannot impact or delay the recovery of a stressed MFL water resource. The identification of brackish groundwater desalination options was based on a review of currently planned or proposed projects and an assessment of potential brackish groundwater resources in the region.

Reverse osmosis membranes in a brackish groundwater treatment facility.

Brackish Groundwater Option #1 – Small Footprint Reverse Osmosis (5 mgd) Pinellas County

- Entity Responsible for Implementation: Tampa Bay Water

In the 2006 RWSP, a Pinellas County brackish groundwater supply option was identified in the planning region. Through TBW's planning process, two other brackish groundwater supply options located in Pasco and Pinellas counties have been added to their Long-Term Water Supply Plan. These projects are not currently part of TBW's Master Plan and may not be reevaluated for many years. These options are listed in the following table.

Project[1]	Quantity Available (mgd)	Capital Cost	Cost/mgd	Cost/1,000 Gallons	Annual O&M/ 1,000 gallons
Mid Pinellas Brackish Groundwater Desalination	5	$115,510,000	$23,102,000	$7.16	$2.70
Small Footprint RO (5 mgd) Pasco Co.	5	$80,330,000	$16,066,000	$5.51	$2.41
Small Footprint RO Pinellas Co. Configuration 1 (groundwater)	5	$134,650,000	$26,930,000	$7.91	$2.72
Small Footprint RO Pinellas Co. Configuration 2 (bay water)	5	$143,000,000	$28,698,000	$8.20	$2.67

[1] All project components and costs are based on estimates from the Tampa Bay Water Long-Term Water Supply Plan (Black and Veatch, 2008).

TBW's Long-Term Water Supply Plan preliminarily evaluated two configurations of the Small Footprint RO in Pinellas County that would utilize different sources of brackish water. Configuration 1 would use groundwater from the Upper Floridan aquifer and Configuration 2 would use surface water from the bay. Both configurations were evaluated while holding constant piping, treatment, storage, easement and permitting costs. Configuration 1 involves the development of a wellfield that would supply brackish groundwater to an RO treatment facility. The waste concentrate would be disposed of in a deep-injection well. Configuration 2 involves the construction of intakes to withdraw water from the bay for treatment in an RO facility. The waste concentrate would also be disposed of in deep-injection wells. Project components and costs for both configurations are based on estimates from the appendices of TBW's Long-Term Water Supply Plan (Black & Veatch, 2008).

Issues:

- Long-term energy costs need further investigation due to salinity fluctuations in both the bay water and brackish groundwater configurations.
- Construction would be challenging because some of the proposed well sites are located in residential areas.

Section 4. Seawater Desalination

A view of reverse osmosis membranes in the Tampa Bay Water Seawater Desalination facility.

Desalinated seawater continues to be an expensive alternative water source due to the level of complexity of the equipment and high levels of energy required to produce potable water. The disposal of concentrate from the desalination process is a significant issue, complicated by the fact that much of the near-shore area in southwest Florida has been designated as either Outstanding Florida Waters (OFW) or aquatic preserves. Therefore, development of seawater desalination options focused on co-locating desalination facility sites with an existing industrial facility where a permitted discharge to the Gulf of Mexico or Tampa Bay might be possible. Sites that met these criteria in the planning region included TBW's existing desalination facility on Tampa Bay in Hillsborough County and Progress Energy's Anclote Power Plant on the Gulf of Mexico in southern Pasco County.

Seawater Desalination Option #1 – Tampa Bay Seawater Desalination Plant Expansion (Big Bend)

- Entity Responsible for Implementation: Tampa Bay Water

The remediation of TBW's seawater desalination plant was completed in December 2007. Once the plant demonstrates a history of successful operation within the original design parameters, an option to expand the capacity of the facility by 10 mgd will be considered. The facility, which is co-located with Tampa Electric's Big Bend Power Plant, was designed and constructed to facilitate the implementation of such an expansion.

During the initial operation of the plant prior to the remediation period, an extensive monitoring program in Tampa Bay indicated that there were no adverse impacts to the environment from concentrate discharge. A modification of the Florida Department of Environmental Protection (FDEP) industrial wastewater facility permit would be required to accommodate the additional concentrate discharge produced by the expanded facility.

Project components and costs are represented as estimates of base costs, assuming infrastructure costs have been accounted for in the implementation of the 25-mgd desalination plant. Depending on the specific configuration, additional expansion components may be required. Enhanced estimates for infrastructure upgrades are included in the TBW Long-Term Water Supply Plan.

Quantity Produced (mgd)	Capital Cost	Cost/mgd	Cost/1,000 Gallons	Annual O&M/1,000 gal
10	$110,010,000	$11,001,000	$5.66	$3.54

Issues:
- The effects of increasing the amount of concentrate from the Big Bend facility would require additional investigation.

Seawater Desalination Option #2 – Gulf Coast Seawater Desalination Project (Anclote Power Plant)

- Entity Responsible for Implementation: Tampa Bay Water

This option is for the development of a seawater desalination plant with a capacity of 25 mgd that would be co-located with Progress Energy's Anclote Power Plant in southwestern Pasco County. This site has been previously evaluated for a seawater desalination plant and offers advantages such as the power plant'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 concentrate. A 9.7-mile pipeline would be constructed to deliver finished water from the plant to the S. K. Keller pumping station, the connection point for TBW's regional distribution system.

The facility would obtain feed water from the power plant's intake canal and release waste concentrate into its discharge canal. The concentrate would be diluted with 450 to 2,900 mgd of cooling water from the power plant. Use of existing infrastructure would allow for a modification of the existing FDEP industrial wastewater discharge permit or establishment of a new discharge permit for the desalination process. Additionally, the diluted concentrate would be discharged within Class III waters of the state, outside of the Pinellas County Aquatic Preserve OFW, which would simplify the waste concentrate discharge permitting process.

Quantity Produced (mgd)	Capital Cost	Cost/mgd	Cost/1,000 Gallons	Annual O&M/1,000 gal
25	$460,910,000	$18,400,000	$7.61	$4.06

Issues:

- Additional research on the effects of discharging concentrate at this site would be required by the FDEP for the National Pollution Discharge Elimination System (NPDES) permit application, prior to implementation. Though the concentrate would be discharged into Class III waters, OFWs and an aquatic preserve exist nearby.
- 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 Options

In the vicinity of TBW's central wellfield system, it is unlikely additional groundwater will be developed until a full evaluation of wellfield withdrawal reductions and water level recovery in the region is made. For this reason, no options were developed in the NTB area for fresh groundwater. Future requests for fresh groundwater will be evaluated based on projected impacts to existing legal users and water resources. The District will give further consideration to projects that can mitigate the impacts of groundwater withdrawals on water resources with established MFLs, including those that use reclaimed water for direct and indirect aquifer recharge.

Section 6. Water Conservation Options

1.0 Non-Agricultural Conservation

The District identified a series of conservation measures that are appropriate for implementation by the public supply, domestic self-supply, I/C, M/D,PG, and recreational aesthetic 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 7.

Low-flow showerheads are one of a number of water-conserving fixtures that can significantly reduce indoor water use.

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 were not addressed as part of the 2010 RWSP, are water-conserving rate structures and local codes/ordinances, which 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. Below 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, 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 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	0.26	$2.31	$2,592,000
Domestic Self–Supply	0.003	$2.31	$32,000
Total	**0.27**	**$2.31**	**$2,624,000**

Non-Agricultural Water Conservation Option #2 – Plumbing Retrofit Kits (residential users)

- Entity 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	0.40	$0.24	$395,160
Domestic Self-Supply	0.02	$0.24	$18,000
Total	**0.41**	**$0.24**	**$413,160**

Non-Agricultural Water Conservation Option #3 – Ultra Low-Flow Toilet (ULFT) (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 or less, while dual-flush toilets 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. ULFT 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.

Sector	Water Savings in 2030 (mgd)	Cost-Effectiveness ($/1,000 gal)	Total Cost
Public Supply	1.81	$1.18	$9,062,550
Domestic Self-Supply	0.04	$1.18	$202,500
I/C,M/D,PG	0.003	$1.18	$14,094
Total	**1.86**	**$1.18**	**$9,279,144**

Non-Agricultural Water Conservation Option #4 – Water-Efficient Landscape and Irrigation Evaluations and Large Landscape Surveys (all users)

- Entities Responsible for Implementation: utilities, municipalities, counties, and industrial organizations

Water-efficient landscape and irrigation evaluation (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 surveys are for accounts that 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 Evaluations			
Sector	Water Savings in 2030 (mgd)	Cost-Effectiveness ($/1,000 gal)	Total Cost
Public Supply	2.95	$2.09	$9,685,300
Domestic Self-Supply	0.05	$2.09	$161,000
I/C,M/D,PG	0.005	$2.09	$16,008
Recreational/Aesthetic	0.005	$2.09	$17,526
Total	**3.01**	**$2.09**	**$9,879,834**

Large Landscape Surveys			
Sector	Water Savings in 2030 (mgd)	Cost-Effectiveness ($/kgal)	Total Cost
Public Supply	0.01	$1.30	$21,000
Recreational/Aesthetic	0.02	$1.30	$33,338
Total	**0.03**	**$1.30**	**$54,338**

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 device 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	7.01	$0.51	$5,607,600
Domestic Self-Supply	0.16	$0.51	$128,000
I/C,M/D,PG	0.003	$0.51	$2,784
Recreational/Aesthetic	0.01	$0.51	$6,096
Total	**7.18**	**$0.51**	**$5,744,480**

Non-Agricultural Water Conservation Option #6 – Industrial Commercial Pre-Rinse Spray Valve 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,PG sector. A traditional spray valve uses 2 to 5 gallons per minute, 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 the 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	4.26	$0.11	$1,960,667
I/C,M/D,PG	0.01	$0.11	$3,202
Total	**4.27**	**$0.11**	**$1,963,869**

Non-Agricultural Water Conservation Option #7 – Industrial, Commercial, Institutional Water Facility Assessments (industrial, commercial, institutional users)

- Entities Responsible for Implementation: utilities, municipalities, counties and industrial organizations

The objective of industrial, commercial, institutional (ICI) facility assessment is to reduce water consumption by conducting surveys 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 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 will get implemented, but it will also increase the program costs. It should also be noted that many performance contractors are 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	1.82	$0.35	$2,715,150
I/C,M/D,PG	0.08	$0.35	$120,060
Total	**1.90**	**$0.35**	**$2,835,210**

Non-Agricultural Water Conservation Option #8 – 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	N/A	N/A	N/A
Domestic Self-Supply	N/A	N/A	N/A
Recreational/Aesthetic	0.01	$0.09	$838
Total	**0.01**	**$0.09**	**$838**

2.0 Agricultural Water Conservation

The FARMS Program is a partnership between District, 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 the agricultural industry's 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 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. Because the District classifies the well back-plugging program 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.

2.3 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. Currently, there are seven model farms projects that are either in operation or planned for implementation in the planning region.

2.6 Best Management Practices

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. The following 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 utilize 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.

The Holmberg Nursery project is an example of tailwater recovery system in Hillsborough County. The project includes one new and two existing tailwater recovery and surface water irrigation reservoirs that are connected to capture and store irrigation tailwater. The project is expected to reduce the use of groundwater by approximately 10 percent or 0.18 mgd. The estimated project cost is $589,000. The annualized costs to create a tailwater recovery system in 2008 dollars are $530 per acre for a 10-acre blueberry farm, $228 per acre for a 30-acre field nursery and $105 per acre for a 300-acre farm.

Option	Potential Savings (mgd)[1]	Capital Cost Per Acre[2]	O&M Cost /Acre[3]	Cost/1,000 Gallons
Tailwater Recovery System	0.18	$105-530	$3.50 - $12.60	$0.63

[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) BMP cost update 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

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.

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.

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 20 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, but 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

This option involves the capture and storage of surface water for agricultural irrigation. An example 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 Sources	0.08	$270,000	N/A	$0.77

This chapter is an overview of water supply projects that are under development in the Tampa Bay 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 nearly 126.9 mgd of new water supply will need to be developed during the 2005–2030 planning period to meet demand for all use sectors and to restore minimum flows and levels (MFLs) for impacted natural systems in the planning region. As of 2010, it is estimated that at least 73 percent of that demand (91 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.

Tampa Bay Water's C. W. Bill Young Regional Reservoir during the construction phase.

Part A. Projects Under Development

Projects under development in the planning region include major expansions of the water supply systems for TBW; brackish groundwater desalination in Tarpon Springs, Clearwater and Oldsmar; development and expansion of reclaimed water systems including certain elements of the Tampa Bay Regional Reclaimed Partnership Initiative; ASR systems for both potable and reclaimed water; and conservation projects for public supply and agriculture.

Section 1. Surface Water/Stormwater

1.0 Surface Water/Stormwater Projects

Surface Water/Stormwater Project #1 – Tampa Bay Water System Configuration II

This project includes an expansion of the capacity of TBW's Regional Surface Water Treatment Plant from 72 to 99 mgd. The project also includes the expansion of pumping and distribution capacity to existing infrastructure to enable the capture of additional flow from the Hillsborough River and Tampa Bypass Canal (TBC). An added benefit of the project is the ability to store more water in the C. W. Bill Young Regional Reservoir. The project was approved by TBW's board in October 2006.

The following are descriptions of the six primary components of the Enhancements Phases A/B and the four additional system interconnects.

Expansion of the Tampa Bay Regional Surface Water Treatment Plant

Raw surface water from the TBC, Alafia River and the C. W. Bill Young Regional Reservoir is delivered to the Tampa Bay Regional Surface Water Treatment Plant. Treated water is blended with desalinated water from the Tampa Bay Seawater Desalination Plant and sent to the regional transmission system for distribution. The expansion will increase the rated capacity of the water treatment plant from 72 mgd to a firm capacity of 99 mgd.

Expansion of the TBW Regional High Service Pump Station

An additional pump station will deliver blended potable water from the seawater desalination plant and the water treatment plant into the regional transmission system. The pump station has a design capacity of approximately 120 mgd. Additional pumps will be added to the pump station to increase its capacity to approximately 135 mgd to accommodate the increased supply that will result from the System Configuration II project.

Expansion of the Tampa Bypass Canal Pump Station

The TBC Pump Station withdraws water from the TBC and pumps the raw water to the water treatment plant for treatment or to the C. W. Bill Young Regional Reservoir via the repump station for storage. The capacity of the TBC Pump Station will be increased from 138 mgd to not less than 200 mgd. This project is being implemented concurrently with the repump station expansion to accommodate the increased pumping capacity at the TBC Pump Station.

Expansion of the Repump Station

The Repump Station will be located downstream of the Alafia River Pump Station and will boost the pressure from the Repump Station at high-flow rates. The capacity of the Repump Station will be increased from 130 to 180 mgd to accommodate the TBC Pump Station expansion.

South-Central Hillsborough Intertie Booster Pump Station

The South-Central Hillsborough Intertie Booster Station pumping facility will be located just west of TBW's existing Alafia River Pump Station and will be used in conjunction with the Repump Station to deliver up to 180 mgd of raw water from the Repump Station to the Reservoir. The booster station construction will include two 3,000-horsepower pumps.

Offstream Reservoir Pump Station

The Offstream Reservoir Pump Station will be located near the existing reservoir site and construction of the facility will include four variable frequency drive pumps. The new pump station will increase the amount of supply that can be delivered from the Regional Reservoir to the expanded water treatment plant from approximately 30 to 70 mgd up to not less than 120 mgd.

Quantity Produced (mgd)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
25	$254,971,221	$116,000,000	$10,198,849	$3.50

2.0 Interconnect/Improvement Projects

Construction of a major potable water transmission pipeline for Tampa Bay Water.

Interconnect/Improvement Project #1 – Tampa Bay Water System Configuration II System Interconnect Projects

Project Name	Description
System Configuration II: N.W. Hillsborough Pipeline	Pipeline to deliver supply from regional system to NW Hills WTP. NW Hills WTP is dependent on supply from NW Hills Wellfield. As demands at NW Hills WTP grow, NW Hills Wellfield will not have capacity to meet demand. Connecting NW Hills WTP to regional system reduces dependence on NW Hills Wellfield and allows alternative supplies to be delivered to WTP.
System Configuration II: South-Central Hillsborough Infrastructure Improvements Phases IB and II	Enables delivery of supply from regional system to South-Central Hills service area. Service area is dependent on supply from South-Central Hills Regional Wellfield. As demands increase, wellfield will not have sufficient capacity. Implementation of Infrastructure Improvements Phases IB and II will reduce service area's dependence on supply from wellfield and allow alternative supplies to be delivered to South-Central Hillsborough service area.
System Configuration II: Morris Bridge Booster Pump Station	Allows original design capacity of booster pumping station to be maintained. Improvements to pumps at station are required due to higher regional system pressures anticipated as more alternative supply source capacity is implemented in southeastern portion of system.
System Configuration II: Cypress Creek Pump Station Expansion	Increases pumping capacity of Cypress Creek Pumping Station. Additional pumps required at facility to handle increasing demands and supplies of regional system.

Interconnect/Improvement Project #2 – Tampa Bay Water West Pasco Infrastructure Improvement Project

Project Name	Capital Cost	Description
West Pasco Infrastructure Improvement Project	$22,500,000	Project provides additional source of water to areas currently served by Starkey and North Pasco wellfields by interconnecting them to regional system. When natural systems at wellfields are stressed, groundwater withdrawals will be reduced to near zero and West Pasco service area will be supplied by this interconnection. These reductions will allow for environmental recovery at Starkey and North Pasco wellfields.

Section 2. 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 three 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 – Pasco County Wet-Weather Reclaimed Water Reservoir

The project consists of design and construction of a lined wet-weather reclaimed water reservoir on the old Swan Lake Borrow Pit, also known as the Boyette Mine property, which will store a minimum of 400 million gallons of Pasco County's surplus reclaimed water to be used to meet dry-season demand. This project provides for the beneficial use of wet-weather reclaimed water flows typically disposed of in rapid infiltration basins. The District is funding 50 percent of the $18,550,000 project costs. When completed in 2011, the reservoir will enable the county to supply reclaimed water to up to 5,500 additional residential customers who currently rely on groundwater when reclaimed water is not available during the dry season.

Reclaimed Water Project #2 – Pinellas County North Reclaimed Water Interconnections

The project consists of design, permitting and construction of reclaimed water interconnects between Pinellas County, Clearwater and the City of Oldsmar's reclaimed water systems. The District funded 50 percent of the $3,172,300 project costs. The project was completed in 2008 and now seasonally provides Pinellas County with 3.8 mgd of reclaimed water (1.5 mgd annualized). This enables 1,600 additional residential irrigation customers to receive reclaimed water, which results in a potable-water offset of more than 0.5 mgd.

Reclaimed Water Project #3 – City of Tampa Reclaimed Water Expansion – STAR II

The project consists of design, permitting and construction of reclaimed water mains to provide service to the large industrial, commercial and residential users in the Tampa International Airport, downtown Tampa, and Bayshore areas. The project also includes opportunities for secondary customers near Raymond James Stadium. The District is funding 50 percent of the $22 million project costs. When completed in the 2018 time frame, the project will provide 4.6 mgd of public access quality reclaimed water, which will result in a potable-water offset of 3.25 mgd of industrial use, primarily for cooling towers and residential irrigation demand.

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

Cooperator	General Project Description	Reuse (mgd)			Customer (#)		Costs		
		Produced	Offset	Stored	Type	Total	Total	District[1]	$/Kg[2]
Hillsborough County									
Tampa Bay Water	Stormwater Recharge Study F011	N/A	N/A	N/A	Recharge	1	$1,685,000	$420,500	N/A
	Downstream Aug. Study H306	N/A	N/A	N/A	Augmentation	N/A	$1,995,114	$1,447,797	N/A
City of Tampa	Transmission K655	4.62	3.25	0.00	Res,Com,Ind	520	$22,000,000	$11,662,600	$1.33
Hillsborough County	Pumping K813	N/A	N/A	N/A	N/A	N/A	$900,000	$400,000	N/A
	Transmission L294	2.66	1.33	0.00	Com,Res,GC	3,221	$3,600,000	$1,296,000	$0.53
	Pump/Store L103	N/A	N/A	6.00	N/A	N/A	$3,000,000	$600,000	N/A
City of Plant City	Trans/Pump L816	0.40	0.30	0.00	Rec,GC	3	$3,568,200	$1,985,915	$2.34
Pasco County									
Pasco County	Interconnect H041	0.00	0.00	0.00	N/A	N/A	$1,330,000	$784,693	N/A
	Interconnect H055	0.00	0.00	0.00	N/A	N/A	$18,600,000	$9,920,000	N/A
	Storage H056	0.00	0.00	600.00	N/A	N/A	$18,550,000	$9,417,225	N/A
	Pump/Store/Trans/Inter H067	0.80	0.40	5.00	Res	1,325	$7,400,000	$3,996,000	$3.69
	Storage H305	0.00	0.00	100.00	N/A	N/A	$24,000,000	$6,167,834	N/A
	Telemetry K790	0.00	0.00	0.00	N/A	N/A	$1,450,000	$725,000	N/A
	Store/Pump L267	0.00	0.00	0.50	N/A	N/A	$500,000	$250,000	N/A
	Telemetry L268	0.00	0.00	0.00	N/A	N/A	$348,840	$174,420	N/A
	Trans/Store L270	2.00	1.20	15.00	Res,Rec	2,001	$2,966,316	$1,539,563	$0.49
	Meter Retrofit L106	0.00	0.00	0.00	N/A	N/A	$358,000	$179,000	N/A
	Transmission L729	1.05	0.52	0.00	Res,Rec	1,749	$1,592,000	$796,000	$0.60
	Trans/Store N157	0.05	0.03	0.32	Rec	1	$900,000	$450,000	$0.21
City of Zephyrhills	Transmission L824	0.01	0.01	0.00	Rec	1	$120,000	$70,000	$3.94
	Transmission K794	0.08	0.06	0.00	Rec	3	$473,000	$236,500	$1.59
City of New Port Richey	Transmission L162	0.15	0.07	0.00	Res	246	$625,032	$312,516	$1.67

Table 6-1. *List of reclaimed water projects under development in the Tampa Bay Planning Region (continued)*

Cooperator	General Project Description	Reuse (mgd)			Customer (#)		Costs		
		Produced	Offset	Stored	Type	Total	Total	District[1]	$/Kg[2]
Pinellas County									
City of Dade City	Trans/Store/Pump L823	0.50	0.30	2.00	Rec	1	$3,844,440	$1,952,030	$2.53
Pinellas County	Interconnect F028	1.50	0.50	0.00	Res	1,600	$3,172,300	$1,586,150	$1.25
	Store/Pump K421	0.00	0.00	5.00	N/A	N/A	$2,406,000	$1,203,000	N/A
	Stormwater ASR K422	0.00	0.00	0.00	N/A	N/A	$4,246,000	$1,650,000	N/A
	ASR K682	0.00	0.00	90.00	N/A	N/A	$613,000	$306,500	N/A
	Trans/Store/Pump K831	0.32	0.16	2.40	Rec	1	$1,780,000	$890,000	$2.23
	Trans/Store/Pump P776	8.00	2.76	5.00	Res,Rec	5,368	$34,945,000	$12,874,823	$2.50
	Telemetry L804	0.00	0.00	0.00	N/A	N/A	$500,000	$250,000	N/A
	Feasibility Study L375	N/A	N/A	N/A	N/A	N/A	$114,500	$57,250	N/A
	Interconnect L104	0.00	0.00	0.00	N/A	N/A	$150,000	$75,000	N/A
City of Clearwater	Transmission L254	0.45	0.28	0.00	Res,Rec,GC	289	$4,000,000	$2,300,000	$2.82
	Meter Retrofit L402	0.00	0.00	0.00	Variety	N/A	$266,978	$133,489	N/A
	Transmission L810	0.27	0.14	0.00	Res	500	$3,954,000	$1,977,000	$5.57
	Trans/Pump L053	0.74	0.37	0.00	Res,Rec,Com	622	$4,818,036	$2,409,018	$2.57
	Transmission N095	0.43	0.25	0.00	Res,Rec,Com	556	$5,780,000	$2,890,000	$4.56
	Transmission N169	0.20	0.10	0.00	Res,Com	310	$2,204,050	$1,102,025	$4.34
	Transmission K833	0.41	0.22	0.00	Res,Com	16	$1,797,072	$898,536	$1.62
	Trans/Store/Pump L695	0.41	0.25	5.00	Res,Com	500	$10,838,000	$10,218,500	$8.55
City of Dunedin	Telemetry L076	0.00	0.00	0.00	N/A	N/A	$291,245	$145,622	N/A
	Transmission L697	0.21	0.11	0.00	Res	502	$2,158,852	$1,268,406	$4.01
City of Oldsmar	Feasibility study ASR L055	N/A	N/A	N/A	N/A	N/A	$74,028	$37,014	N/A
	Trans/Telemetry L821	0.07	0.37	0.00	Res	148	$667,000	$409,500	$0.36
	Feasibility Design ASR L739	N/A	N/A	N/A	N/A	N/A	$95,782	$47,891	N/A
	ASR Exploratory N212	N/A	N/A	TBD	N/A	N/A	$422,292	$211,146	N/A

Table 6-1. *List of reclaimed water projects under development in the Tampa Bay Planning Region (continued)*

Cooperator	General Project Description	Reuse (mgd)			Customer (#)		Costs		
		Produced	Offset	Stored	Type	Total	Total	District[1]	$/Kg[2]
Pinellas County (continued)									
City of St. Petersburg	Feasibility Design ASR P787	N/A	N/A	N/A	N/A	N/A	$706,686	$353,343	N/A
	Store/Pump/Telemetry K847	0.00	0.00	10.00	N/A	N/A	$9,655,000	$5,217,000	N/A
City of Tarpon Springs	Storage L051	0.00	0.00	2.50	0	N/A	$1,350,000	$675,000	N/A
City of Largo	Transmission K503	0.41	0.21	0.00	Res,Rec	681	$1,974,828	$987,414	$1.85
Total	**50 Projects**	**25.74**	**13.19**	**848.72**		**20,165**	**$218,786,591**	**$104,957,220**	**$2.50**

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

The District has partnered with many utilities in Pinellas County to develop projects to irrigate golf courses with reclaimed water.

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 11 research projects for which the District has provided more than $2,853,361 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. *Reclaimed water research projects under development in the District*

Cooperator	General Project Description	Costs	
		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
Tampa Bay Water	Stormwater Recharge Study F011	$1,685,000	$420,500
Tampa Bay Water	Downstream Aug. Study H306	$1,995,114	$1,447,797
Totals	**11 Projects**	**$6,514,214**	**$2,853,361**

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

Section 3. Seawater Desalination

Seawater Desalination Project #1 – Tampa Bay Water Seawater Desalination Facility

Although the Tampa Bay Seawater Desalination facility began producing water in 2003, it was taken offline in the summer of 2005 for repairs and became operational in December 2007 after the facility was remediated. The facility is an integral part of TBW's Regional Water Supply System. The facility, which is capable of producing 25 mgd of potable water, produced an annual average of 20.1 mgd in its first year of operation (December 2007 to December 2008).

Quantity Produced (mgd)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 Gallons
25	$148,430,000	$85,000,000	$5,937,200	$4.75

Section 4. Brackish Groundwater Desalination

Brackish Groundwater Desalination Project #1 – Oldsmar Water Supply, Phase 4

This project consists of a reverse osmosis (RO) treatment facility that is permitted to use 2.7 mgd of brackish groundwater to produce 2.0 mgd of potable water. Phase 1 of this project was a preliminary feasibility study, and Phase 2 provided details on major issues pertaining to wellfield evaluation, treatability, concentrate disposal evaluation and permitting. The studies concluded that (1) the Tampa and Upper Suwannee groundwater zones were suitable for a municipal water supply, (2) surficial aquifer drawdown would be negligible, (3) carefully managed withdrawals would not impact the Upper Floridan aquifer and existing wellfields and (4) the effect on established lake and wetland minimum levels would be negligible. Phase 3, preliminary design and permitting, was not funded by the District. This phase included data collection, groundwater and surface water impact modeling, preliminary facility designs and permitting. Phase 4 is ongoing and includes construction of the production wells, concentrate byproduct injection well, RO water treatment facility, and raw water and waste concentrate pipelines.

Although TBW is not affiliated with this project, they have included it and the Tarpon Springs Brackish Groundwater project in their Recommended Master Water Plan. TBW is monitoring the progress of this project and has determined to further evaluate it as part of their Master Water Plan if the city does not implement the project.

Quantity Produced (mgd)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
2.0	$20,108,297	$9,146,460	$4,576,230	$2.43

Brackish Groundwater Desalination Project #2 – Tarpon Springs Alternative Water Supply

This project consists of the design and construction of a brackish groundwater wellfield, RO treatment facilities and byproduct discharge infrastructure. The facility is designed to produce 5 mgd of potable water on an annual average basis. Water produced by the facility will be used to replace 3.0 mgd of water the city currently purchases from Pinellas County Utilities. The city initiated a water supply feasibility study in 2004, with District cooperative funding, to characterize the hydrogeology and water quality of the Upper Floridan aquifer in the vicinity of the city. In 2006, the city completed construction of test wells, conducted an aquifer performance test and determined that brackish water could be extracted from a wellfield north of the Anclote River and treated by RO to produce potable water to supply the city. The permitted quantity of withdrawal will be determined by several parameters, including impacts of withdrawals on wetlands and the established minimum flow for the Anclote River. The project is targeted for completion in December 2010. The Pinellas-Anclote River Basin Board is contributing 50 percent of eligible project costs.

Although TBW is not affiliated with this project, they have included it and the Oldsmar Water Supply project in their Master Water Plan. TBW is monitoring the progress of this project and has determined to further evaluate it if the city does not implement the project.

Quantity Produced (mgd)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
5.0	$42,388,676	$20,141,895	$8,477,735	$2.05

Issues:

- The groundwater quantities requested by the city may not be allowable due to drawdowns near estuarine portions of the Anclote River.

Brackish Groundwater Project #3 – City of Clearwater Brackish Facility at Water Treatment Plant #2 (Phases 2A and 2B)

This project includes the design and construction of a brackish groundwater treatment facility with the capacity to treat up to 8 mgd of brackish groundwater to produce up to 5.0 of potable water supply on an annual average basis. Project components include pilot plant testing; brackish wellfield construction, including the installation of nine additional production wells; design and construction of treatment facilities and raw water transmission lines; and concentrate treatment and discharge infrastructure. Phase 2A includes design of pretreatment facilities; RO processes and the raw water system; site selection for monitoring and production wells; and site selection and design of a concentrate injection well. Phase 2B includes designing the plant operation and preparing a data collection and analysis report.

Phases of the project that are complete include Phase I — the production and monitoring wells design and aquifer performance testing; Phase 1B — the construction of test wells and monitoring well clusters; and Phase 1C — the analysis and financial feasibility studies. These phases were funded entirely by the city. Future funding for fiscal years 2011 through 2015 will include Phase 3A for the final design and Phase 3B for construction. The City of Clearwater currently purchases water from Pinellas County, which receives its water from TBW.

According to the city, this project will reduce the demand on TBW's regional system by approximately 5.0 mgd on an annual average basis. Costs were provided by the City of Clearwater.

Quantity Produced (mgd)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
5.0	$34,288,820	$14,618,014	$6,857,764	$3.98

Section 5. Aquifer Storage and Recovery (ASR) Projects

One potable ASR project is currently under development in the planning region and is being designed to provide up to 10 mgd of new water supply during the dry season. Table 6-3 provides project information including stage of development, project yield, number of wells and costs. Figure 4-3 shows ASR project locations in the District. Reclaimed water ASR projects are listed in Table 6-1.

Section 6. Water Conservation

1.0 Non-Agricultural Water Conservation

1.1 Indoor Water Conservation Projects

Utilities in the planning region have demonstrated a high level of commitment to water conservation. Local utilities have historically partnered with the District for cooperative funding of conservation projects. Since 1993, the District has assisted local utilities in the region with the distribution of nearly 167,925 ultra low-flow or high-efficiency toilets, and 477,903 plumbing retrofit kits. These programs have cost the District and cooperating local governments a combined $20.9 million and have yielded a potable water savings of 9.8 mgd. TBW has instituted parallel water conservation efforts as detailed in their Master Water Plan. The indoor conservation efforts associated with the plan

The District assists utilities with the development of incentive programs that encourage their customers to install water-saving fixtures such as faucet aerators.

Table 6-3. *List of ASR projects under development in the Tampa Bay Planning Region*

Project Site	Status[1]	Test Well Annual Stored Volume Goal (mg)	Final System Goal			Approximate Cooperative Funding Total Project Costs (District Share Is Half of Reported Costs)
			Annual Stored Volume (mg)	100 Day Dry Season Yield (mgd)	Total Number of Wells	
Potable Water ASR Projects						
City of Tampa – Rome Avenue	Construct/testing. ASR well construction complete. Cycle testing in progress.	100	100	1.0	1	Feasibility program = $700,000
	Final system. Construction permit issued and ASR well construction complete. Cycle testing under way.	n/a	900	9.0	7	Monitor well construction = $894,000 Final system = $4,424,000 for six additional wells

[1]Construction/testing generally includes demand projections, water quality assessment, construction permitting, site selection, well design, geologic testing, cycle testing and final report. Final system includes all the necessary wells to store the overall project goal volume if feasibility is proven.

include tracking indoor conservation program savings long-term to provide a cost-efficient strategy to address future water use; conducting research relative to indoor plumbing fixture performance; and implementing education campaigns geared to maximize water savings over the lifetime of the water-efficient fixtures. The District also offers technical assistance to local entities to develop conservation programs and participates in research to ensure the latest conservation information is available to stakeholders. Table 6-4 provides information on indoor water conservation projects under development in the planning region.

Table 6-4. *Indoor water conservation projects under development*

Cooperator	Project Number	General Description	Savings (gpd)	Devices and Rebates	Total Cost[1]	District Cost	$/1,000 gal Saved
City of Tampa	L276	Toilet Rebate	13,100	520	$48,394	$24,197	$0.87
Pinellas Co.	B135	ICI Retrofit	13,299	4	$26,598	$13,299	$0.55
City of Tampa	L442	Toilet Rebate	66,800	2,200	$300,000	$100,000	$1.08
City of Tampa	L742	Toilet Rebate	66,800	2,200	$330,000	$110,000	$1.16
Pasco County	L843	Toilet Rebate	10,184	500	$100,000	$50,000	$2.31
Pasco County	N114	Toilet Rebate	35,708	1,500	$220,000	$110,000	$1.45
Pasco County	N232	Toilet Rebate	35,708	1,500	$200,000	$100,000	$1.54
City of St. Petersburg	L259	Retrofit - Commercial	44,635	187	$12,012	$6,006	$0.17
City of St. Petersburg	L549	Retrofit - Commercial	28,968	100	$5,018	$2,509	$0.11
Pinellas County	K679	Toilet Rebate Universal	1,316,309	58,887	$7,771,676	$3,885,838	$1.62
Pinellas County	L706	Retrofit - Commercial	131,175	586	$14,000	$7,000	$0.07
Pinellas County	L876	Toilet Rebate Universal	164,000	8,000	$1,096,000	$548,000	$1.57
City of St. Petersburg	L943	Toilet Rebate Universal	55,890	2,070	$300,000	$150,000	$1.31
Pinellas County	N121	Toilet Rebate Universal	164,000	8,000	$1,101,000	$550,000	$1.58
City of St. Petersburg	P784	Toilet Rebate Universal	97,662	3,452	$456,548	$228,274	$0.13
City of St. Petersburg	N239	Toilet Rebate Universal	27,000	1,000	$150,000	$75,000	$1.53
Totals:			**2,271,238**	**90,706**	**$12,131,246**	**$5,960,123**	**$1.39**[2]

[1]The total project costs 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.

1.2 Outdoor Water Conservation Projects

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. Outdoor water use can be a significant portion of a water supply utility's total demand, accounting for as much as 50 percent of each residential account's metered use. Since a large portion of this use can be attributed to a lack of education, operational experience and preventative maintenance, the District 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 provides leak detection surveys for utility systems to reduce water loss associated with distribution system leaks and inaccurate metering. The District also promotes 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 state legislation promoting use of FFL. Projects related to landscaping efficiency have been funded by the District since 1992. Since 1991, the District has assisted utilities in the planning region with 717 irrigation evaluations and 473 rain sensor rebates. These programs have cost the District and cooperating governments a combined $179,654 and have yielded a potable water savings of 225,755 gallons per day. The District and local governments have also funded FFL demonstration program water use studies. Tables 6-5 and 6-6 provide information on outdoor water conservation projects and outdoor irrigation research projects under development in the planning region respectively.

Table 6-5. *Outdoor water conservation projects under development*

Cooperator	Project Number	General Description	Savings (gpd)	Sensors/Audits	Total Cost[1]	District Cost	$ / Kgal Saved
Pasco County	K791	Rain Sensor Rebate	33,000	500	$20,000	$10,000	$0.39
City of St. Petersburg	L548	Irrigation Efficiency Audit w/Rain Sensor	110,210	738	$94,664	$47,332	$0.77
City of St. Petersburg	L942	Irrigation Efficiency Audit w/Rain Sensor	57,340	610	$100,000	$50,000	$1.35
City of St. Petersburg	N160	Irrigation Efficiency Audit w/Rain Sensor	35,000	250	$100,000	$50,000	$1.90
Pinellas County	L772	Shallow Well Rebate	75,000	500	$165,000	$82,500	$0.60
Pinellas County	L805	Shallow Well Rebate	75,000	500	$150,000	$75,000	$0.55
Total:			**385,550**	**3,098**	**$629,664**	**$314,832**	**$0.85**

[1]The total project costs 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.

Table 6-6. *List of irrigation research projects under development*

Cooperator	Project Number	General Description	Total Cost	District Cost
University of Florida (IFAS), Pinellas	B187	Soil Moisture Sensor Research	$519,010	$519,010
University of Florida (IFAS), Pinellas	B252	Soil Moisture Sensor Research	$450,000	$450,000
University of Florida (IFAS)	B283	Landscape Irrigation Water Use	$1,187,000	$1,187,000
University of Florida (IFAS)	B284	Acceptable Deficit Irrigation of Turfgrass	$440,000	$440,000
Total:			**$2,596,010**	**$2,596,010**

2.0 Agricultural Water Conservation Projects

Solar-powered, remotely operated values on an irrigation system enhance the efficiency of irrigation events, which reduces water use.

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 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. Table 6-7 is a listing of agricultural water conservation research projects that are under development in the planning region.

Table 6-7. *Agricultural water conservation research projects under development*

Project	Total Project Cost + District Cooperator	Total Project and Land Costs	Funding Source	Planning Region(s)[1]
Study of Bahiadwarf and Persi Water Use Efficiency and Mowing Requirement	$157,500	$157,500	District	Tampa Bay Southern Heartland
Reducing Water Consumption in Mulched Tomato and Pepper Fields	$150,000	$150,000	District	Tampa Bay Southern Heartland
Reduction of Water Use for Citrus Cold Protection	$15,000	$15,000	District	Tampa Bay Southern Heartland
Total	**$322,500**	**$322,500**		

[1]Projects affecting several planning regions. The outcome of research projects can benefit all planning regions.

The construction of large rapid infiltration basins (RIBs) for recharging aquifers with large quantities of highly treated reclaimed water is a potential water resource development project for the Tampa Bay Planning Region.

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.

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 below. 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 Districtwide toward these activities 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 that includes data collected by District staff and permittees, as well as data collected as part of the District's cooperative funding program with the USGS. Data collected from this program allows the District to gauge 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 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 and 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

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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	SWFWMD, 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	SWFWMD, Local Partnerships
(3) Quality of Water Improvement Program	$699,341	$699,341	$699,341	$699,341	$699,341	$3,496,705	SWFWMD
(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	SWFWMD, USGS
(b) Remediating Existing Problems	$17,450,106	$17,450,106	$17,450,106	$17,450,106	$17,450,106	$87,250,530	SWFWMD, 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	SWFWMD
(5) Hydrologic Investigations:							
(a) USGS Hydrologic Studies	$439,250	$439,250	$439,250	$439,250	$439,250	$2,196,250	SWFWMD/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	SWFWMD/USGS Local Government Cooperators
Totals	**$30,702,606**	**$30,702,606**	**$30,702,606**	**$30,702,606**	**$30,702,606**	**$153,513,030**	

through analysis of data collected from the ROMP well network. These impacts 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. This will provide additional data for the water resource assessment projects (WRAPs) and aquifer characteristics inventory, along with well performance data for wellhead protection projects.

3.0 Quality of Water Improvement Program (QWIP)

District technicians work to plug an abandoned free-flowing well.

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.

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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.

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 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 water 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. These investigations have included (1) development of computer models of the regional groundwater flow systems for the District; Highlands Ridge WUCA; Hardee and DeSoto counties; Cypress Creek, Cross Bar and Morris Bridge wellfields; and the St. Petersburg ASR site; (2) detailed analysis of the hydrologic budgets for two benchmark lakes (Lucerne and Starr); (3) hydrogeologic characterization of the intermediate aquifer; (4) hydrologic assessments of the Peace and Alafia rivers; and (5) investigation of the hydrology of the upper Hillsborough River Basin. In recent years, this program has included projects to determine the effects of using groundwater to augment stressed lakes and investigation of factors influencing coastal spring flows. Ongoing projects include evaluation of the effects of using groundwater for supplemental hydration of wetlands; assessing the lake/aquifer interaction in a spring-fed lake by using isotopes in groundwater to estimate lake seepage; statistical characterization of lake level fluctuations; and a pilot study that will compare the hydrologic effects, including water supply demand, of converting land from agricultural to urban use-types on similar size tracts of land in the SWUCA.

5.2 Water Resource Assessment Projects (WRAPs)

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 both 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, but the 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 can be modified as necessary.

In 1999, the District initiated the NTB Phase II investigation as a follow-up to the NTB WRAP. Through a series of projects, 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, TBW 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 for control purposes in areas of minimal hydrologic impacts. Upon completion, the District and TBW'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 currently has 20 projects that meet the 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. Eleven 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 pilot research projects, agricultural environmental restoration projects and restoration of flows to the lower Hillsborough River. District funding for a number of these projects is matched to varying degrees by local cooperators, including local governments, regional water supply authorities and others. In addition, a number of projects have received state and federal funding. District funds for these projects are being generated through a number of different mechanisms described in Chapter 8. Each of the projects included in Table 7-2 is described in greater detail below.

The rehydration of wetlands using reclaimed water is a potential water resource development project that has been proposed in the Tampa Bay Planning Region.

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

Project	Total Prior District Funding	FY2010 District Cost	Total Cost District + Cooperator	Funding Source[1]	Quantity Developed Or Conserved (mgd)[1]
(1) Alternative Water Supply Research, Restoration and Pilot Projects					
(a) Pilot Augmentation Project for Lake Lotela	$133,216	$0	$133,216	District	TBD
(b) ASR Pretreatment Investigation	$304,666	$32,185	$736,851	District, PRMRWSA, Bradenton, Other WMD's	N/A
(c) Clearwater Groundwater Replenishment Project	$0	$234,404	$20,069,404	District, City of Clearwater	3 mgd
(d) Rocky Creek Lake Enhancement Project	$2,029,649	$1,056,252	$4,984,698	District, TBW	3.24 mgd
(2) Agricultural Water Supply/Environmental Restoration Projects					
(a) Irrigation Well Back-Plugging Program	$1,486,436	$90,595	$1,547,031	District	TBD
(b) FARMS Program[2]	$17,075,018	$1,698,720	$21,859,752	FDACS, District, State of FL	40
(c) Mini-FARMS Program	$75,000	$0	$75,000	FDACS, District	2
(3) Restoration of Minimum Flows to the Lower Hillsborough River					
(a) Lower Hillsborough River Recovery Strategy	$3,850,000	$2,850,000	$44,500,000	District, City of Tampa	TBD
(b) Sulphur Springs Weir Modifications	$172,436	$11,392	$333,828	District, City of Tampa	TBD
Totals	**$25,125,421**	**$5,973,548**	**$94,239,780**		

[1] FDACS – Florida Department of Agriculture and Consumer Services. Funding from the Water Protection and Sustainability Trust Fund is indicated as State of Florida.
[2] FARMS budget represents the Districtwide project costs. Ongoing components of the FARMS Program specific to the Tampa Bay Planning Region are included in Table 7-3.

1.0 Alternative Water Supply Research, Restoration and Pilot Projects

Alternative water supply research, restoration and pilot projects are designed to further the development of innovative technologies that will produce water from alternative sources and restore levels and flows to water resources. Included in these projects is research to improve the water quality of ASR systems, feasibility projects for recharging the Upper Floridan aquifer from surface water and lake augmentation projects.

(a) Pilot Augmentation Project for Lake Lotela. The purpose of this project is to evaluate and design a pilot lake augmentation system at Lake Lotela, located in Highlands County within the SWUCA. The District has established minimum levels for Lake Lotela and other lakes in the region. Historically, a number of these lakes have fluctuated below their established minimums. Developing an augmentation system will ensure that the lake will fluctuate at a higher level. The project will involve a review and evaluation of the overall condition of the lake and development of design criteria for a potential augmentation system.

(b) **ASR Pretreatment Investigation.** The purpose of this project is to investigate methods to suppress the mobilization of arsenic that often occurs during ASR activities. The project consists of three sub-projects: (1) evaluation of arsenic mobilization processes occurring during ASR activities, which is being pursued by two independent consultant teams, (2) bench-scale leaching studies on storage zone cores and (3) development of a degasification system to remove dissolved oxygen (DO) from source water prior to injection. This project is being co-funded by the Peace River Manasota Regional Water Supply Authority (PRMRWSA), the South Florida and St. Johns River water management districts and the City of Bradenton. The third component of the project consists of design, permitting and construction of a DO removal system at the City of Bradenton's ASR site. The degasification system will be capable of processing water at 450 gpm at 99.98 percent DO removal, but it is capable of flow rates as high as 750 gpm with lower DO removal efficiency. A technical advisory committee is designing the testing program to demonstrate the effectiveness of DO reduction in the control of arsenic mobilization. A final report documenting the effectiveness of DO removal will be prepared at the end of cycle testing in 2009.

The City of Bradenton received an underground injection control permit renewal and consent order in October 2008. Installation of the degasification system was completed in September 2008 and the performance test was completed in September and October. In October, the city continued recovery of water from the ASR well to remove any remaining arsenic mobilized by earlier cycle tests. Injection of the first de-oxygenated water into the aquifer began in December 2008 at a rate of 1.0 mgd. Due to dry conditions, the city did not have sufficient water to inject, and cycle testing was postponed until the wet season began in June 2009. Recovery of 6 million gallons of degassed water stored in December began in May 2009. Recovery was completed by the end of May 2009. The full-scale cycle test for storing 140 million gallons began in June 2009.

By the end of August 2010, the effectiveness of controlling arsenic mobilization through degasification should be known. Design and permitting of the degasification system and cycle testing of water quality parameters will continue. If the project is successful, the city may expand the system to a flow rate of 1.5 mgd.

(c) **Clearwater Groundwater Replenishment Project.** This project is a feasibility study to assess the potential to improve water levels in the Upper Floridan aquifer by utilizing aquifer recharge. Three mgd of highly treated reclaimed water may be recharged into the aquifer to protect groundwater supplies from saltwater intrusion and supplement groundwater supplies within the City of Clearwater. Elements of the study will include determining optimal locations for recharge and withdrawal, performing groundwater modeling, evaluating permitting requirements (including additional water treatment) and performing cost analyses. The City of Clearwater currently purchases water from Pinellas County that is supplied from TBW's central wellfield system. According to the city, the project would enable them to utilize 100 percent of their reclaimed water, supplement water supplies within the aquifer and possibly provide a seawater barrier to help prevent saltwater intrusion along the coast. The study will include an assessment of the type of aquifer recharge (direct or indirect) and the location of the groundwater replenishment system.

The feasibility study is scheduled for 2010. The city plans to review the results of the Regional Reclaimed Water Partnership Initiative Project report, “The Feasibility of Using Reclaimed Water for Direct and Indirect Aquifer Recharge in the Tampa Bay Area,” to outline the scope of work for the feasibility study to avoid duplication of portions of the study. If the study is successful, the design and construction of an aquifer recharge system will proceed.

(d) **Rocky Creek Lake Enhancement Project.** The purpose of the Rocky Creek Lake Enhancement Project is to divert excess wet-season flows from Rocky Creek into a number of lakes that fluctuate below their minimum levels due to groundwater withdrawals from a nearby wellfield. Rocky Creek flows through Pretty Lake into Lake Armistead and then toward Tampa Bay. During wet periods when excess water flows out of Pretty Lake into Lake Armistead, it may be possible to divert a portion of these flows into Horse Lake. When the desired level is reached in Horse Lake, excess water will be routed to nearby Raleigh and Rogers lakes. Previous studies have indicated that it may be possible to divert up to 3.24 mgd from Pretty Lake during wet periods. This project is being conducted in three phases. The objective of Phase 1 was to perform surface water modeling, identify the preferred engineering alternative, identify permitting requirements and determine the level of landowner participation. Phase 2 consists of developing the engineering design of the water delivery system and obtaining the necessary permits. Construction and testing will be completed during Phase 3 of the project.

The District’s contractor is currently working on Phase 2. The final technical memorandum for the Phase 1 Lake Water Budget Model was provided in January 2008. The easement corridor was finalized and surveyed. The final geotechnical report was submitted to the District in June 2008. The draft hydrologic model analysis was submitted in April 2008. The District is currently engaged in acquiring land and pipeline easements for the project. Negotiations to access Pretty Lake have not been successful and the rerouting of the pipeline may be necessary. Phase 2 has been delayed until land acquisition issues can be resolved.

2.0 Agricultural Water Supply/Environmental Restoration Projects

These projects utilize many of the agricultural water conservation strategies described in Chapter 5, Section 7 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) **Irrigation Well Back-Plugging Program.** In the coastal and southern portions of SWUCA, groundwater quality in the deep, high-production zone of the Upper Floridan aquifer is generally marginal to poor. Investigations conducted by the District have determined that agricultural pumping from this zone can cause localized upward movement of highly mineralized groundwater into irrigation wells. The use of mineralized groundwater for irrigation reduces crop yield, corrodes pumping equipment and degrades the quality of surface waters. Surface water quality impacts have been documented in the Shell Creek, Prairie Creek and Joshua Creek (SPJC) watersheds located in DeSoto and Charlotte counties. As a result, these watersheds are a priority area for the back-plugging program. Back-plugging is already an important management tool in other areas of the SWUCA where irrigation wells exhibit poor water quality. Back-plugging of these wells to a recommended depth is helping to improve surface water quality, maintain groundwater resources, and improve crop yields.

A total of 63 wells have been back-plugged in the SWUCA; 46 are located in the SPJC priority watersheds. Results from analysis of water samples collected from these wells show a reduction in TDS and chloride levels of 47 percent and 63 percent respectively, with a reduction in pumping yields of only 23 percent. For the 17 wells in the SWUCA outside of the SPJC area, seven 7 were back-plugged in the Peace River watershed, 6 in the Alafia River watershed, 2 in the Manatee River watershed, 1 in the Myakka River watershed and 1 in the Horse Creek watershed. Water quality results for all back-plugged wells combined in the SWUCA showed reductions in TDS and chloride levels of 46 and 60 percent, respectively, with a combined reduction in pumping yields of only 24 percent. Routine monitoring results of selected back-plugged wells continues to show improvements in the quality of groundwater used for irrigation purposes. Staff will continue to identify wells for back-plugging.

(b) **Facilitating Agricultural Resource Management Systems (FARMS) Program.** The purpose of the FARMS initiative 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 primarily 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 10 active FARMS projects in the planning region — all located in Hillsborough County. Each of the projects reduces withdrawals from the Upper Floridan or intermediate aquifers 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. Six of the projects are operational and are being monitored for groundwater use offset, two are under construction and two are awaiting contractual

Table 7-3. *Active FARMS projects in the Tampa Bay Planning Region*

Project Name/Location	Project Description	Offset (GPD)	Project Cost	District Funding
H515 Hillsborough County	Groundwater reduction using 1 new, 2 existing tailwater and irrigation reservoirs. Container nursery/sod, 260 acres.	178,000	$589,172	$294,587
H519 Hillsborough County	Groundwater reduction using tailwater reservoir and pumping station, filters, controls and mainline pipe. Row crops 35 acres.	42,600	$229,825	$101,997
H520 Hillsborough County	Groundwater reduction using reservoir, 2 pump stations, filtration, and piping to connect reservoir to existing irrigation system. Strawberries/melons 60 acres.	82,890	$246,198	$111,089
H533 Hillsborough County	½ acre tower hydroponic system (strawberries). Stacker containers, support structure, irrigation controls.	30,000	$150,000	$112,500
H541 Hopewell Business Center, Hillsborough Co.	Tailwater system and irrigation reservoir. Strawberries, 2 acres.	112,500	$225,000	$112,500
H559 Balaban Farms, LLC, Hillsborough Co.	Automation of 3 pump stations, filtration, and piping to connect tailwater/reservoir system to existing irrigation system. Strawberries, 55 acres.	140,250	$730,000	$547,500
H561 Strawberry Red Ranch, LLC, Hillsborough Co.	Two tailwater irrigation reservoirs, 2 pump stations, filtration, and piping to connect to existing irrigation system. Surface water will be used for bed prep, crop establishment, and frost-freeze protection. Strawberries, 80 acres.	60,800	$335,000	$167,500
H587 Tornello Landscape Corp., Hillsborough Co.	Groundwater reduction using stormwater in highly efficient irrigation system. Collection/use of stormwater from 3 acres of greenhouse roofs. Collection/recirculation of water from hydroponic vegetables in greenhouses. Stormwater collection tanks and piping to connect rainwater cisterns to hydroponic irrigation system.	12,060	$99,300	$49,965
H589 Floyd W. Williams Blueberry Farm, Hillsborough Co.	Groundwater reduction by converting overhead irrigation to microjet spray. Irrigation hardware (spray heads, hoses, and valves). Blueberries, 7 acres.	5,400	$20,000	$15,000
H595 Hillsborough County	Groundwater reduction through construction/operation of reservoir. One surface water irrigation pump station including pump, power unit and filtration. Strawberries, 60 acres.	44,000	$151,000	$65,500
Totals		**708,500**	**$2,775,495**	**$1,578,138**

approval. Collectively, these projects are expected to offset approximately 0.7 mgd 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. The priority for the development of future projects is in the Upper Myakka and SPJC watersheds in the Southern Planning Region.

(c) 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 within the District, 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.

3.0 Restoration of Minimum Flows to the Lower Hillsborough River

The District is partnering with the City of Tampa to build a number of water resource development projects that will help achieve the minimum flow for the lower Hillsborough River.

The District established minimum flows for the lower Hillsborough River, Sulphur Springs, and the TBC in 2007. If the actual flow of a watercourse is below the proposed minimum flow over the next 20 years, then the development of a recovery strategy is required by Florida Statute as part of the minimum flow development process. Due to diversions of water by the City of Tampa for its water supply system, the lower river does not meet its minimum flow and therefore requires a recovery strategy.

(a) Lower Hillsborough Recovery Strategy. The recovery strategy includes several proposed projects and a timeline for their implementation. Each major project will require an individual funding agreement between the City of Tampa and the District. Although the city may propose alternative or additional projects to the District for funding consideration, a number of projects were explicitly detailed in the strategy. These projects include modifications to the weir and pump station at Sulphur Springs, the Blue Sink project, a transmission pipeline project and the investigation of storage options. In addition, the District has constructed three temporary pump stations to transfer water from the TBC to the base of the Hillsborough River dam, and it is exploring the feasibility of developing and implementing the Morris Bridge Sink Project.

Due to improved hydrologic conditions in the fall of 2009, flow over the City of Tampa's dam is currently exceeding the required MFL, and all augmentation to meet the MFL has ceased. A pump test at Morris Bridge Sink has been completed, along with the data analysis, and a report was issued in January 2010. Funds for the design of the permanent pump station have been included in the 2010 budget. The District will retain an engineering contractor to proceed with design and permitting of the permanent pump station for Morris Bridge Sink in FY2010.

(b) **Sulphur Springs Weir Modifications.** The purpose of this project is to modify the weir to enable maximum protection of the ecology of the Sulphur Springs Run while making water available for potable supply and to meet minimum flows for the lower Hillsborough River. The project will also investigate the feasibility of using Blue Sink to help meet minimum flows for the river. A study of weir modifications was completed by the City of Tampa, with District cooperation, in conjunction with the establishment of minimum flows for Sulphur Springs. This study indicated that modifying the weir at the mouth of the spring run could better protect the run against salinity incursions. The weir would need to be low enough to allow fish passage during periods of high tides but high enough to prevent salinity incursions. The city proposes to install an operable weir so that adjustments can be made to protect the spring run during times of low flow. The weir could also be raised to allow full access to the spring run during times of high flow. These modifications would allow for greater flexibility to use flow from the spring to meet the minimum flow for the lower Hillsborough River and Sulphur Springs Run. Another component of the recovery plan for the lower Hillsborough River is the possibility of moving flows from Blue Sink to the base of the City of Tampa's dam to help meet the minimum flow.

The District has agreed to provide funding for the City of Tampa's installation of a modified weir on the Sulphur Springs Run. The city has since asked that a portion of these funds be used to assess the feasibility of using Blue Sink to augment flows to the lower Hillsborough River. The District has concurred with this change in scope and the city is in the process of getting a permit issued to modify the lower weir. The Blue Sink feasibility assessment is on schedule.

Chapter 8: Overview of Funding Mechanisms

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.

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:

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

Section 373.707(2)(c), F.S., describes the responsibilities of the 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 water management districts, with water suppliers and users having the primary responsibility and the state of Florida and the water management districts being responsible for providing funding assistance.*

In accordance with 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 used, 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 publications *Avoiding Rate Shock: Making the Case for Water Rates* (AWWA, 2005) 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. 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 FY2010 or FY2011. 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 TBW'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 FARMS Program provides funding from the District, FDACS and the federal EQIP program to help farmers increase the efficiency of their water use and reduce impacts to natural systems.

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, TBW 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 supply responsibilities. Partnerships work best where (Kulakowski, 2005) risks are beyond public sector tolerance, a project is new and stand-alone, 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

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

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 (millions of $)*

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 and 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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