2020 Regional Water Supply Plan

Southern Planning Region

November 2020

Southwest Florida Water Management District

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Southern Planning Region

Board Approved

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Southwest Florida Water Management District

2020 Regional Water Supply Plan

This report is produced by the Southwest Florida Water Management District

November 2020

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List of Abbreviations

AADF	Annual Average Daily Flow
AG	Agriculture
AMO	Atlantic multidecadal oscillations
AR	Aquifer Recharge
ASR	Aquifer Storage and Recovery
AWE	Alliance for Water Efficiency
AWEP	Agriculture Water Enhancement Program
AWS	Alternative Water Supply
BEBR	Bureau of Economic and Business Research
BG	Billion Gallons
BMP	Best Management Practice
CAR	Consolidated Annual Report
CDD	Community Development District
CFI	Cooperative Funding Initiatives
CFS	Cubic Feet per Second
CFWI	Central Florida Water Initiative
CHAMP[SM]	Conservation Hotel and Motel Program
CII	Commercial, Industrial, and Institutional
CIP	Capital Improvement Plan
DCI	DeSoto Correctional Institute
DO	Dissolved Oxygen
DOH	Department of Health
DPCWUCA	Dover/Plant City Water Use Caution Area
DSS	Domestic Self Supply
DWRM	Districtwide Regulation Model
ECFT	East-Central Florida Transient
ECFTX	East-Central Florida Transient Expanded
EDR	Electrodialysis Reversal
ELA	Environmental Look Arounds
ENSO	El Nino Southern Oscillations
EPA	U.S. Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ER	Environmental Restoration
ET	Evapotranspiration
ETB	Eastern Tampa Bay
ETBWUCA	Eastern Tampa Bay Water Use Caution Area
ETDM	Efficient Transportation Decision Making
F	Fahrenheit
F.A.C.	Florida Administrative Code
F.S.	Florida Statutes
FARMS	Facilitating Agricultural Resource Management Systems
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
FFL	Florida Friendly Landscaping
FPL	Florida Power & Light Company
FSAID	Florida Statewide Agricultural Irrigation Demand

FTMR	Focus Telescopic Mesh Refinement
FWS	Florida Water Star
FY	Fiscal Year
GIS	Geographic Information System
GOES	Geostationary Operational Environmental Satellites
GPD	Gallons per Day
GPF	Gallons per Flush
GPM	Gallons per Minute
GRP	Gross Regional Product
HET	High Efficiency Toilets
HRWUCA	Highlands Ridge Water Use Caution Area
I/C	Industrial/Commercial
IFAS	Institute of Food and Agricultural Sciences
IPCC	Intergovernmental Panel on Climate Change
L/R	Landscape/Recreation
LFA	Lower Floridan aquifer
LiDAR	Light Detection and Ranging
M/D	Mining/Dewatering
MAL	Minimum Aquifer Level
MCU	Middle Confining Unit
MCU I	Middle Confining Unit I (1)
MCU II	Middle Confining Unit II (2)
M/D	Mining/Dewatering
MFL	Minimum Flows and Levels
MG/YR	Million Gallons per Year
MGD	Million Gallons per Day
MG/L	Milligrams per Liter
MIA	Most Impacted Area
MIL	Mobile Irrigation Lab
NHARP	North Hillsborough Aquifer Recharge Program
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NTB	Northern Tampa Bay
NTBWUCA	Northern Tampa Bay Water Use Caution Area
O&M	Operation and Maintenance
OFW	Outstanding Florida Water
OPPAGA	Office of Program Policy Analysis and Governmental Accountability
PD&E	Project Development and Environment
PG	Power Generation
PRF	Peace River Facility
PRIM	Peace River Integrated Model
PRMRWSA	Peace River Manasota Regional Water Supply Authority
PRWC	Polk Regional Water Cooperative
PS	Public Supply
PTW	Partially Treated Water
QWIP	Quality of Water Improvement Program
RC&D	Florida West Coast Resource Conservation and Development Council
RIB	Rapid Infiltration Basin

RO	Reverse Osmosis
ROMP	Regional Observation and Monitor-well Program
RPC	Regional Planning Council
RWSP	Regional Water Supply Plan
SAS	Surficial Aquifer System
SHARE	Southern Hillsborough Aquifer Recharge Expansion
SHARP	South Hillsborough Aquifer Recharge Program
SLR	Sea Level Rise
SPJC	Shell, Prairie and Joshua Creek
SJRWMD	St. Johns River Water Management District
SMS	Soil Moisture Sensor
STAG	State and Tribal Assistance Grants
SWCFGWB	Southern West-Central Florida Groundwater Basin
SWFWMD	Southwest Florida Water Management District
SWIM	Surface Water Improvement and Management Program
SWIMAL	Saltwater Intrusion Minimum Aquifer Level
SWUCA	Southern Water Use Caution Area
TBC	Tampa Bypass Canal
TBW	Tampa Bay Water
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Loads
UFA	Upper Floridan aquifer
UMRW	Upper Myakka River Watershed
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geologic Survey
WISE	Water Incentives Supporting Efficiency
WMD	Water Management District
WMIS	Water Management Information System
WMP	Watershed Management Program
WPCG	Water Planning Coordination Group
WPSPTF	Water Protection and Sustainability Program Trust Fund
WQMP	Water Quality Monitoring Program
WRAP	Water Resource Assessment Project or West-Central Florida Water Restoration Action Plan
WRD	Water Resource Development
WSD	Water Supply Development
WTF	Water Treatment Facility
WTP	Water Treatment Plant
WUCA	Water Use Caution Area
WUE	Water Use Efficiency
WUP	Water Use Permit
WUWPD	Water Use Well Package Database
WWTP	Wastewater Treatment Plant
ZLD	Zero Liquid Discharge

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Chapter 1. Introduction

The Regional Water Supply Plan (RWSP) for the Southwest Florida Water Management District (SWFWMD) (District) is an assessment of projected water demands and potential sources of water to meet these demands for the period from 2020 through 2040. The RWSP has been prepared in accordance with the Florida Department of Environmental Protection's (FDEP) 2019 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 the 2020 RWSP update for the Southern Planning Region, which includes DeSoto, Manatee and Sarasota counties and the portion of Charlotte County within the District. The District completed RWSPs in 2001, 2006, 2010, and 2015 that included the Southern Planning Region.

The purpose of the RWSP is to provide the framework for future water management decisions in the District. The RWSP for the Southern Planning Region shows that sufficient alternative water sources (sources other than fresh groundwater from the Upper Floridan aquifer [UFA]) exist to meet future demands and replace some of the current fresh groundwater withdrawals causing hydrologic stress. The RWSP also identifies hundreds of potential options and associated costs for developing alternative sources as well as fresh groundwater. The options are not intended to represent the District's most preferable options for water supply development (WSD). 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 as presented in the RWSP or combine elements of different options that suit their water supply needs, provided such options are consistent with the intent and direction of the RWSP. Additionally, the RWSP provides information to assist water users in developing funding strategies for 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 was prepared pursuant to these provisions. Key components of this legislation include:

- Designation of one or more water supply planning regions within the District.
- Preparation of a Districtwide water supply assessment.
- Preparation of a 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.

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 WSD projects. In addition, the legislation 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.

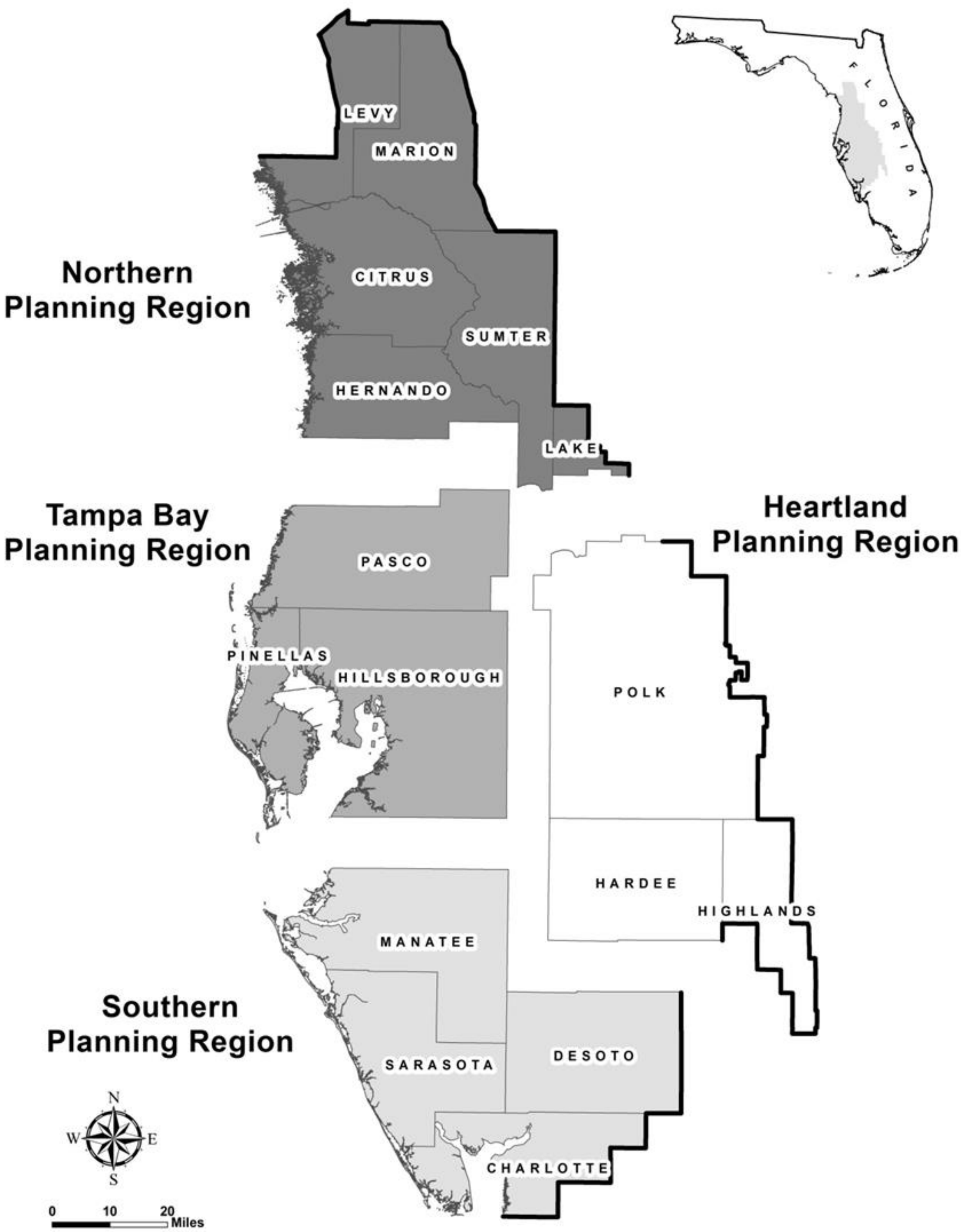

Figure 1-1. *Location of the four water supply planning regions within the District*

Part A. Introduction to the Southern Planning Region Regional Water Supply Plan

The following describes the content of the Southern Planning Region RWSP. Chapter 1, Introduction, contains an overview of the District's accomplishments in implementing the water supply planning objectives of the 2015 RWSP; 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 the District has implemented or is considering implementing, including water use caution areas (WUCAs) and the 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 2040 for public supply, agricultural, industrial/commercial, mining/dewatering, power generation, and landscape/recreation 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, Water Supply Development Component, contains a list of alternative WSD options for local governments, utilities and other water users that includes 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 WSD projects that are currently under development and receiving District funding assistance. Chapter 7, 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 (WRD). Chapter 8, Funding Mechanisms, provides an estimate of the capital cost of WSD and WRD projects proposed by the District and its cooperators to meet the water supply demand projected through 2040 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 2015 Regional Water Supply Plan

This following is a summary of the District's major accomplishments in implementing the objectives of the RWSP in the planning region since the 2015 update was approved by the Governing Board in November 2015.

Section 1. Alternative Water Supply, Conservation and Reuse Development

1.0 Alternative Water Supply

The Peace River Manasota Regional Water Supply Authority (PRMRWSA) provides regional planning efforts to its four member-counties, and is a wholesale water supplier to Sarasota, Charlotte, and DeSoto counties and the City of North Port. The PRMRWSA's services are critical to the District's Southern Water Use Caution Area (SWUCA) recovery strategy, which promotes the use of alternative water supplies to meet growing public supply demands, while reserving limited groundwater supplies for agriculture and other inland users.

The PRMRWSA continues to expand its Regional Integrated Loop System to meet future demands and assure reliability of water supply in the four-county region. The District is cooperatively funding two ongoing Loop System projects: The Phase 1 Interconnect between Punta Gorda's water treatment facility on Shell Creek and DeSoto County's Project Prairie regional pump station, and the Phase 3B Interconnect in central Sarasota County. As future demands necessitate, the Loop System may be extended north from the Phase 3B terminus to allow deliveries of PRMRWSA water to Manatee County. Future segments of the Loop System may also extend into rapidly developing portions of Charlotte and Sarasota counties.

The PRMRWSA's water supply is provided by the 51 million gallons per day (mgd) Peace River Facility (PRF) in DeSoto County. The facility has a 6.5 billion-gallon offstream reservoir system and a 6.0 billion-gallon aquifer storage and recovery (ASR) wellfield storage system, which can hold approximately one year's worth of the facility's contracted demands for drought reliability. The PRMRWSA has an ongoing testing/permitting effort for a partial-treatment ASR injection system, which may allow some treatment capacity reserved for the ASR recharge to become available to meet customer demands. In 2019, the PRMRWSA's water use permit (WUP) increased from 34.9 mgd to 80 mgd (annual average), allowing for future facility expansions to meet most of the region's public supply demands.

In addition to these regional-scale activities, several other alternative water supply projects have been initiated or completed since the 2015 RWSP. These include brackish groundwater development projects by the cities of Punta Gorda and North Port, as well as potable water and reclaimed water aquifer storage and recovery projects by Braden River Utilities and the cities of Bradenton and Venice. Information on these projects is included in Chapter 6 of this Planning Region volume.

2.0 Water Conservation

The District continues to promote and cooperatively fund water conservation efforts to more efficiently use existing water supplies. In the public supply sector, for fiscal years 2015 to 2019, this includes cooperatively funded projects for toilet rebates, rain sensors, soil moisture sensors, line looping to reduce flushing, advanced metering analytics customer portals, and conservation kits. The District has funded conservation projects undertaken by Manatee County, Braden River Utilities, and the cities of Venice, North Port, and Arcadia. The District also formed the Water Conservation Initiative to assist public supply utilities in achieving their water conservation goals.

In 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. These projects predominantly include tailwater recovery systems as an alternative water supply (AWS), and precision irrigation systems.

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 more than 385 projects between fiscal year (FY) 1987 and FY2020 for the design and construction of transmission, distribution, recharge, natural system enhancement, storage and pumping facilities, metering, feasibility studies, reuse master plans, and research projects. As a consequence of District and utility cooperation, reuse projects have been developed that will result in the 2025 Districtwide utilization of more than 228 mgd and a water resource benefit of more than 137 mgd (FDEP, 2015) beneficial reuse plus growth and projects currently under construction. Utilities are on their way to achieving the 2040 Districtwide goals of 353 mgd utilization (75 percent) and 269 mgd of water resource benefit (75 percent efficiency).

Within the Southern region in 2015, utilities were utilizing approximately 52 percent or 35 mgd of the 68 mgd of available wastewater treatment plant flows, resulting in an estimated 25 mgd of water resource benefits (70 percent efficiency). There are five reclaimed water supply projects under development and another two that are estimated to experience additional future supply growth. The projects will supply more than 8 mgd of reclaimed water that will result in 7 mgd of potable-quality water benefits at a total cost of approximately $16 million.

Section 2. Support for Water Supply Planning

The PRMRWSA completed the most recent update to its *Integrated Regional Water Supply Master Plan* in 2020 which addresses water demands, water supply project needs and connectivity issues for its service area. The update, cooperatively funded by the District, assesses future needs through 2040 and includes recommended WSD options to address the region's projected growth.

The District is actively involved in providing technical support to local governments as they prepare statutorily required Water Supply Facilities Work Plans and related updates as part of their comprehensive plans. District staff worked with the Department of Economic Opportunity and its predecessor (Department of Community Affairs), the FDEP and the other WMDs to develop a guidance document for preparing the work plans. Staff provides ad hoc assistance to local governments and has instituted a utility services program to assist utilities with planning, permitting, and information/data needs.

Section 3. Minimum Flows and Levels Establishment

1.0 Established Minimum Flows and Levels

No additional minimum flows and water levels (MFLs) were established in the planning region during or since 2015; however, the District continues to reevaluate MFLs per the Priority List and Schedule for the Establishment of Minimum Flows, Minimum Water Levels, and Reservations (see Chapter 2 Appendix).

2.0 Minimum Flows and Levels Recovery Initiatives

The District's SWUCA recovery strategy, approved in 2006 (SWFWMD, 2006) with effective rules in 2007, relies on a variety of activities that are collectively aimed at achieving MFLs for all priority water resources in the SWUCA by 2025. Resource monitoring is ongoing and a SWUCA progress report is provided to the Governing Board annually. In 2018, the District completed its second five-year assessment of the SWUCA recovery strategy (SWFWMD, 2018). The purpose of the five-year assessment, as required by rule, is to evaluate and assess the recovery in terms of resource trends; trends in permitted and used quantities of water; and completed, ongoing, and planned projects. The assessment provides the information necessary to determine progress in achieving recovery and protection goals and allows the District to revise its approach to respond to changes in resource conditions and issues. Results from the second five-year assessment indicate the District continues to make progress toward recovery, but challenges to full recovery by 2025 remain. Recovery will ultimately be achieved through a combination of maintaining existing withdrawals at or below current levels and implementing Water Resource Development Projects designed to augment or preserve existing flows and water levels.

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

Since the 1970s, the Quality of Water Improvement Program (QWIP) has prevented waste and contamination of water resources (both groundwater and surface water) by reimbursing landowners for plugging abandoned or improperly constructed artesian wells. The program focuses on the southern portion of the District where the UFA is under artesian conditions, creating the potential for mineralized water to migrate upward and contaminate other aquifers or surface waters. The program reimburses approximately 200 well-pluggings per year and, Districtwide, more than 6,800 well-pluggings have been reimbursed since inception. In the Southern Planning Region, 4,828 well-pluggings have been reimbursed since the QWIP program began.

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. Shell Creek is the City of Punta Gorda’s municipal water supply. The program has rehabilitated 85 wells as of September 2018, with 63 of these in the target watersheds. A total of 79 agricultural wells were rehabilitated in the Southern Planning Region.

Part C. Description of the Southern Planning Region

Section 1. Land Use and Population

The Southern Planning Region is characterized by a diversity of land-use types (Table 1-1). These range from urban built-up areas, such as the cities of Bradenton, Palmetto and Longboat Key in Manatee County; the cities of Sarasota, Venice and North Port in Sarasota County; and Punta Gorda in Charlotte County, to predominantly agricultural land uses in the inland portions of these counties and in most of DeSoto County. Significant phosphate mining activities occur in the planning region, primarily in Manatee County; however, mining operations are moving southward into DeSoto County as phosphate reserves at existing mines are depleted.

The population of the planning region is projected to increase from approximately 1,123,883 in 2015 to 1,472,277 in 2040. This is an increase of approximately 348,394 new residents, which represents a 31 percent increase over the 25-year planning period. The majority of this population growth will be due to net migration.

Table 1-1. *Land use/land cover in the Southern Planning Region (2017)*

Land-Use/Land-Cover Types	Acres	Percent
Urban and Built-up	334,930.71	21.36
Agriculture	489,576.75	31.22
Rangeland	147,317.24	9.39
Upland Forest	174,307.62	11.11
Water	65,939.92	4.20
Wetlands	297,014.05	18.94
Barren Land	2,232.48	0.14
Transportation, Communication and Utilities	26,094.44	1.66
Industrial and Mining	30,819.60	1.97
TOTAL	**1,568,232.81**	**100.00**

Based on: SWFWMD 2017 LULC layer (SWFWMD, 2019)

Section 2. Physical Characteristics

Land surface elevations gradually increase from sea level at the gulf coast to a high of 136 feet in northeastern Manatee County. This change in topography over this area is evidence of former marine shorelines, called terraces. Each terrace consists of poorly drained flatlands with many swamps, ponds and lakes. Over large areas of Charlotte and Manatee counties, canals were constructed to drain some of these swampy areas for agriculture. Further to the east, DeSoto County is topographically very similar to Charlotte and Manatee counties, with poorly drained marine terraces increasing in elevation to the east. Most of the undeveloped sections of the planning region are pine flatwoods, saw palmetto, and prairie grassland.

Section 3. Hydrology

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

1.0 Rivers

The planning region contains all or part of eight major drainage basins defined by the U.S. Geological Survey (USGS) including the Little Manatee River, Manatee River (including its tributary the Braden River), Sarasota/Lemon Bay, Myakka River (including its tributary Myakkahatchee Creek), Peace River (including its

Manatee River Control Structure

tributaries Horse, Charlie, Joshua, and Shell creeks), and Charlotte Harbor drainage. There are many smaller tributaries to these larger systems, as well as several coastal watersheds drained by many small tidally influenced or intermittent streams. The Braden, Manatee, and Peace rivers and Myakkahatchee and Shell creeks are utilized as public water supply sources.

2.0 Lakes

There are few named lakes with extensive water-level data in the planning region. Most large lakes were created through impoundment of rivers or from off-stream diversions such as Lake Parrish in Manatee County. The largest lake is Lake Manatee which was created through an impoundment on the Manatee River. Other large lakes include Upper Myakka and Lower Myakka in Sarasota County. Lakes greater than 20 acres in size are included in Figure 1-2. Most small lakes are surface depressions connected to the surficial aquifer that are hydraulically separated from the underlying confined aquifers. Many of the lake systems are connected to river systems through natural streams or man-made canals.

3.0 Springs

There are no first-magnitude springs (discharge exceeds 100 cubic feet per second [cfs]) and only one second-magnitude spring (discharge between 10 and 100 cfs) located within the planning region. Warm Mineral Springs is located in and owned by the City of North Port in Sarasota County. Periodic measurements indicate that average discharge is approximately 10 cfs (Roseneau et al., 1977). The warm temperature and mineralized quality of the spring water indicates that its source is much deeper in the Floridan aquifer than springs further to the north, which tend to have shallow flow systems formed by karst geology.

Warm Mineral Springs in North Port

4.0 Wetlands

Prior to significant development, approximately 54 percent of Florida was covered by wetlands. However, due to drainage and development, only approximately 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. In the Southern Planning Region, Charlotte Harbor, Sarasota Bay, and the southernmost portion of Tampa Bay are estuaries of national significance that have been included in the National Estuary Program.

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 land surface for a considerable portion of the year. Marshes are typically shallower systems vegetated by herbaceous plants rather than trees. Wet prairies, also present in 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 within the Myakka River watershed. Other less extensive swamps, as well as isolated wetlands, occur throughout the planning region.

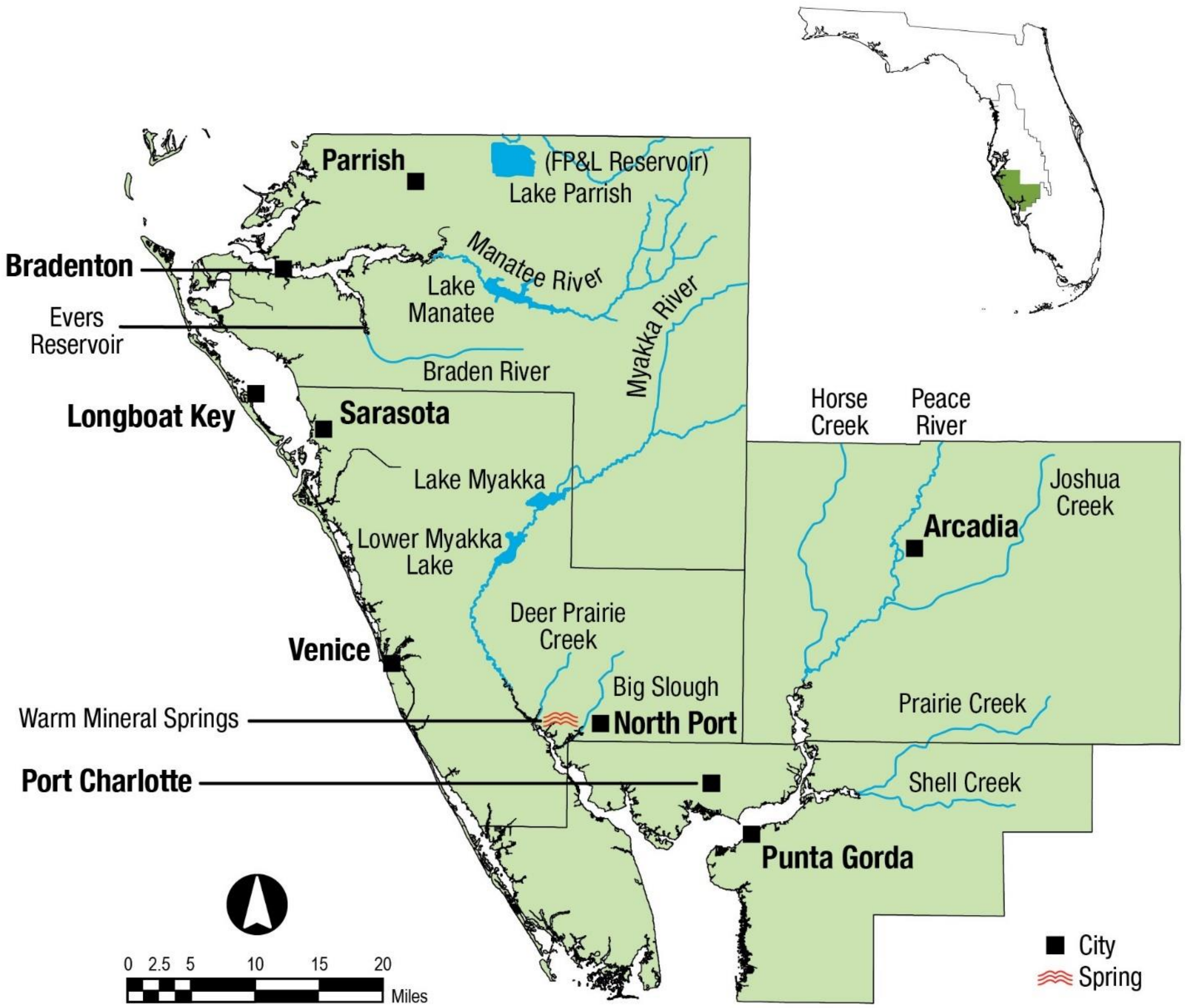

Figure 1-2. *Major hydrologic features in the Southern Planning Region*

Section 4. Geology/Hydrogeology

Three principal aquifers, the surficial, intermediate, and UFA, are present throughout the planning region and are used as water supply sources. Figure 1-3 is a generalized north-south geologic cross section showing the hydrogeology of the District and Figure 1-4 shows the West-Central Florida groundwater basins. As seen in the figures, the Southern West-Central Florida Groundwater Basin (SWCFGWB) encompasses the southern portion of the District where the intermediate aquifer system and its associated clay confining units separate the surficial aquifer from the UFA and tightly confine the UFA across the entire planning region.

The surficial aquifer (SA) is contained within near-surface deposits that mainly consist of undifferentiated sands, clayey sand, silt, shell, and marl of Quaternary age. The aquifer produces relatively small quantities of water, which are generally used for low-volume irrigation or domestic water supply. Surficial deposits range in thickness from 10 feet in coastal areas to greater than 100 feet further along the Lake Wales Ridge (SWFWMD, 1993).

Underlying the SA is the confined intermediate aquifer system with its associated confining units. This aquifer consists predominantly of discontinuous sand, gravel, shell, limestone, and dolomite beds of the Hawthorn Group and contains up to three confined or semi-confined production zones throughout much of the planning region (Wolansky, 1983). The production zones are separated by low-permeability sandy clays, clays, and marls. These confining beds restrict vertical movement of groundwater between individual water-bearing zones in the intermediate aquifers and the overlying surficial and underlying UFA. In general, the thickness of the intermediate aquifer system increases from north to south across the District. Thickness varies from approximately 50 feet in northern Manatee County to more than 600 feet in Charlotte County (Duerr et al., 1988). The intermediate aquifers are utilized extensively for public supply, agricultural irrigation, and recreational, domestic and industrial water uses, especially in the southern coastal portions of the planning region where its water quality is better than the UFA.

The UFA, by far the most important source of groundwater in the planning region, is composed of a thick, stratified sequence of limestone and dolomite units that include (in order of increasing geologic age and depth) the Suwannee Limestone, Ocala Limestone, and Avon Park Formation. The aquifer is confined throughout the planning region by the low-permeability sediments of the overlying intermediate aquifer system. The UFA can be separated into upper and lower flow zones. The Suwannee Limestone forms the upper flow zone and the lower zone is composed of the highly transmissive portion of the Avon Park Formation. The two zones are separated by the lower permeability Ocala Limestone. The two flow zones are locally 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 II (MCU II) of the Floridan aquifer lies near the base of the Avon Park Formation (Miller, 1986). It is composed of evaporate minerals such as gypsum and anhydrite, which occur as thin beds or as nodules within dolomitic limestone that overall has very low permeability. MCU II is generally considered to be the base of the freshwater production zone of the aquifer, except in coastal areas of Manatee and Sarasota counties, southern DeSoto, and Charlotte counties. In this area, water quality within the Avon Park Formation is mineralized or saline with sulfate or chloride concentrations exceeding 1,000 mg/L.

There is generally no recharge to the UFA along the coast, southern DeSoto County, and Charlotte County because the area is a zone of discharge. Further inland, recharge to the aquifer system increases from zero to a few inches per year (Sepulveda, 2002). This low recharge rate is due to the clay confining layers within the intermediate aquifer system that overlie the UFA and restrict the vertical exchange of water between the surficial and UFA across most of the planning region (SWFWMD, 1993). Groundwater is highly mineralized throughout much of the aquifer in the southern portions of the planning region. In these areas, groundwater from the shallower intermediate aquifers are used extensively for water supply.

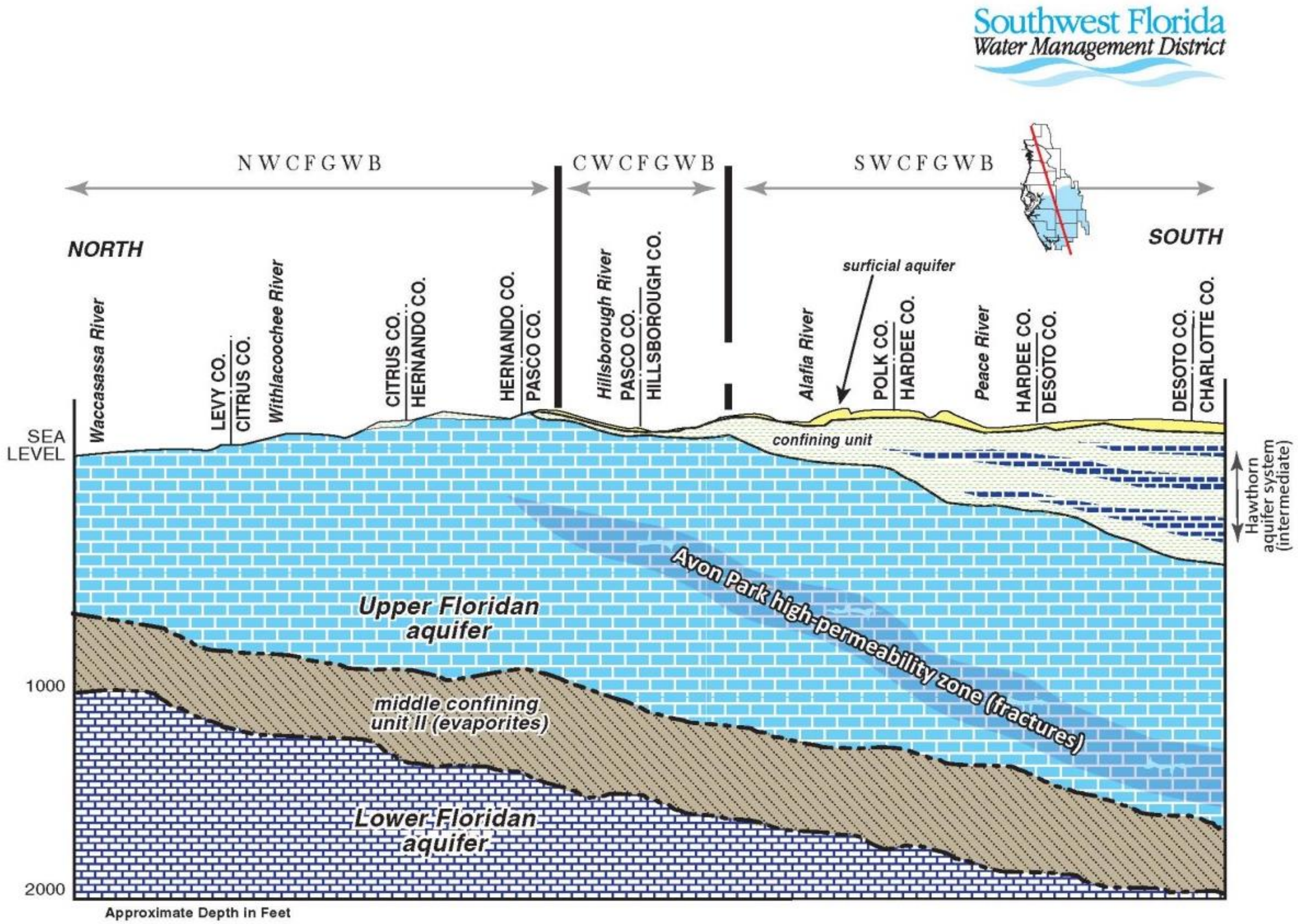

Figure 1-3. *Generalized north-south geologic cross section through the District*

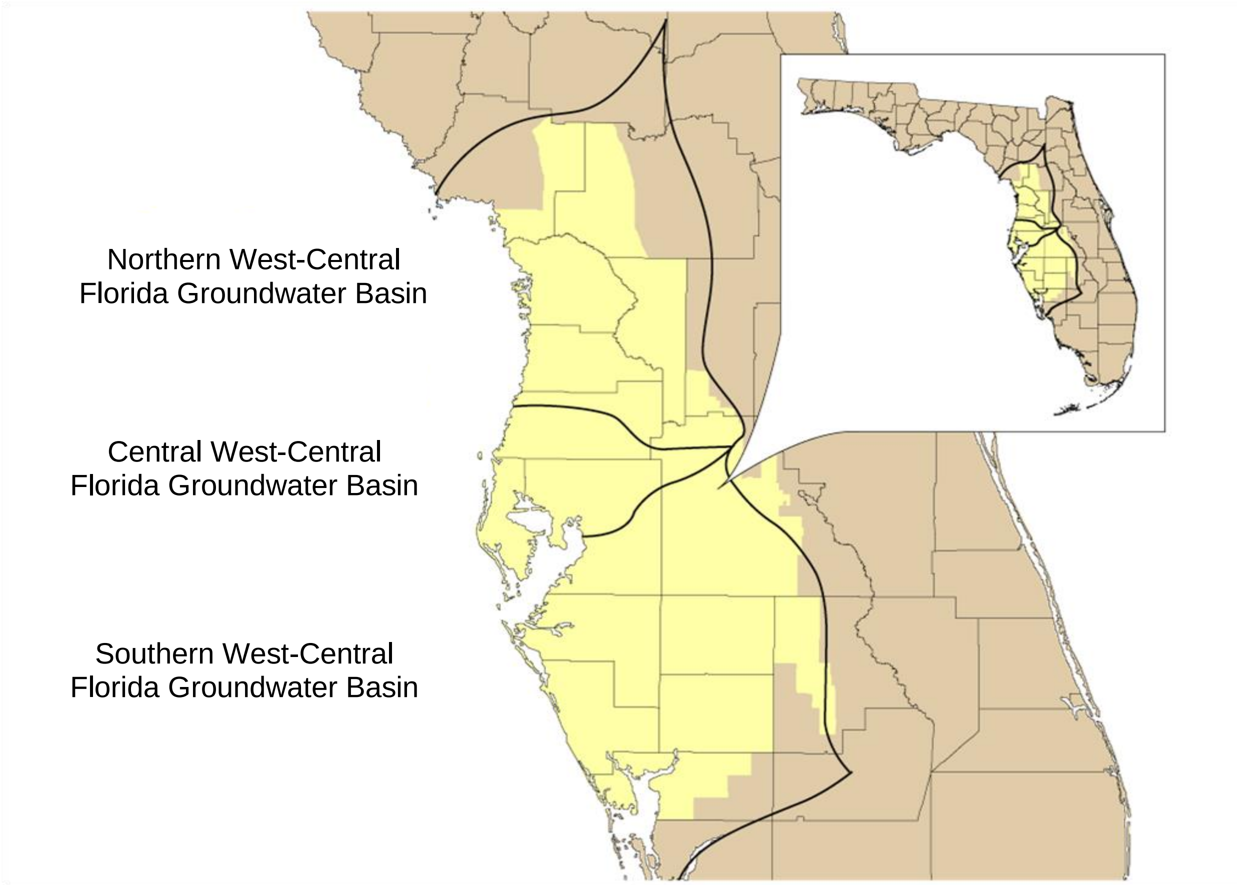

Figure 1-4. *Southwest Florida Water Management District and West-Central Florida Groundwater Basins*

Part D. Previous Technical Investigations

The 2020 RWSP builds on a series of cornerstone technical investigations that were undertaken by the District and the USGS beginning in the 1970s. These investigations provide District staff with an understanding of the complex relationships between human activities (i.e., surface and groundwater usage and large-scale land-use alterations), climatic cycles, aquifer and surface water interactions, aquifer and surface hydrology, and water quality. Investigations conducted in the Southern 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 were initiated by the District to collect critical information about the condition of 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 ground-water interactions. Approximately 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.

In 1978, the Peace River Basin Board directed that a hydrologic investigation be performed to assess causes of lake level declines along the Lake Wales Ridge in Polk and Highlands counties that were occurring since the 1960s. The investigation (referred to as Ridge I) was completed in 1980 and concluded that the declines were due to below-normal rainfall and groundwater withdrawals. In 1987, the District initiated the Ridge II study to implement the data collection that was recommended in the previous study and further assess lake level declines. The Ridge II investigation concluded that lake level declines were a result of below-average rainfall and aquifer withdrawals. Ridge II also recognized that groundwater withdrawals throughout the groundwater basin contributed to declines within the Ridge area. Additionally, it was concluded that, in some cases, alterations to surface drainage were significant and affected lake level fluctuations.

During the 1980s, hydrologic and biologic monitoring from the District's expanded data collection networks began to reveal water resource impacts in other areas. In the late 1980s, the District initiated water resource assessment projects (WRAPs) for 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 Floridan aquifer in the ETB area.

Based on the preliminary findings of the Ridge II and WRAP studies and continued concern about water resource impacts, the District established the Ridge area, ETB and NTB WUCAs in 1989. The District also 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, NTB and Ridge area WUCAs. These meetings are summarized in the Highlands Ridge Work Group Report (SWFWMD, 1989) and Management Plan (SWFWMD, 1990a), Eastern Tampa Bay Work Group Report (SWFWMD, 1990b) and Management Plan (SWFWMD, 1990c), and Northern Tampa Bay Work Group Report (SWFWMD, 1990d) and Management Plan (SWFWMD, 1990e). These deliberations led to major revisions of the District's water use permitting rules, as special conditions were added that were specific to each WUCA. It was also during these deliberations that the original concept of the 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 and impacts to lakes in the Ridge area. A significant finding of both the Ridge II study and the ETB WRAP was that the lowering of the potentiometric surface within those areas was due to groundwater withdrawals from beyond the areas as well as within these areas. Additionally, the ETB WRAP concluded that there was a need for a basin-wide 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 and Ridge area WUCAs and the remainder of the groundwater basin.

The District established MFLs for several water bodies in the SWUCA and adopted a SWUCA Recovery Strategy (SWFWMD, 2006a) to address depressed aquifer levels causing saltwater intrusion along the coast, reduced flows in the upper Peace River, and lower lake levels in areas of Polk and Highlands counties. The initial five-year assessment of the recovery strategy for FY2007-2011 was completed in 2013 (SWFWMD, 2013), with the latest five-year assessment for

FY2012-2016 completed in 2018 (SWFWMD, 2018). The District continues to work with key stakeholders and the public on implementation of current strategies and to develop additional options to address resource recovery within the SWUCA.

Section 2. U.S. Geological Survey 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 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 Southern Planning Region*

Investigation Type	Description
Completed Investigations	
Groundwater	Regional Groundwater Flow System Models of the SWFWMD, Highlands Ridge WUCA, and Hardee and DeSoto Counties
	Hydrogeologic Characterization of the Intermediate Aquifer System
	Hydrogeology and Quality of Groundwater in Highlands County
Surface Water	Effect of Kart Development on Peace River Flow
	Hydrologic Assessment of the Alafia River
	Primer of Hydrogeology and Ecology of Freshwater Wetlands in Central Florida
	Methods to Define Storm Flow and Base Flow Components of Total Stream Flow in Florida Watersheds
	Charlie Creek Watershed Hydrologic Characterization
Groundwater and Surface Water	Effects of Using Groundwater for Supplemental Hydration of Lakes and Wetlands
	Effects of Development on the Hydrologic Budget in the SWUCA
Ongoing Investigations/Data Collection Activities	
Data Collection	MFLs Data Collection
	Surface Water Flow, Level, and Water Quality Data Collection
	Statewide Light Detection and Ranging (LiDAR) Mapping
	Mapping Actual Evapotranspiration Over Florida Model Support
	Statewide Geostationary Operational Environmental Satellites (GOES) Evapotranspiration (ET) Project

Section 3. Water Supply Investigations

Water Supply investigations for the planning region were initiated in the 1960s as part of the United States Army Corps of Engineers (USACE) Four River Basins project. The Four River Basins project began as a flood control project developed in response to severe coastal and inland flooding caused by Hurricane Donna in September 1960. The District was formed in 1961 to help implement this federal project, which led to development of several large control structures including the Tampa Bypass Canal (TBC), the Lake Tarpon and Tsala Apopka Outfalls, and the Masaryktown Canal. Following a period of drought conditions in the mid-1960s that led to numerous dry well complaints, along with findings of project-related ecological studies, there was an apparent need for a broader-based approach to water management than just flood control. The scope of the Four River Basins project was expanded into a more comprehensive effort to assess water resources in the region and determine ways to utilize excess surface water and groundwater for regional water supply solutions. The revised approach led to changes for the TBC design to allow surface water transfers to the City of Tampa; the use of land preservations for water recharge and natural flood attenuation; and the cancellation of other structural projects that would have greatly altered environmental resources.

Since the 1970s, the District 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 (Ch. 373.0395 F.S.) covering areas deemed appropriate by the WMDs' Governing Boards. The District completed inventory reports for the 13 counties predominantly located within its jurisdiction. These reports described the groundwater resources of the individual counties and respective groundwater basins.

Water level gauge

Based on the hydrologic assessments and the District's continuous hydrologic and biologic monitoring programs, the District established three WUCAs in the late 1980s in response to observed impacts of groundwater withdrawals. The District subsequently prepared the Water Supply Needs & Sources: 1990-2020 study (SWFWMD, 1992) to assess future water demands through the year 2020 and groundwater supply limitations in some areas. One objective of the study was to optimize resource management to provide for reasonable and beneficial uses without causing unacceptable impacts to water resources, natural systems, and existing legal users. Major recommendations of the study included reliance on local sources to the greatest extent practicable before pursuing more distant sources; requiring users to increase their water use efficiency; and pursuing a regional approach to water supply planning and future development.

In 1997, the Florida Legislature significantly amended Chapter 373, F.S., to include specific regional water supply planning requirements for the WMDs. The statutes were revised to require the preparation of a districtwide Water Supply Assessment; the designation of one or more water supply planning regions within each district; and the preparation of a RWSP for any planning regions where sources of water were determined to be inadequate to meet future demands. The statute requires the reassessment of the need for a RWSP every five years, and that each RWSP shall be based on a minimum 20-year timeframe (Section 373.0361, F.S.). In response to the amended statutes, the District completed a Water Supply Assessment in 1998 that quantified water supply needs through the year 2020 and identified areas where future demand could not be met with traditional groundwater sources (SWFWMD, 1998). The District published its first RWSP in 2001 for the 10 counties located in the SWUCA and Northern Tampa Bay Water Use Caution Area (SWFWMD, 2001). The 2001 RWSP quantified water supply demands through the year 2020 within these counties and identified water supply options for developing sources other than fresh groundwater.

The RWSP was updated in 2006, and the planning period was extended to 2025. The 2006 RWSP concluded that fresh groundwater from the UFA 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 (SWFWMD, 2006b). It also concluded that a regional approach to meeting future water demands, including regional transmission systems, was required for some areas that had limited access to alternative water supplies.

The District's 2010 and 2015 RWSP updates extended the planning horizon to 2030 and 2035, respectively, and included four regional volumes covering all counties of the District. It was concluded that the Northern Planning Region demand for water through 2035 could be met with fresh groundwater; however, the need for additional fresh groundwater supplies could be minimized through the use of available reclaimed water and implementation of comprehensive water conservation measures. This could result in averting impacts such as those witnessed in other regions. For the three remaining planning regions, both the 2010 and 2015 RWSPs adopted several AWS options that were developed or are currently under development by the respective regional water supply authorities in those regions (SWFWMD, 2010; SWFWMD, 2015).

Section 4. Minimum Flows and Levels Investigations

Extensive field-data collection and analysis is typically required to support MFLs development. These efforts include measurement of water levels and flows, assessment of aquatic and semi-aquatic plant and animal species or communities and their habitats, water quality characterization, and assessment of current and projected withdrawal-related impacts. Ultimately, ecological and hydrological information are linked using some combination of conceptual, statistical and numerical models to assess environmental changes associated with potential flow or level reductions. Goals for these analyses include identifying sensitive criteria that can be used to establish MFLs and prevent significant harm to a wide-range of human-use and natural system values.

Section 5. Modeling Investigations

Since the 1970s, the District has developed numerous computer models to support resource evaluations and water supply investigations. These models have been subdivided into groundwater flow models for general resource assessments and solute transport models to assess past and future saltwater intrusion. In recent years, the District has begun to support the use of integrated hydrologic models that simulate the entire hydrologic cycle and include information on both the surface water and groundwater flow systems. These models are 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 was collected and computers became more sophisticated, models developed by the District 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

The early groundwater models developed for the SWUCA were completed by the USGS. In the early 1990s, the District developed the ETB model (Barcelo and Basso, 1993) that simulated flow within the SWCFGWB. Though this model was originally designed to evaluate groundwater withdrawals for the ETB WRAP, it has been used to evaluate effects of various proposed and existing withdrawals across the SWUCA in the SWCFGWB. Results of the modeling effort have confirmed the regional nature of the groundwater basin in the SWUCA. Following completion of the ETB model, the USGS was contracted to develop a model of the Lake Wales Ridge area (Yobbi, 1996), which has been used to provide assessments of the effects of regional groundwater withdrawals on surficial aquifer water levels in the Ridge area.

The East-Central Florida Transient (ECFT) groundwater model is a transient numerical model of the surficial aquifer, intermediate aquifer system, and Floridan aquifer system in east-central Florida (Sepulveda and others, 2012). The model encompasses the east-central portion of the State. The hydrogeology of east-central Florida was evaluated and used to develop and calibrate the groundwater-flow model that simulates the regional fresh groundwater-flow system. The model is used to simulate transient groundwater flow from 1995 to 2006 using monthly stress periods. The ECFT model footprint has recently been expanded and includes about 25,000 square miles from coast to coast across the Florida peninsula from southern Marion County in the north to the Charlotte-DeSoto County line in the south. This expanded model is named the East-Central Florida Transient Expanded (ECFTX) and has been constructed and calibrated by the South Florida Water Management District, St. Johns River Water Management District, and the SWFWMD. The ECFTX model has been calibrated to 2003 steady-state conditions and a monthly transient period from 2004 through 2014. The focus of the model calibration was the Central Florida Water Initiative (CFWI) area in the central part of the state.

The ECFTX model is fully three dimensional and is composed of 11 distinct layers. From top to bottom, the layers represent the surficial aquifer (model layer 1), the intermediate confining unit/Intermediate aquifer system (model layer 2), the Suwannee permeable zone (model layer 3), the Ocala low-permeable zone (model layer 4), the Avon Park permeable zone (model layer 5), the middle confining units I/II (model layers 6-8), and the Lower Floridan aquifer (LFA) (model layers 9-11). Horizontally, the model area is divided into grid cells 1,250 by 1,250 feet in size.

The ECFTX model will increase the understanding of hydraulic connection between the surficial, aquifer, UFA, and LFA. Most importantly, the model can be utilized by water-resource professionals to assess the effects of changes in groundwater withdrawals with regard to wetlands, lakes, spring flows and potentiometric surfaces of the UFA and LFA. The model will be used to provide the technical framework for water-supply planning and decisions regarding the allocation of future groundwater withdrawals. The model also may be used for WUP evaluations in the model area. Other uses of the ECFTX model will include planning and regulatory impact assessments in the CFWI area.

The Districtwide Regulation Model (DWRM) was developed to produce a regulatory modeling platform that is technically sound, efficient, reliable, and has the capability to address cumulative impacts. The DWRM was initially developed in 2003 (Environmental Simulations, Inc., 2004). It is mainly used to evaluate whether requested groundwater withdrawal quantities in WUP applications have the potential to cause unacceptable impacts to existing legal users, off-site land uses and environmental systems on an individual and cumulative basis. The DWRM Versions 1, 2, 2.1, and 3 (Environmental Simulations, Inc., 2004, 2007, 2011, 2014) incorporate Focused Telescopic Mesh Refinement (FTMR), which was developed to enable DWRM to be used as a base model for efficient development of smaller scale sub-models (FTMR models). The FTMR uses a fine grid around a well or group of wells and increasing grid spacing out to the edge of the model. It was specifically designed to enhance WUP analysis. DWRM Version 3 simulates groundwater flow of the entire District using a quasi-3D conceptualization of the Modular Finite-Difference Groundwater Flow Model code (MODFLOW2005). DWRM3 simulates groundwater flow in the surficial, intermediate, UFA and LFA. DWRM3 supports current regulatory functions as a core business process addressed in the District's Strategic Plan.

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-section 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 and were used to make the initial estimates of movement of the saltwater-freshwater interface in the former ETB WUCA. To address the three-dimensional nature of the interface, a sharp interface code, known as 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., 1994) and the results were compared to those of the sharp interface model (HydroGeoLogic, Inc., 1994). The cross-sectional models compared well with the sharp interface model.

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 by HydroGeoLogic, Inc. in 2002 (HydroGeoLogic, Inc., 2002). The model encompassed all of Manatee and Sarasota counties and the southern half of Hillsborough and Pinellas counties and simulated flow and transport in the UFA. The model was calibrated (including start-up period) from 1900 to 2000, although there is only water quality data for the period from 1990 to 2000. The model was used to derive estimates of the number of wells and amount of water supply at risk to future saltwater intrusion under different pumping scenarios.

3.0 Integrated Groundwater/Surface Water Models

The Peace River Integrated Model (PRIM) is an integrated surface water and groundwater model of the entire Peace River Basin (HydroGeoLogic, 2011). The PRIM was developed using MODHMS®, which is a proprietary model code by HydroGeoLogic, Inc. The surface water component of the model is grid-based. The PRIM was used to understand the effects on river flows from historical changes and to simulate the effects of future resource management options. The model is used to examine potential effects to wetlands, lakes, springs, and rivers from rainfall variation, land use changes, and regional groundwater withdrawals in the SWUCA.

The Myakka River Watershed Initiative was a comprehensive watershed study and planning effort to address environmental damage caused by excess water attributed to agricultural operations and land use alterations in the watershed. The Myakka River Watershed Water Budget Model was a component of this initiative. The objectives of the model were to estimate quantities and timing of excess flows in the upper Myakka River; investigate linkages between land use practices and excess flows; develop time-series of flow rates sufficient for pollutant load modeling; evaluate alternative management scenarios to restore natural hydrology; and simulate hydroperiods for the Flatford Swamp under historic, existing and proposed flow conditions. The model is complete and has been calibrated and verified. The period of record of the model has been updated to 2014.

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Chapter 2. Resource Protection Criteria

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

Part A. Water Use Caution Areas

Section 1. Definitions and History

Water Use Caution Areas (WUCAs) are areas where the District's Governing Board has determined that regional action is necessary to address cumulative water withdrawals that are causing adverse impacts to the water and related natural resources or the public interest. District regional water supply planning is the primary tool in ensuring water resource sustainability in WUCAs. Florida law requires regional water supply planning in areas where it has been determined that existing sources of water are not adequate for all existing and projected reasonable-beneficial uses, while sustaining the water resources and related natural systems. Regional water supply planning quantifies the water needs for existing and projected reasonable-beneficial uses for at least 20 years, and identifies water supply options, including traditional and alternative sources. In addition, MFLs, established for priority water bodies pursuant to Chapter 373, Florida Statues (F.S.), identify the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area. If the existing flow or level of a water body is below, or is projected to fall below, the applicable MFLs within 20 years, a recovery or prevention strategy must be implemented as part of the regional water supply plan (RWSP). Figure 2-1 depicts the location of the District's WUCAs. In order to determine whether an area should be declared a WUCA, the Governing Board must consider the following factors:

- 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 (NTBWUCA), Eastern Tampa Bay (ETBWUCA) and Highlands Ridge (HRWUCA). 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) in the ETBWUCA. The MIA consists of the coastal portion of the SWUCA in southern Hillsborough, Manatee, and northern Sarasota counties. The Saltwater Intrusion Minimum Aquifer Level (SWIMAL) was established to stabilize regional water level declines so that long-term management efforts could slow the rate of regional saltwater intrusion in the MIA. Within this area, no increases in permitted groundwater withdrawals from the Upper Floridan aquifer (UFA) were allowed and withdrawals from outside the area could not cause further lowering of UFA levels within the area. The ETBWUCA and HRWUCA were superseded in 1992 by the establishment of the SWUCA, which encompasses the entire southern portion of the District. The NTBWUCA was expanded in 2007 to include an additional portion of northeastern Hillsborough County and the remainder of Pasco County. In 2011, the District established the Dover/Plant City Water Use Caution Area (DPCWUCA) in eastern Hillsborough and western Polk counties following impacts from intense frost/freeze protection withdrawals. The District has not declared a WUCA in the Northern Planning Region; however, the St. Johns River Water Management District has declared a priority water resource caution area adjacent to the District boundary in Lake and Marion counties.

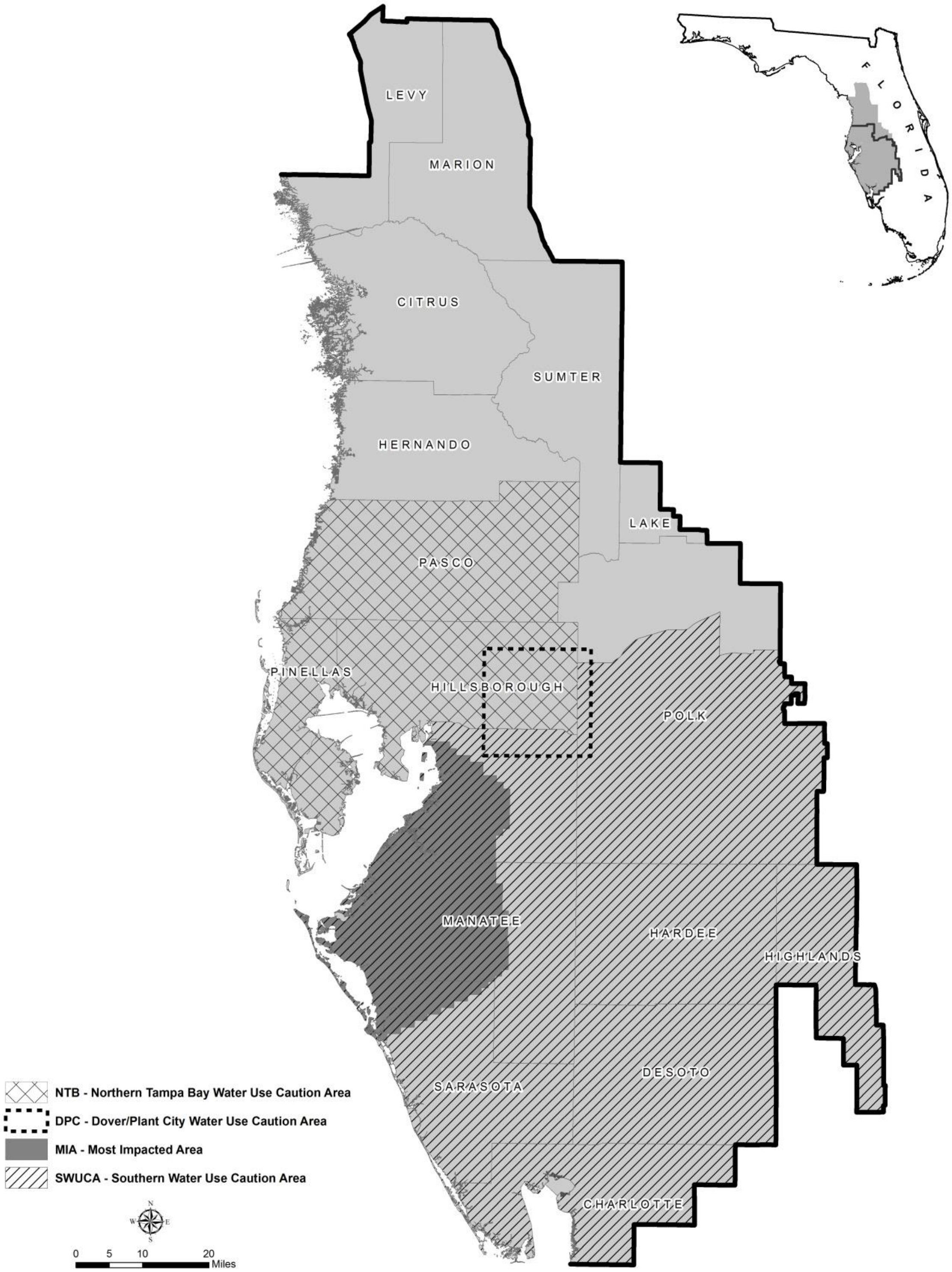

Figure 2-1. *Location of the District's water use caution areas and the MIA of the SWUCA*

1.0 Southern Water Use Caution Area

Since the early 1930s groundwater withdrawals have steadily increased in the Southern West-Central Florida Groundwater Basin (Figure 2-2) in response to growing demands for water from the mining and agricultural industries and later from public supply, power generation and recreational users. Before peaking in the mid-1970s, these withdrawals resulted in declines in UFA 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 UFA, reduced flows in the upper Peace River and lowered water lake levels in some lakes within upland areas in Polk and Highlands counties. In response to these resource concerns, the District established the SWUCA in 1992. The SWUCA encompasses all or portions of eight counties in the southern portion of the District, including all of the ETBWUCA and HRWUCA, and the MIA within these counties. Although groundwater withdrawals in the region have stabilized over the past few decades as a result of management efforts, area water resources continue to be impacted by the decline in aquifer water levels.

In 1994, the District initiated rulemaking 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 UFA 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 (MAL) and to allow renewal of existing permits, while gradually reducing permitted quantities as a means to recover aquifer levels to the established minimum level. A number of parties filed objections to parts of the rule and an administrative hearing was conducted. In March 1997, the District received the Final Order upholding the MAL, the science used to establish it, and the phasing in of conservation. However, in October 1997, the District appealed three specific components of the ruling and withdrew the MAL. The minimum aquifer level was withdrawn because parts of the rule linked the level to the provisions for reallocation of permitted quantities and preferential treatment of existing users over new permit applications, both of which were ruled to be invalid.

In 1998, the District initiated a reevaluation of the SWUCA management strategy and, in March 2006, established minimum "low" flows for the upper Peace River, minimum levels for eight lakes along the Lake Wales Ridge in Polk and Highlands counties, and a SWIMAL for the UFA in the MIA. Since most, if not all, of these water resources were not meeting their adopted MFLs, the District adopted a recovery strategy for the SWUCA in 2006 (SWFWMD, 2006). When the recovery strategy was adopted in 2006, it was estimated that recovery could be achieved if total groundwater withdrawals were reduced to approximately 600 mgd. As part of the strategy, the status of District monitoring efforts is reported to the Governing Board on an annual basis, and every five years a comprehensive review of the strategy is performed. Adjustments to the strategy will be made based on results of the ongoing monitoring and recovery assessments. In 2013, the District completed the first five-year review of the recovery strategy (SWFMWD 2013) that addressed the period from 2007 through 2011. It was found that recent groundwater withdrawals in the region had declined to below 600 mgd; however, the upper Peace River, 16 lakes, and the most impacted area (MIA) aquifer level all remained below adopted MFLs. Because adopted MFLs for many water bodies were still not being met, the District initiated a series of stakeholder meetings to review results of the technical assessments and identify potential recovery options.

Four meetings were held in 2015 to address issues associated with MFLs recovery in the MIA and Ridge Lakes areas. Meeting participants represented all the major water use groups, a variety of environmental organizations, state agencies and other interested parties. For the MIA, six options were identified to help meet the SWIMAL goal. The Governing Board voted to support five options (listed below) and directed staff to gather more information on the exploration of aquifer recharge (AR) and aquifer storage and recovery (ASR). There was also subsequent approval of an increase to the District's cost share to 75 percent for the Facilitating Agricultural Resource Management Systems (FARMS) projects in the MIA for a period of three years to encourage participation in the program.

MIA Options:

- Continue monitoring
- Update analytical tools
- Promote water conservation initiatives
- Expand FARMS
- Expand beneficial reuse

For the Ridge Lakes area, the Governing Board supported all three identified options, as listed below.

Ridge Lakes Options:

- Continue monitoring
- Reevaluate established minimum lake levels
- Evaluate options for individual lakes

The second SWUCA Recovery Strategy Five-Year Assessment (SWFWMD 2018), which addressed the period from 2012 through 2016 (SWFMWD 2018), evaluated and assessed recovery in terms of trends in water resources, permitted quantities, and development of projects and initiatives to address issues within the SWUCA. An important conclusion of the second five-year assessment was that the District continues to make progress toward recovery, but challenges remain to achieving full recovery by 2025. Recovery will ultimately be achieved through a combination of maintaining existing withdrawals at or below current levels and implementing water resource development (WRD) projects designed to augment or preserve levels and flows.

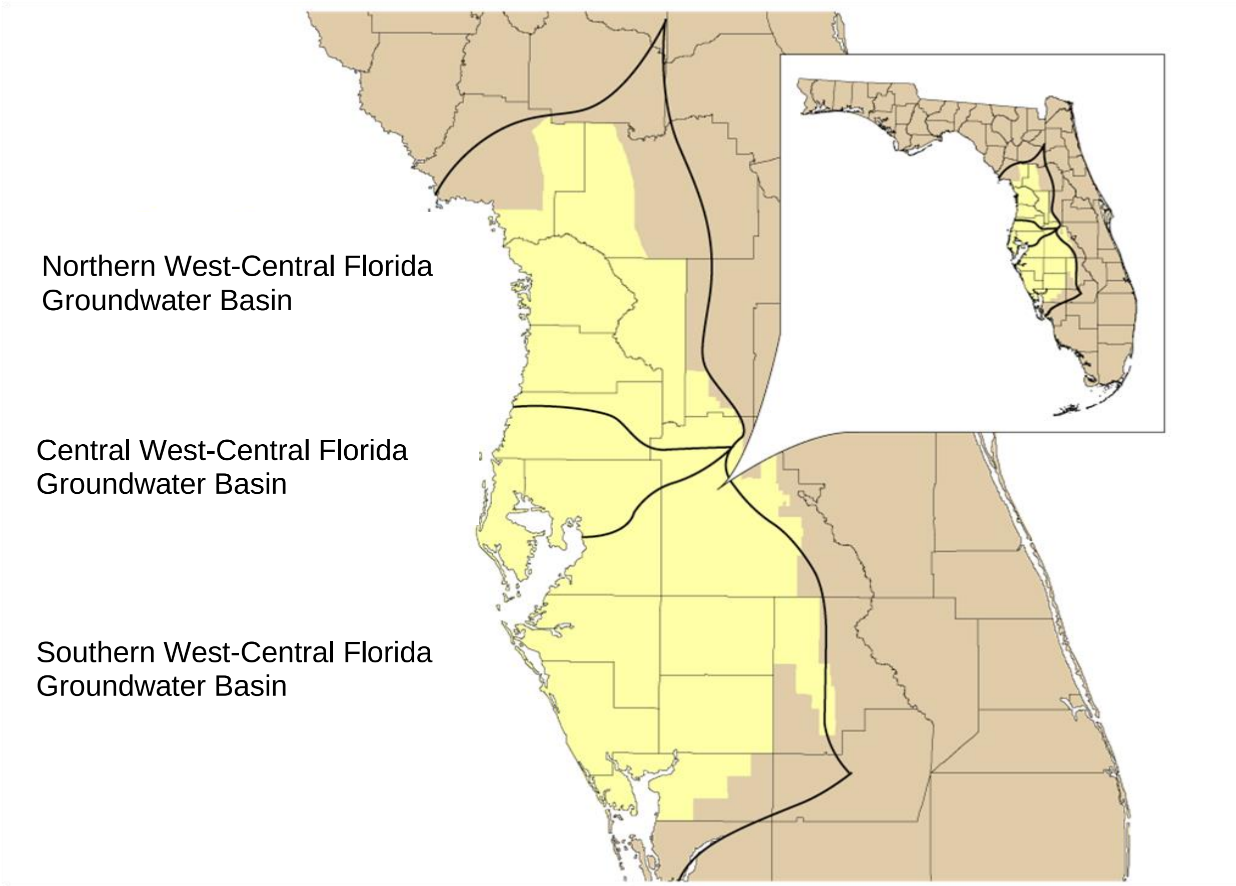

Figure 2-2. *Southwest Florida Water Management District and West-Central Florida Groundwater Basins*

Part B. Minimum Flows and Levels

Section 1. Definitions and History

Section 373.042 of the Florida Water Resources Act of 1972 (Chapter 373, F.S.), directs the Florida Department of Environmental Protection (FDEP) or the water management districts (WMDs) to establish minimum flows or minimum water levels (MFLs) for priority water bodies using the best available information. The minimum flow for a given watercourse is defined by statute as the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area. The minimum water level of an aquifer or surface waterbody is similarly defined by statute as the level of groundwater in an aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources or ecology of the area.

Minimum flows and levels (MFLs) are established and used by the District for water resource planning; as one of the criteria used for WUP applications; and for the design, construction and use of surface water management systems. Water bodies with MFLs benefit from District funding of water resource and water supply development projects that are part of a recovery or prevention strategy identified for achieving an established MFL. The District's MFLs program addresses all

MFLs-related requirements expressed in the Florida Water Resources Act and the Water Resource Implementation Rule (Chapter 62-40, Florida Administrative Code [F.A.C.]).

Section 2. Priority Setting Process

In accordance with Sections 373.036(7) and 373.042(2), F.S., the District annually updates its Priority List and Schedule for the Establishment of Minimum Flows, Minimum Water Levels, and Reservations. As part of determining the priority list and schedule, which also identifies water bodies scheduled for development of reservations, 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.
- Stakeholder input.

The updated priority list and schedule is submitted to FDEP for approval by November 15 of each year and, as required by statute, is published in the District's Consolidated Annual Report. The District's current priority list and schedule is also posted on the District website and is included in the Chapter 2 Appendix to this RWSP.

Section 3. Technical Approach to Minimum Flows and Levels Establishment

District methods used to establish MFLs for wetlands, lakes, rivers, springs and aquifers are briefly summarized in the Chapter 2 Appendix to this RWSP. Additional details regarding MFLs methods are provided in District rules (Chapter 40D-8, F.A.C.) and within MFLs reports that are developed for individual priority water bodies and posted on the District website. Refinement and development of new MFLs methods and ongoing and new data collection efforts ensure that MFLs are established and reevaluated, as necessary, using the best available information.

The District's technical approach for MFLs development assumes that alternative hydrologic regimes may exist that differ from historic conditions but are sufficient to protect water resource features from significant harm. For example, consider a historic condition for an unaltered river or lake system with no 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 substantially alter the regime. A threshold hydrologic regime may exist that included water levels or flows that are lower or less than those of the historic regime, but which protects the water resources and ecology of the system from significant harm. This threshold regime could conceptually allow for water withdrawals, while protecting the water resources and ecology of the area. MFLs established based on such a threshold hydrologic regime may therefore represent minimum acceptable, rather than historic or potentially optimal, hydrologic conditions.

1.0 Scientific Peer Review

Section 373.042(4), F.S., permits affected parties to request independent scientific peer review of the scientific and technical data and methodologies used to establish MFLs. In addition, the District or FDEP may decide to voluntarily subject MFLs to independent scientific peer review, based on guidelines provided in Rule 62-40.473, F.A.C.

Currently, the District voluntarily seeks independent scientific peer review of methods used to develop MFLs for all water body types. Similarly, the District voluntarily seeks peer review of MFLs proposed for all flowing water bodies and aquifer systems, based on the unique characteristics of the data and analyses used for the supporting analyses.

Section 4. Established and Proposed Minimum Flows and Levels

Figure 2-3 depicts priority MFLs for water resources as of October 22, 2019, that are in or partially within the Southern Planning Region. A complete list of water resources with established MFLs throughout the District is provided in the Chapter 2 Appendix to this RWSP.

Priority water resources with established MFLs in or partially within the planning region include:

- Braden River (upper segment)
- Dona Bay/Shakett Creek System
- Myakka River (lower segment)
- Myakka River (upper segment, partially located in the Heartland Planning Region)
- Peace River (lower segment)
- Peace River (middle segment, partially located in the Heartland Planning Region)
- SWUCA SWIMAL (partially located in the Tampa Bay Region Planning Area and affected by withdrawals in the Southern Planning Region, Heartland Planning Region, and Tampa Bay Planning Region)

Priority water resources in or partially within the planning region for which MFLs have not yet been established or are being reevaluated include:

- Braden River (lower segment)
- Horse Creek (partially located in the Heartland Planning Region)
- Little Manatee River (upper segment, partially located in the Tampa Bay Planning Region)
- Manatee River (lower segment)
- Peace River (lower segment; reevaluation)
- Prairie Creek
- Shell Creek (lower segment)
- Shell Creek (upper segment)
- SWUCA SWIMAL (partially located in the Tampa Bay Region Planning Area and affected by withdrawals in the Southern Planning Region, Heartland Planning Region, and Tampa Bay Planning Region; reevaluation)

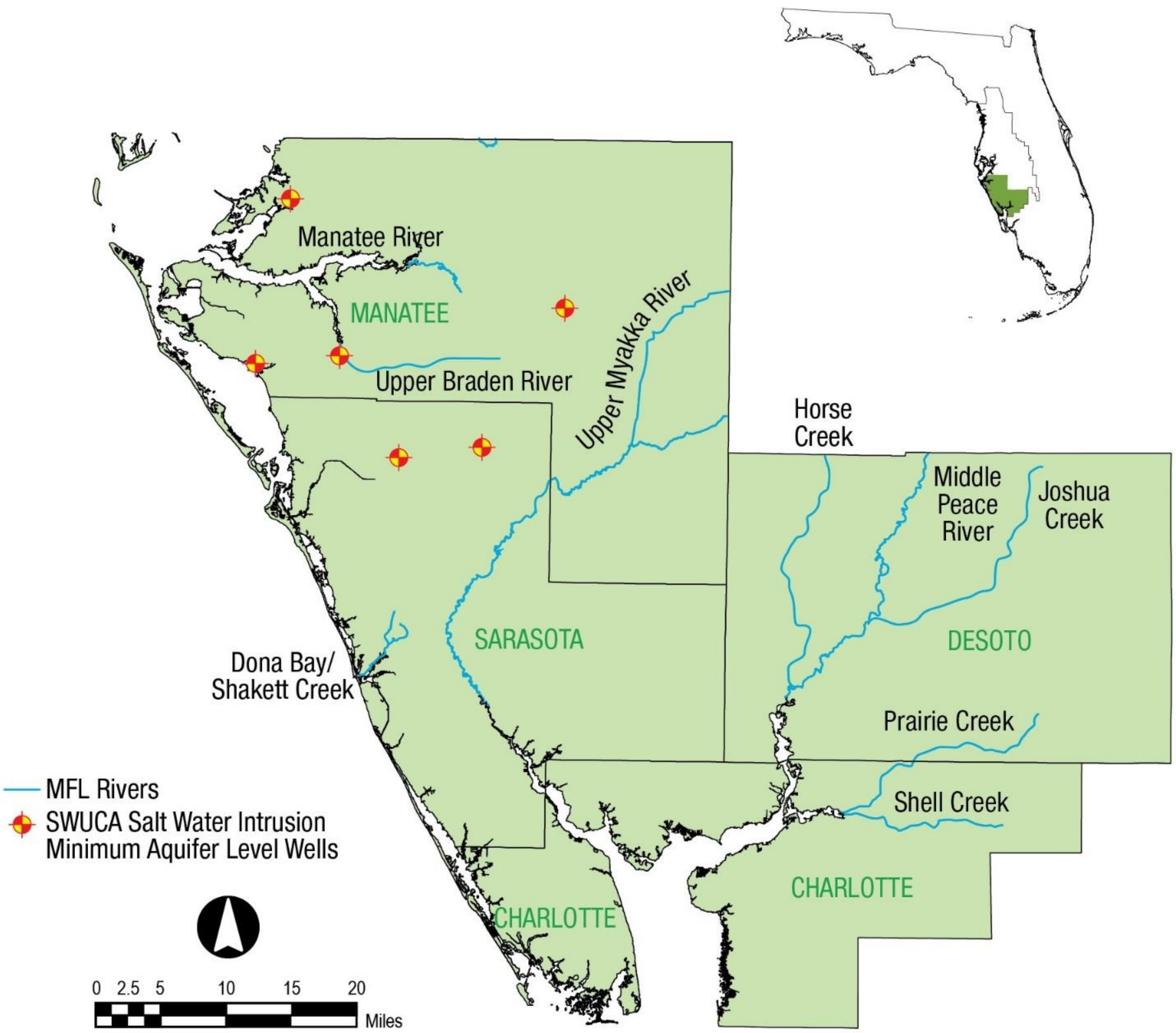

Figure 2-3. *MFL priority water resources in the Southern Planning Region*

Part C. Prevention and Recovery Strategies

Section 1. Prevention Activities

Section 373.0421(2), F.S., requires that a prevention strategy be developed if within 20 years the flow or level in a water body is projected to fall below an applicable MFL. 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 engaged in planning efforts that are coordinated with and complement those of the District. A goal of these efforts 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.

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 body is below an applicable MFL. The District has established recovery strategies by rule in Chapter 40D-80, F.A.C. When an MFL for a water resource is not being met or, as part of the recovery strategy, is not expected to be met based on future water-use demand projections, the District will first evaluate the established MFL in light of any newly obtained scientific data or other relevant information to determine whether or not the MFL should be revised. If no revision is necessary, management tools that may be considered include the following:

- Developing alternative water supplies.
- Implementing structural controls and/or augmentation systems to raise levels or increase flows in water bodies.
- Reducing water use permitting allocations (e.g., through water conservation).

The following is a description of the District's SWUCA recovery strategy – the only recovery strategy adopted in the planning region to date.

1.0 Southern Water Use Caution Area

The purpose of the SWUCA recovery strategy (Rule 40D-80.074, F.A.C. and SWFWMD, 2006) is to provide a plan for reducing the rate of saltwater intrusion and restore low flows to the upper Peace River and lake levels by 2025, while ensuring sufficient water supplies and protecting the investments of existing WUP holders. The strategy has six basic components: regional water supply planning, use of existing rules, enhancements to existing rules, financial incentives, projects to achieve MFLs, and resource monitoring. Regional water supply planning allows the District and its communities to strategize on how to address growing water needs while minimizing impacts to the water resources and natural systems. Existing rules and enhancements to those rules will provide the regulatory criteria to accomplish the majority of recovery strategy goals. Financial incentives to conserve and develop alternative water supplies will help meet water needs, while implementation of water resource development projects will help reestablish minimum flows to rivers and enhance recharge. Finally, resource monitoring, reporting, and cumulative impact analysis will provide data to analyze the success of recovery. 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 implemented and considered.

The success of the SWUCA recovery strategy will be determined through continued monitoring of area resources. The District uses an extensive monitoring network to assess actual versus anticipated trends in water levels, flows and saltwater intrusion. Additionally, the District assesses the cumulative impacts of factors affecting recovery. Information developed as part of these monitoring and assessment efforts is provided to the Governing Board on an annually and on a five-year basis. Results from two five-year assessment of the SWUCA recovery strategy (SWFWMD 2013, 2018), indicate the District continues to make progress toward recovery, but challenges to achieving full recovery by 2025 remain. Recovery will ultimately be achieved through a combination of maintaining existing withdrawals at or below current levels and implementing water resource development projects designed to augment or preserve levels and flows.

2.0 Punta Gorda Water Supply Master Plan

Shell Creek, located in Charlotte County in the SWUCA, was impounded in the mid-1960s to create a reservoir to supply drinking water to the City of Punta Gorda. Minimum flows have not been adopted for the lower or upper segments of Shell Creek. Preliminary draft minimum flows identified for the lower segment of Shell Creek, below Hendrickson Dam, indicate a recovery strategy would need to be adopted in conjunction with establishment of the minimum flows. The City of Punta Gorda prepared a Water Supply Master Plan in 2006 and a Master Plan Update in 2009 to address their water supply issues. The City is supplied by the Shell Creek surface water treatment facility which has faced numerous operational challenges including poor source water quality, permitting restrictions on its ASR system, and the potential need of a recovery strategy for the lower segment of Shell Creek that could affect available withdrawals. Following a recommendation of the 2009 Master Plan Update, the City pursued the development of a brackish wellfield and reverse osmosis (RO) system to provide a blending source for the Shell Creek plant. The new RO facility was cooperatively funded by the District and will be complete in 2020. The District, the PRMRWSA, and the City are also constructing the Phase 1 regional interconnect to the treatment facility for supply-reliability, to allow supplies from the Shell Creek facility to be utilized regionally and help maintain minimum flow levels in Shell Creek.

Part D. Reservations

Reservations of water are established by rule and authorized 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…” (Section 373.223(4), F. S.).

In accordance with Rule 62-40.474, F.A.C., as exemplified by Rule 40D-2.302, F.A.C. for the SWUCA, the District will consider establishing a reservation of water when a District water resource development project will produce water needed to achieve and adopted MFL. The rule-making process associated with reservation adoption, 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. 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.

For example, within the Heartland Planning Region, the District is planning to reserve water to aid in the recovery of MFLs in the upper Peace River. To address identified recovery needs for the river, the District is implementing a project to raise water levels in Lake Hancock and use this stored water to provide a significant portion of the flows necessary for meeting the river's MFLs. Rulemaking to reserve from permitting the quantity of water stored in the lake to support the recovery effort is scheduled for completion in 2020. There are currently no plans to establish a reservation in the Southern Planning Region.

Part E. Climate Change

Section 1. Overview

Climate change has been a growing global concern for several decades. According to the Intergovernmental Panel on Climate Change (IPCC), the global mean average land and ocean temperatures have likely increased approximately 1.4 to 2.2°F from pre-industrial levels (IPCC, 2018). Such increases are driving a slow but persistent increase in sea levels and are altering precipitation regimes. These conditions will likely have local impacts including changes to natural habitats, encroachment of seawater into surface and groundwater resources, risk to public infrastructure, warmer temperatures that increase evaporation and impact agriculture, and changes to seasonal and annual rainfall patterns. Climate change is a global issue that requires international coordination and planning, although strategies for assessing vulnerabilities and developing adaptation plans are necessary on the local, regional, and statewide level.

In recent years, numerous agencies and organizations in Florida have developed initiatives to address climate change. Many of the state's Regional Planning Councils (RPCs) have pooled resources and are developing vulnerability assessments, climate adaptation plans, and post-disaster redevelopment plans for member communities. The FDEP's Community Resilience Initiative provides planning tools and promotes collaboration among RPCs and coastal communities. The WMDs and other agencies participate in focus groups organized by RPCs, Florid Sea Grant, and other entities to consolidate climate information, develop consistent approaches to planning, and provide technical expertise when appropriate. Other participants in these initiatives include the National Weather Service; regional water supply authorities; state universities; and Florida Fish and Wildlife Conservation Commission, Department of Transportation, Department of Health, FDEP, and the Division of Emergency Management.

Climate change is one water supply challenge among others such as droughts, water quality deterioration, and limitations on the availability of water resources. This section of the RWSP addresses climate issues for water supply planning, identifies current management strategies in place to address these concerns, and considers future strategies necessary to adaptively manage water supply resources.

Section 2. Possible Effects

The District's water supply planning efforts may be affected by climate change in three primary ways: sea level rise, air temperature rise, and changes in precipitation regimes.

1.0 Sea Level Rise

Data from the National Oceanic and Atmospheric Administration (NOAA) tide gauge in St. Petersburg shows that monthly mean water levels have already increased 7.8 inches from the gauge's first reliable records in 1946 to 2019 (CSAP, 2019). The latest NOAA projections over this report's 20-year horizon (2020 through 2040) estimate that local sea levels will rise by 3.5 inches based a linear extrapolation, 4.3 inches by factoring the likely acceleration, and over 12 inches if accounting for potential polar ice sheet instabilities. With a 50-year horizon (2020 through 2070), a common lifecycle for infrastructure design, the NOAA projections range from 9 inches to over 3 feet (Sweet et al, 2017).

Sea level rise (SLR) is likely to stress the District's water resources in a variety of ways. The inundation or upward migration of coastal wetlands may affect their ability to improve the quality of stormwater runoff and provide natural habitats. Estuarine water encroachment in coastal rivers may reduce the viable withdrawal periods at non-isolated freshwater intakes of water treatment facilities. Saltwater intrusion reduces water quality in aquifers that supply urban, agricultural, and industrial water users. Aging municipal sewer systems can experience infiltration that reduces the quality of reclaimed water currently used to offset fresh water demands.

One positive aspect is that SLR is projected to occur relatively slowly, although persistently, which allows time to thoroughly evaluate the impacts to natural resources and public infrastructure, plan and implement adaptation strategies, and continue to use most existing coastal infrastructure for several decades. The cost of initiating SLR planning or incorporating it into other existing efforts is relatively low compared to disaster recovery efforts.

2.0 Air Temperature Rise

The IPCC estimates that current green-house emission levels will cause mean global air temperatures to reach or stabilize at approximately 2.7°F above pre-industrial levels (1850 to 1900) by the end of this century, with greatest warming at inland and polar regions (IPCC, 2018). The impacts to southwest Florida will likely be more hot days and few cold days seasonally. Evaporation is likely to increase with a warmer climate, which could result in lower surface water levels and increased irrigation demand. Increased evaporation is likely to impact stormwater runoff, soil moisture, groundwater recharge, and reservoir storage losses (Bates et al., 2008). Additionally, higher air temperatures may exacerbate algal blooms and declines in reservoir water quality that could raise treatment costs for potable water supply.

3.0 Precipitation Regimes and Storm Frequency

Increasing temperatures are expected to change global precipitation patterns, although changes will likely be more pronounced in the earth's tropical and temperate zones. Southwest Florida, being sub-tropical, has climatic precipitation patterns largely influenced by Atlantic multidecadal oscillations (AMO) of ocean sea surface temperatures, along with shorter-term El Nino southern oscillations (ENSO). The AMO warm periods tend to make the region's summer-fall seasons wetter, while strong ENSO phases caused by warming in the eastern Pacific make the region's winter and spring seasons wetter (Cameron, 2018). An AMO warm phase is currently in effect.

Warming temperatures in the Atlantic and Gulf of Mexico can increase the likelihood of intense tropical storms and hurricanes that can generate storm surge, strong winds, and heavily concentrated rainfall. Hurricane activity near Southwest Florida is statistically more common during AMO warm periods. Higher summer temperatures and humidity may also increase the frequency of local convective weather events, resulting in thunderstorms, higher peak surface water flows, and increased flooding in some areas (Groisman et al., 2005).

Section 3. Current Management Strategies

The District has taken several steps to address the management of water resources that will also benefit efforts to plan and prepare for climate change impacts. 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 for natural systems and 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 Coastal Groundwater Quality Monitoring and Water-Use Permit networks are the largest and longest ongoing well sampling networks of their kind at the District. The networks currently have a combined total of over 350 wells that cover 13 counties, and new wells have been added to the networks at a rate of 5 to 10 wells per year. Having long-term water quality data will become increasingly important with continued demands for groundwater withdrawals in the District and statewide. Although the entire coastal region of the District is included in the monitoring effort, much emphasis is placed on the southern region of the District formally designated as the SWUCA. District staff is also determining how to use or modify existing groundwater models to predict density and water-level driven changes to aquifers utilized for water supply. Through cooperative funding, the District is assisting water utilities and regional water supply authorities with wellfield evaluations for improving withdrawal operations and planning for brackish treatment upgrades.

The District also encourages maximizing the use of diverse water supply sources and establishing system redundancies to ensure a resilient water supply. The District promotes water conservation across all use sectors, including agricultural and industrial uses, which not only saves supplies for the future but also reduces chemical and energy use. Through partnerships, the District continues to increase the availability and use of reclaimed water, the development of wet-weather storage facilities, and enhanced water efficiencies. 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 helps to fund environmentally sustainable and drought-resistant water supply options such as reclaimed water, stormwater reuse, brackish groundwater treatment, surface water reservoirs, ASR, AR, and seawater desalination.

Section 4. Future Adaptive Management Strategies

While ongoing District efforts can provide critical information and allow flexibility to accommodate future changes in water supply, local governments and industries are principally tasked with developing and communicating the appropriate risk assessment and adaptation strategy for each municipality or other significant water user. The commonly evaluated community adaptation strategies can be grouped into three generalized approaches: armament, accommodation, or organized retreat. The District is able to provide a supporting role during the planning and implementation for each of these approaches.

- Armament. An armament strategy involves the erection of defensive barriers such as dykes and pumping systems to protect existing infrastructure from storm surges and SLR. Armament may be a preferred approach for dense urban and commercial areas, although they may limit transitional natural habitats and create an effective tipping point for inundation. The community's existing water supply infrastructure and demand centers would be maintained.
- Accommodation. An accommodation strategy utilizes improved infrastructure such as elevated roads and buildings and canal systems that allow coastal inundation to occur. Accommodation strategies may suit growing municipalities that can apply innovative community planning to assure longevity. The District's water supply planning efforts may involve the technological development of alternative water supplies including AR systems, direct and indirect reuse, and RO treatment options for these communities. The District would also have a role in assuring the transitional health of water bodies.
- Organized Retreat. An organized retreat strategy may involve the rezoning of property threatened by inundation, or transfer to public ownership, potentially through rolling easements or post-disaster development plans. Retreat strategies typically include ecological engineering projects to assist the transition of natural habitats that will also provide shelter to upland infrastructure.

The District would account for these strategies through the five-year update schedule of the RWSP. The schedule allows sufficient time to anticipate transitional changes to population centers in the water demand projections, and to develop appropriate water supply options. Continued development of regionally interconnected water systems also allows large-scale water treatment facilities to adjust distribution to new demand locations.

Climate change may have a 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 the 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. For these reasons, the District is maintaining a "monitor and adapt" approach toward the protection of natural resources from 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 more evident.

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Chapter 3. Demand Estimates and Projections

This chapter is an analysis of the demand for water for all use categories in the Southern Planning Region for the 2015 to 2040 planning period. The chapter includes 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. The Southwest Florida Water Management District (SWFWMD) (District) projected water demand for the public supply (PS), agricultural (AG), industrial/commercial (I/C), mining/dewatering (M/D), power generation (PG) and landscape/recreation (L/R) water use sectors for each county in the planning region. 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 2040. The District determined 5-in-10 (average condition) and 1-in-10 (drought condition) demands for each five-year increment from 2015 to 2040 for each sector. The demand projections for Charlotte County, located partially in the District, reflect only the anticipated demands in the portion of the county located within the District's boundaries. Decreases in demand are reductions in the use of groundwater for the AG and I/C, M/D and PG use categories.

General reporting conventions for the Regional Water Supply Plan (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 water management districts (WMDs) and the Florida Department of Environmental Protection (FDEP), formed in 1997 as a means to reach consensus on the methods and parameters used in developing the RWSPs. Some of the key guidance parameters include:

- Establishment of a base year: The year 2015 was agreed upon as a base year for the purpose of developing and reporting 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 2015; whereas, data for the years 2020 through 2040 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 2040. 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

Demand projections were developed for five sectors: (1) PS, (2) AG, (3) I/C, M/D, (4) PG, and (5) L/R. The categorization provides for the projection of demand for similar water uses under similar assumptions, methods and reporting conditions.

Section 1. Public Supply

1.0 Definition of the Public Supply Water Use Sector

The PS sector is composed 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 (DSS) (individual private homes or businesses that are not utility customers that receive their water from small wells that do not require a WUP), and (4) additional irrigation demand (water from domestic wells that do not require a WUP 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 2015 would be the base year from which projections would be determined. The District calculated the 2015 population by extrapolating from GIS Associates, Inc.'s 2016 population estimate. Utilities with permitted quantities less than 100,000 gallons per day are not required to report population or submit service area information. Subsequently, population was obtained from the last issued permit.

Potable water pumping station

2.2 Methodology for Projecting Population

The population projections developed by the University of Florida 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. Subsequently, the District's projections are BEBR projections disaggregated to land parcel level, which is the smallest area of geography possible for population studies. In turn, these parcel-level projections are normalized to the BEBR medium projection for the counties. Using this methodology, the District contracted with GIS Associates, Inc. to provide small-area population projections for the 16 counties entirely or partly within the District.

3.0 2015 Base Year Water Use and Per Capita Rate

3.1 Base Year Water Use

The 2015 PS base year water use for each large utility is derived by multiplying the average 2011 to 2015 unadjusted gross per capita rate by the 2015 estimated population for each individual utility. For small utilities, per capita information is found in the last issued permit. If no per capita information is available, the per capita is assumed to equal the average county per capita. Base year water use for small utilities is obtained by multiplying the per capita from the current permit by the 2015 estimated population from the last issued permit. Domestic self-supply (DSS) base year is calculated by multiplying the 2015 DSS population for each county by the average 2011 to 2015 residential countywide per capita water use.

4.0 Water Demand Projection Methodology

4.1 Public Supply

Water demand is projected in five-year increments from 2020 to 2040. To develop the projections, the District used the 2011 to 2015 average per capita rate multiplied by the projected population for that increment. An additional component of PS demand is water derived from domestic wells for irrigation. These wells have a diameter of less than 6 inches, do not require a WUP 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 gallons per day (gpd) are used for each well.

4.2 Domestic Self-Supply

Domestic Self-Supply (DSS) is any portion of the county population not served by a utility. County DSS population estimates and projections were calculated as the difference between the total county population estimate or projection and the total population served by the utilities. For counties that are in multiple districts, only that portion of the population within the District was included.

5.0 Water Demand Projections

Table 3-1 presents the projected PS demand for the planning period. The table shows that demand will increase by 30.78 mgd for the 5-in-10 condition. These projections are lower than those in the District’s 2015 RWSP. The differences can be attributed to slower than anticipated regional population growth and more accurate utility level population projections using a GIS model that accounts for growth and build-out at the parcel level.

Table 3-1. *Projected PS demand including PS, DSS, and private irrigation wells in the Southern Planning Region (5-in-10 and 1-in-10) (mgd)*

County	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% Change	
	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
Charlotte	19.21	20.36	20.56	21.79	21.75	23.05	22.77	24.14	23.65	25.07	24.43	25.89	5.22	5.53	27.2%	27.2%
DeSoto	2.77	2.93	2.84	3.01	2.90	3.08	2.96	3.14	3.02	3.20	3.06	3.24	0.29	0.31	10.5%	10.6%
Manatee	39.48	41.85	43.46	46.06	47.36	50.20	50.84	53.89	53.92	57.16	56.54	59.94	17.06	18.09	43.2%	43.2%
Sarasota	40.25	42.67	42.56	45.11	44.58	47.25	46.17	48.94	47.46	50.31	48.46	51.36	8.21	8.69	20.4%	20.4%
Total	**101.71**	**107.81**	**109.42**	**115.97**	**116.59**	**123.58**	**122.74**	**130.11**	**128.05**	**135.74**	**132.49**	**140.43**	**30.78**	**32.62**	**30.3%**	**30.3%**

Note: Summation and/or percentage calculation differences occur due to rounding. See Appendix 3-3 for source values.

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.

Section 2. Agriculture

1.0 Description of the Agricultural Water Use Sector

Agriculture (AG) represents the second largest sector of water use in the District after PS. Included in this category are irrigated crops and other miscellaneous water uses associated with agricultural commodity production within the District. Irrigation demand was determined and reported in the RWSP for each of the following major categories of irrigated crops: (1) citrus, (2) field crops, (3), fruits (non-citrus), (4) greenhouse/nursery, (5) hay, (6) potatoes, (7) sod, and (8) fresh market vegetables. Most of these crop categories are self-explanatory, but some include several crops which are grouped together for reporting purposes by the Florida Department of Agriculture and Consumer Services (FDACS). The fruits category includes several prominent crops in the District, such as strawberries, blueberries, and peaches, and the fresh market vegetables category includes tomato production along with cucumbers, peppers and other vegetables. Water demands associated with non-irrigated agriculture such as aquaculture and livestock were also estimated and projected.

Agriculture represents the second largest sector of water use in the District after public supply

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 developed by FDACS as part of the Florida Statewide Agricultural Irrigation Demand (FSAID5) projections through 2040. These projections were based on trends in historic National Agricultural Statistics Service irrigated acreage data. Irrigation requirements were adjusted from the FSAID5 demands and were based on permit-level metered water use data. Where possible, permit-level water use rates were maintained, and in non-metered operations, average application rates were developed for each crop category by county. Per acre water use for each crop category was held constant, and changes in projected water demands were based on increases or decreases in irrigated acreages for each crop type. The methodologies are described, and detailed data are provided, in Appendix 3-1.

Non-irrigation demand (e.g., aquaculture and livestock) was based on a combination of metered water use at the permit level and estimated demands from the FSAID5 geodatabase which were based primarily on livestock count data and water demands per head. The projected trends were based on the FSAID5 projections, and demands were held steady throughout the planning period, based on steady statewide livestock counts and lack of data upon which to make better projections. The methodologies are described, and detailed data are provided, in Appendix 3-1.

In addition to the method developed by the District, which is based on the FSAID5 acreage projections and District metered water use rates, the FDACS has also developed a complete set of alternate water use projections through 2040. The District elected to use its modified FSAID5 approach to meet the statutory directive to use the best available data in developing agricultural water use projections. In this case, the District has extensive metered data on agricultural water use at the permit level, and the use of direct metered water use application rates will provide a more accurate assessment of local water use than synthesized modeled water use rates. This allows the District projections to capture permit-level and regional variations in grower irrigation practices. This also means that the application rates in the projections will also be reflective of the progress made in agricultural conservation through the District's Facilitating Agricultural Resource Management Systems (FARMS) Program and other regional efforts such as the SWUCA Recovery Strategy.

3.0 Water Demand Projections

Trends indicate that agricultural activities are expected to slightly increase in the Southern Planning Region during the planning period. Irrigated acreage is expected to increase by about five percent, from 158,000 acreage in 2016 to nearly 167,000 acres in 2040. This projection indicates a stabilization for the region, which has experienced a dramatic decrease in water use from peak levels in the early 2000s. Total agricultural water use in this region has fallen from over 160 to 260 mgd annually in the late 1990s and early to 2000s to about 107 mgd from 2014 to 2016.

Current average year demands are estimated at 105.05 mgd for 2016 acreage levels. The District projects that in 2040 the increase in irrigated acreage will result in a 4 percent increase in water demands to 109.65 mgd. Most of the increase in acreage will be in fresh market vegetables, with a small recovery in citrus acreage. FDACS forecasts that Charlotte, Desoto, and Manatee counties will gain about 10,000 acres of irrigated land, while Sarasota County is expected to have a slight decrease in irrigated acreage of about 1,900 acres. Citrus represents the largest or second largest crop by acreage in each of these counties, and the long-term response of the industry to citrus greening disease will likely drive water use trends in the Southern Planning Region. Table 3-2 displays projected combined agricultural irrigation and non-irrigation demands for the 5-in-10 (average) and 1-in-10 (drought) conditions for the planning period.

4.0 Stakeholder Review

District staff began presenting draft agricultural demand projections to the District's Agricultural and Green Industry Advisory Committee permit evaluation staff and FDACS staff in September 2018. The District additionally requested input from the Agricultural and Green Industry Advisory Committee on the FSAID5 water use projections and methodology as well as the adjusted FSAID5 method developed by the District. The Committee wished to take time to consider the proposed methods and adjourned to solicit feedback from industry groups and other stakeholders. In October 2018, the Committee reconvened, and District staff provided an additional presentation on the potential agricultural projections methods and draft results. Stakeholders present included representatives from the Florida Turfgrass Association, Florida Citrus Mutual, Florida Strawberry

Growers Association, Florida Nursery Growers and Landscape Association, and University of Florida Institute of Food and Agricultural Sciences (IFAS), among others. After discussion, the Agricultural and Green Industry Advisory Committee unanimously voted to support the District's updated Agricultural Water Demands Projections Methodology based on FSAID5 acreage projections and adjustments to the incorporated District metered water use data. Additionally, the District consulted with staff from the FDACS Office of Agricultural Water Policy on the proposed method, and FDACS assented to the Districts' method based on FSAID5 acreage projections and District metered water use data.

Table 3-2. *Projected AG demand in the Southern Planning Region (5-in-10 and 1-in-10) (mgd)*

County	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% Change	
	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
Charlotte	8.12	11.39	8.31	11.65	8.75	12.26	9.20	12.86	9.89	13.76	10.30	14.29	2.18	2.90	26.8%	25.5%
DeSoto	44.09	64.75	44.29	65.03	44.45	65.24	44.63	65.50	44.70	65.61	45.09	66.15	1.00	1.40	2.3%	2.2%
Manatee	48.87	64.43	49.28	64.97	49.68	65.48	50.45	66.49	50.93	67.12	51.34	67.68	2.47	3.25	5.1%	5.0%
Sarasota	3.97	4.99	3.71	4.64	3.60	4.51	3.24	4.050	3.03	3.75	2.92	3.62	-1.05	-1.37	-26.4%	-27.5%
Total	**105.05**	**145.56**	**105.59**	**146.29**	**106.48**	**147.49**	**107.52**	**148.90**	**108.55**	**150.24**	**109.65**	**151.74**	**4.60**	**6.18**	**4.4%**	**4.2%**

Note: Summation and/or percentage calculation differences occur due to rounding. See Appendix 3-1 for source values.

Section 3. Industrial/Commercial and Mining/Dewatering

1.0 Description of the Industrial/Commercial and Mining/Dewatering Water Use Sectors

Industrial/Commercial (I/C) and Mining/Dewatering (M/D) 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. 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 for the 2020 RWSP were developed by multiplying the 2015 amount of water used for each I/C and M/D facility by growth factors based on Woods & Poole Economics' gross regional product (GRP) forecasts by county in five-year increments. For example, if an I/C facility used 0.30 mgd in 2015 and the county calculated growth factor from 2015 to 2020 was 3 percent, the 2020 projection for that facility would be 1.03 x 0.30 = 0.31 mgd. If the 2015 to 2020 growth factor was 4 percent, the 2020 projection would be 0.32 mgd. Water use for 2015 is derived from the District's 2015 Water Use Well Package Database (WUWPD).

This methodology was applied for all sectors with the exception of Mosaic Company M/D permits (ore processing). The District was asked by Mosaic to consider data on future mining activity at current and future mine sites contained in a recently prepared environmental impact study. In lieu of changing 2010 baseline pumpage in accordance with growth factors based on projected gross regional product, percent changes in Mosaic-projected permitted quantities by county were used to project use quantities from the 2010 baseline pumpage. Please see Appendix 3-2 for more details.

3.0 Water Demand Projections

Table 3-3 shows the projected net change in I/C and M/D water demand for the planning period. Demand is projected to change from 6.09 mgd in 2015 to 10.65 mgd in 2040, a change of 74.9 percent, due primarily to a projected increase in mining activities in Manatee County.

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 WUP bureau. Non-consumptive dewatering uses are no longer included in permitted quantities. Starting with the 2010 RWSP, demand projections were included for all 16 counties; whereas, earlier RWSPs included demand projections for only the 10 southern counties. Additionally, mining quantities permitted for product entrainment were not included in the 2010 or 2015 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).

In accordance with the 2019 Format and Guidelines, the 5-in-10 and 1-in-10 demands are the same. The uses "are assumed to be reasonably the same in a 1-in-10-year drought event as in an average year (i.e., no significant demand variation)" (FDEP et al., June 2009).

Table 3-3. *Projected I/C and M/D demand in the Southern Planning Region (5-in-10 and 1-in-10) (mgd)*

County	2015 Base	2020	2025	2030	2035	2040	Change 2015-2040	% Change
Charlotte	0.14	0.08	0.09	0.09	0.09	0.09	-0.05	-35.7%
DeSoto	0.59	0.60	0.62	0.63	0.64	0.66	0.06	11.9%
Manatee	4.99	6.15	6.17	9.55	9.56	9.57	4.58	91.8%
Sarasota	0.37	0.30	0.31	0.32	0.33	0.33	-0.04	-10.8%
Total	**6.09**	**7.13**	**7.19**	**10.59**	**10.62**	**10.65**	**4.56**	**74.9%**

Note: Summation and/or percentage calculation differences occur due to rounding. See Appendix 3-2. Changes in small demand numbers across time can represent a large percent change in demand over time that is not readily seen from the rounded values in the table.

4.0 Stakeholder Review

The demand projection methodology, results, and analyses were provided to the District's water use permitting staff and I/C and M/D 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 additional stakeholder comments, the District reviewed suggested changes and, when appropriate, included updates.

Section 4. Power Generation

1.0 Description of the PG Water Use Sector

The PG uses within the District include water for thermoelectric power generation used for cooling, boiler make-up water, or other purposes associated with the generation of electricity. The PG quantities have previously been grouped with I/C and M/D quantities but are provided separately in this section per the 2019 Format and Guidelines (FDEP et al., 2019).

2.0 Demand Projection Methodology

Demand projections for the 2020 RWSP were developed by multiplying the 2015 amount of water used for each PG facility by growth factors based on Woods & Poole Economics' GRP forecasts by county in five-year increments. For example, if a PG facility used 0.30 mgd in 2015 and the county calculated growth factor from 2015 to 2020 was 3 percent, the 2020 projection for that facility would be 1.03 x 0.30 = 0.31 mgd. If the 2015 to 2020 growth factor was 4 percent, the 2020 projection would be 0.32 mgd. Water use for 2015 is derived from the WUWPD. Please see Appendix 3-2 for more detail.

3.0 Water Demand Projections

Table 3-4 shows the projected increase in PG water demand for the planning period. Demand in 2015 was 3.60 mgd and is expected to be 4.64 mgd in 2040, an increase of 28.9 percent. The demand projections do not include reclaimed, seawater, or non-consumptive use of freshwater.

In accordance with the 2019 Format and Guidelines, the 5-in-10 and 1-in-10 demands are the same. Power generation (PG) uses "are assumed to be reasonably the same in a 1-in-10-year drought event as in an average year (i.e., no significant demand variation)" (FDEP et al., June 2009).

Table 3-4. *Projected PG demand in the Southern Planning Region (5-in-10 and 1-in-10)) (mgd)*

County	2015 Base	2020	2025	2030	2035	2040	Change 2015-2040	% Change
Charlotte	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
DeSoto	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Manatee	3.60	3.69	3.92	4.17	4.40	4.64	1.04	28.9%
Sarasota	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Total	**3.60**	**3.69**	**3.92**	**4.17**	**4.40**	**4.64**	**1.04**	**28.9%**

Note: Summation and/or percentage calculation differences occur due to rounding. See Appendix 3-2 for source values. Changes in small demand numbers across time can represent a large percent change in demand over time that is not readily seen from the rounded values in the table.

4.0 Stakeholder Review

The demand projection methodology, results, and analyses were provided to the District's water use permitting staff and 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 additional stakeholder comments, the District reviewed suggested changes and, when appropriate, included updates.

Section 5. Landscape/Recreation

1.0 Description of the Landscape/Recreation Water Use Sector

The L/R sector 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 major users within this category.

2.0 Demand Projection Methodology

Landscape/Recreation (L/R) baseline use data is from the WUWPD (SWFWMD, 2017). This database includes metered use for active individual/general permits and estimated use for General Permits by Rule. The projection methodologies are divided into those for golf and those for other L/R demand. A more detailed description of the methodologies used is contained in Appendix 3-4.

Based on comments from knowledgeable stakeholders that initial demand projections for golf may be too high, the District engaged the services of a respected golf industry consulting firm to develop county-level percent changes in demand for 18-hole equivalent golf courses for each five-year period of the planning period. The percent changes were then applied to the previous five-year period's pumpage beginning with the 2015 baseline pumpage. The projected percentage changes were based on projected socioeconomic factors such as household income and ethnicity, and golf play rates associated with those socioeconomic factors.

Landscape and other recreation demands are based on population growth within each county. Water use for this sector is assumed to grow at the projected county-level percent change in population. The five-year population percent changes were calculated for each five-year period and then applied to the previous five-year period's pumpage, beginning with the baseline pumpage.

3.0 Water Demand Projections

Table 3-5 provides total L/R demand for the planning period (both golf and other L/R demand). An increase in demand of 3.41 mgd for the 5-in-10 condition is projected between 2015 and 2040. This represents an increase in demand of 18.4 percent. Reclaimed water has made a definite impact on golf course water use and this should continue into the future. Most landscape/recreation water use occurs near major population centers in the coastal counties where large quantities of reclaimed water can be used to offset the use of potable water for this category.

Table 3-5. *Projected L/R demand in the Southern Planning Region (5-in-10 and 1-in-10) (mgd)*

County	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% Change	
	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
Charlotte	1.79	2.30	1.83	2.36	1.87	2.40	1.90	2.44	1.92	2.47	1.95	2.50	0.16	0.20	8.9%	8.7%
DeSoto	0.33	0.42	0.33	0.42	0.34	0.43	0.34	0.43	0.34	0.44	0.35	0.44	0.02	0.02	6.1%	4.8%
Manatee	9.85	12.48	10.28	13.02	10.87	13.77	11.39	14.42	11.86	15.01	12.26	15.52	2.41	3.04	24.5%	24.4%
Sarasota	6.53	8.36	6.77	8.66	6.96	8.91	7.12	9.11	7.25	9.27	7.35	9.40	0.82	1.04	12.6%	12.4%
Total	**18.50**	**23.56**	**19.21**	**24.46**	**20.04**	**25.51**	**20.75**	**26.40**	**21.37**	**27.19**	**21.91**	**27.86**	**3.41**	**4.30**	**18.4%**	**18.3%**

Note: Summation and/or percentage calculation differences occur due to rounding. See Appendix 3-4 for source values.
Quantities do not include reclaimed water, re-pumped groundwater from ponds or stormwater.

4.0 Stakeholder Review

The demand projection methodology, results and analyses were provided to the District's water use permitting staff and L/R use sector stakeholders for review and comment. The District's Agricultural and Green Industry Advisory Committee generally confirmed stable or decreasing water demands for golf as part of the L/R projections.

Section 6. Summary of Projected Demands

Tables 3-6 summarizes the projected changes in demand for the 5-in-10 and 1-in-10 conditions for all use categories in the planning region. It shows that 44.39 mgd of additional water supply will need to be acquired from permitted reserves, developed, and/or existing use retired to meet demand in the planning region through 2040. Public supply (PS) water use will increase by 30.78 mgd over the planning period. Agricultural (AG) water uses will increase by 4.6 mgd. The I/C and M/D water uses will increase by 4.56 mgd and the PG water use will increase by 1.04 mgd. The L/R water use will increase by 3.41 mgd. Table 3-7 summarizes the projected demands for each county in the planning region for the 5-in-10 condition.

Table 3-6. *Summary of the projected demand in the Southern Planning Region (5-in-10 and 1-in-10) (mgd)*

Water Use Category	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% Change	
	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
PS	101.71	107.81	109.42	115.97	116.59	123.58	122.74	130.11	128.05	135.74	132.49	140.43	30.78	32.62	30.3%	30.3%
AG	105.05	145.56	105.59	146.29	106.48	147.49	107.52	148.90	108.55	150.24	109.65	151.74	4.60	6.18	4.4%	4.2%
I/C & M/D	6.09	6.09	7.13	7.13	7.19	7.19	10.59	10.59	10.62	10.62	10.65	10.65	4.56	4.56	74.9%	74.9%
PG	3.60	3.60	3.69	3.69	3.92	3.92	4.17	4.17	4.40	4.40	4.64	4.64	1.04	1.04	28.9%	28.9%
L/R	18.50	23.56	19.21	24.46	20.04	25.51	20.75	26.40	21.37	27.19	21.91	27.86	3.41	4.30	18.4%	18.3%
Total	**234.95**	**286.62**	**245.04**	**297.54**	**254.22**	**307.69**	**265.77**	**320.17**	**272.99**	**328.19**	**279.34**	**335.32**	**44.39**	**48.70**	**18.9%**	**17.0%**

Notes: Summation and/or percentage calculation differences occur due to rounding.

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

Water Use Category	Planning Period						Change 2015-2040	
	2015	2020	2025	2030	2035	2040	mgd	%
Charlotte								
PS	19.21	20.56	21.75	22.77	23.65	24.43	5.22	27.2%
AG	8.12	8.31	8.75	9.20	9.89	10.30	2.18	26.8%
I/C & M/D	0.14	0.08	0.09	0.09	0.09	0.09	-0.05	-35.7%
PG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
L/R	1.79	1.83	1.87	1.90	1.92	1.95	0.16	8.9%
Cumulative Total	**29.26**	**30.78**	**32.46**	**33.96**	**35.55**	**36.77**	**7.51**	**25.7%**
DeSoto								
PS	2.77	2.84	2.90	2.96	3.02	3.06	0.29	10.5%
AG	44.09	44.29	44.45	44.63	44.70	45.09	1.00	2.3%
I/C & M/D	0.59	0.60	0.62	0.63	0.64	0.66	0.06	11.9%
PG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
L/R	0.33	0.33	0.34	0.34	0.34	0.35	0.02	6.1%
Cumulative Total	**47.78**	**48.06**	**48.31**	**48.56**	**48.70**	**49.16**	**1.38**	**2.9%**
Manatee								
PS	39.48	43.46	47.36	50.84	53.92	56.54	17.06	43.2%
AG	48.87	49.28	49.68	50.45	50.93	51.34	2.47	5.1%
I/C & M/D	4.99	6.15	6.17	9.55	9.56	9.57	4.58	91.8%
PG	3.60	3.69	3.92	4.17	4.40	4.64	1.04	28.9%
L/R	9.85	10.28	10.87	11.39	11.86	12.26	2.41	24.5%
Cumulative Total	**106.79**	**112.86**	**118.00**	**126.40**	**130.67**	**134.35**	**27.56**	**25.8%**
Sarasota								
PS	40.25	42.56	44.58	46.17	47.46	48.46	8.21	20.4%
AG	3.97	3.71	3.60	3.24	3.03	2.92	-1.05	-26.4%
I/C & M/D	0.37	0.30	0.31	0.32	0.33	0.33	-0.04	-10.8%
PG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
L/R	6.53	6.77	6.96	7.12	7.25	7.35	0.82	12.6%
Cumulative Total	**51.12**	**53.34**	**55.45**	**56.85**	**58.07**	**59.06**	**7.94**	**15.5%**
Region Total	**234.95**	**245.04**	**254.22**	**265.77**	**272.99**	**279.34**	**44.39**	**18.9%**

Notes: Summation and/or percentage calculation differences occur due to rounding. Changes in small demand numbers across time can represent a large percent change in demand over time that is not readily seen from the rounded values in the table. Additional water quantities may be required over the planning period to address environmental restoration needs for water bodies discussed in Chapter 2.

Section 7. Comparison of Demands between the 2015 Regional Water Supply Plan and the 2020 Regional Water Supply Plan

There are several notable differences between the 2015 and 2020 RWSP demand projections. Th 2015 base numbers include a reduction in demands for the AG, I/C and M/D sectors from the 2015 projected numbers used in 2015 RWSP, whereas the PS and PG categories include slight increases in demands when compared with the 2015 RWSP. The differences for the PS category are largely attributable to methodology changes that include a parcel-based population projection approach. Regarding the PS category, the 2015 RWSP projected an increase of 28.68 mgd for the 2010 to 2035 planning period, while the 2020 RWSP projects an increase of 30.78 mgd from 2015 to 2040, only slightly higher than the 2015 RWSP.

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Chapter 4. Evaluation of Water Sources

This chapter presents the results of investigations by the Southwest Florida Water Management District (SWFWMD or District) to quantify the amount of water that is potentially available from all sources of water within the planning region to meet demands through 2040. 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 2040.

Part A. Evaluation of Water Sources

Fresh groundwater from the UFA is currently the primary source of supply for all use categories except public supply in the planning region. Public supply users acquire approximately 60 percent from surface water facilities, and brackish water treatment facilities are also prevalent in the region. It is assumed that sources other than fresh groundwater will meet much of the projected demands during the planning period. This assumption is based largely on the impacts of groundwater withdrawals on water resources in the SWUCA, as 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 UFA, 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 or ASR systems for storage. To facilitate the development of these projects, the District encourages partnerships between neighboring municipalities and counties for purposes of developing regionally coordinated water supplies.

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. Fresh Groundwater

Fresh groundwater from the UFA is the principal source of water supply for all use categories in the planning region. In 2017, approximately 76 percent (204 mgd) of the 269 mgd of water (including domestic self-supply [DSS]) used in the planning region was from groundwater sources. Approximately 18 percent (48 mgd) of the fresh groundwater used was for public supply (PS) (permitted and DSS). 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

The surficial aquifer is mostly composed of fine-grained sand that is generally less than 50 feet thick. While small-diameter, low-yield wells can be constructed in the surficial aquifer almost anywhere, there clearly are more favorable areas for development. In general, the surficial aquifer is most productive in areas where it is greater than 100 feet thick or where it includes a significant shell bed, as is the case in the southwest portion of the planning region in Charlotte, southern DeSoto, and Sarasota counties.

Permitted surficial aquifer withdrawals are for PS and agricultural (AG) uses. The Gasparilla Island Water Association in Charlotte County has maintained a surficial aquifer wellfield near Placida for PS use for over 30 years. The average depth of each well is 25 feet. The Englewood Water District in southwest Sarasota County also withdraws from surficial aquifer wells for PS. Withdrawals from wells with WUPs in the surficial aquifer occur in Charlotte County and were 0.1 mgd in 2014. Small, unpermitted quantities are also withdrawn from domestic wells for lawn watering or household use. The quantity of water estimated for this use totaled 0.1 mgd for Charlotte, DeSoto, Manatee, and Sarasota counties in 2014.

It is difficult to quantify the potential availability of water from the surficial aquifer on a regional basis due to the uncertainty in hydraulic capacity of the aquifer, local variations in geology and existing water use that may limit supply. For this reason, estimates of available quantities from the surficial aquifer were combined with estimates of available quantities from the intermediate aquifer system. These estimates were largely based on identifying the types of uses that could be reasonably supplied by these aquifers. These uses include residential turf and landscape irrigation and golf course and common area landscape irrigation.

Agriculture is also a significant user in Charlotte, southern DeSoto, and southern Sarasota counties, where significant shell beds have been identified in the surficial aquifer. In Charlotte County, a four-acre pit excavated into a shell bed is utilized for citrus irrigation. At least four other citrus operations in eastern Charlotte County are planning to irrigate with water from shell pits. In most cases, these withdrawals will supplement or replace withdrawals of poor-quality water from the UFA. It is possible that up to 5 mgd of water could be obtained from these shell beds in the southwest part of the planning region (Basso, 2009). Additional exploratory drilling and testing would greatly expand knowledge of the ultimate water-producing potential of these beds.

2.0 Intermediate Aquifer System

The intermediate aquifer system, or the Hawthorn aquifer system, lies between the surficial aquifer and the UFA. It exists over much of the planning region and is most productive in Charlotte, DeSoto, and Sarasota counties. Use of the aquifer increases in the southern portion of the region where the water-bearing zones increase in permeability and water quality of the UFA is poor.

The upper portion of the intermediate aquifer system is characterized by low permeability and is of limited extent. Water in this part of the aquifer is generally of sufficient quality and quantity for DSS indoor water use/outdoor irrigation and recreational uses. Annual average water use from permitted withdrawals within the intermediate aquifer system in 2006 was 34.8 mgd, with 44 percent (15.3 mgd) occurring in Sarasota County, 30 percent (10.6 mgd) in Charlotte County, 19 percent (6.6 mgd) in DeSoto County, and 7 percent (2.3 mgd) in Manatee County.

Small, unpermitted quantities are also withdrawn from the aquifer for lawn watering or individual household use. The quantity of water for these uses is estimated to be a total of 5.1 mgd in Sarasota, Charlotte, DeSoto, and Manatee counties in 2006. The estimated availability of water from the surficial and intermediate aquifers to meet demand in the planning region is 12.5 mgd (excluding 3.0 mgd that will replace existing UFA withdrawals), with 3.4 mgd allocated to recreational use, 5.1 mgd to DSS and household irrigation use, and 4.0 mgd to agricultural irrigation. See Table 4-1 for a summary of this estimated demand.

Table 4-1. *Estimated demand for groundwater from the surficial and intermediate aquifers (mgd)*

County	Domestic Self-Supply/ Irrigation	Recreation	Agriculture[1]	Total
Charlotte	0.9	0.2	3.0[1]	4.1
DeSoto	0.2	0.0	1.0	1.2
Manatee	1.0	2.4	0.0	3.4
Sarasota	3.0	0.8	0.0	3.8
Total	**5.1**	**3.4**	**4.0**	**12.5**

[1] Replacement of existing UFA withdrawals.

3.0 Upper Floridan Aquifer

During development of the SWUCA Recovery Strategy (2006), it was anticipated that development of new water supplies from the UFA in the region would be limited due to existing impacts to minimum flows and levels (MFLs) water bodies. Requests for new groundwater supplies would not be allowed to cause further lowering of water levels in impacted MFLs water bodies.

The SWUCA Recovery Strategy emphasized the implementation of conservation measures and development of alternative water supplies (AWSs) as much as possible to meet future additional demands. Additionally, it was thought that changes in land use would result in the opportunity for some new demands to be met by accessing some portion of historically used groundwater withdrawals that were retired as a result of a change in land-use activities. However, based on demand projections prepared for this plan and work completed for the SWUCA Five-Year Assessment (SWFWMD, 2018), it appears that the ability to meet future water demands based on changes in land use activities is more limited than previously anticipated. Chapter 3, Table 3-6, indicates a net demand increase of 5.60 mgd for I/C, M/D, PG sectors combined and 4.60 mgd for agricultural irrigation by 2040, which is anticipated to be primarily met with groundwater.

It is also anticipated that some reductions in the use of groundwater can be achieved as a result of the District's comprehensive agricultural water conservation initiatives and the permanent retirement of WUPs on lands purchased for conservation. These reductions could be used to help meet the SWUCA Saltwater Intrusion Minimum Aquifer Level (SWIMAL) and lake MFLs, and/or to mitigate impacts from new groundwater withdrawals.

3.1 Intermediate and Upper Floridan Aquifer Permitted/Unused Quantities

A number of PS utilities in the planning region are not currently 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 PS WUPs in the planning region, approximately 25.9 mgd of additional groundwater quantities are available.

It is important to consider current impacts to MFL water bodies and other environmental features. Because of impacts that have occurred, it is possible that, in the future, some portion of currently permitted demands will need to be met using alternative water sources.

Section 2. Water Conservation

1.0 Non-Agricultural Water Conservation

Non-agricultural water conservation is defined as the beneficial reduction of loss, waste, or other inefficient uses of water accomplished through the implementation of mandatory or voluntary best management practices (BMPs) that enhance the efficiency of both the production and distribution of potable water (supply-side measures) and indoor or outdoor water use (demand-side measures). The implementation of a comprehensive portfolio of conservation measures creates the benefits listed below:

- Infrastructure and Operating Costs. The conservation of water allows utilities to defer expensive expansions of potable water and wastewater systems, while limiting operation and maintenance costs at existing treatment plants, such as the use of electricity for pumping and treatment or expensive water treatment chemicals.
- Fiscal Responsibility. Most water conservation measures have a cost-effectiveness that is more affordable than that of other AWS sources such as reclaimed water or desalination. 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 designs and practices, including the promotion of Florida-Friendly Landscaping™ (FFL), can provide natural habitat for native wildlife as well as reduce unnecessary runoff from properties into water bodies. This, in-turn, can reduce nonpoint-source pollution, particularly from operations that use fertilizers, pesticides or fungicides, which, in turn, may hamper a local government's overall strategy of dealing with total maximum daily load (TMDL) restrictions within their local water bodies or maintain spring water quality health.

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. The District has a long history of successful water use reduction projects, which encourages water users to seek assistance by working with District staff when implementing water-saving and educational water conservation programs.

Water savings have been achieved in the Southern Planning Region through a combination of regulatory and economic measures, as well as incentive-based outreach and technical assistance for the development and promotion of the most recent technologies and conservation activities. Regulatory measures include WUP conditions, year-round water restrictions, and municipal 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 FFL. Periodically, water management districts (WMDs) in Florida issue water shortage orders that require short-term mandatory water conservation through situational BMPs and other practices.

Economic measures, such as inclining block rate structures, are designed to promote conservation by providing price signals to customers of public water supply systems to reduce inefficient use. 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, high-efficiency toilets (HET), low-flow faucet aerators, high-efficiency showerheads, smart irrigation controllers, rain sensors, and soil moisture sensors., Recognition programs, such as the District's Water Conservation Hotel and Motel Program (CHAMP℠) and Florida Water Star℠ (FWS), are also incentive programs that recognize homeowners and businesses for their environmental stewardship.

The District's Utilities Services Group provides guidance and technical expertise to PS water utilities and helps identify and reduce water loss. The non-regulatory assistance and educational components of the program maximize water conservation throughout the PS water use sector and improve both local utility system efficiency and regional water resource benefits. Among the services provided upon request are leak detection surveys, meter accuracy testing, and water audit guidance and evaluation. Since the program's inception, the leak detection team has conducted 155 leak detection surveys throughout the District, locating 1,554 leaks of various sizes and totaling an estimated 5.86 mgd. In the Southern Planning Region, the District leak detection team has conducted 13 leak detection surveys, locating 75 leaks totaling an estimated 0.18 mgd.

For the past 10 years, the District has administered the statewide FWS voluntary water conservation certification program for new and existing homes and commercial developments. Residences, businesses, and communities can earn FWS certification through meeting efficiency standards in appliances, plumbing fixtures, irrigation systems, and landscapes.

A single-family home built to meet FWS criteria may use at least 40 percent less water outdoors and approximately 20 percent less water indoors than a home built to the current Florida Building Code. Local governments that adopt FWS criteria as their standard for new construction can expect greater long-term savings to occur than for similar structures built to conventional standards. In addition, FWS offers installation and BMPs training for landscapers and irrigation contractors, providing an opportunity for them to become FWS accredited professionals.

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 measurable, the effort greatly increases the success of all other facets of a 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 conservation education programs accompanied with other effective conservation measures can be an effective supplement to a long-term water conservation strategy. On a Districtwide scale, water conservation efforts have contributed to declining unadjusted gross per capita use rates, from 115 gallons per day (gpd) per person in 2005 to 97 gpd per person in 2015. The per capita use rate for the District is the lowest of all five WMDs. The per capita trend for the Southern Planning Region is also decreasing as shown in Figure 4-1.

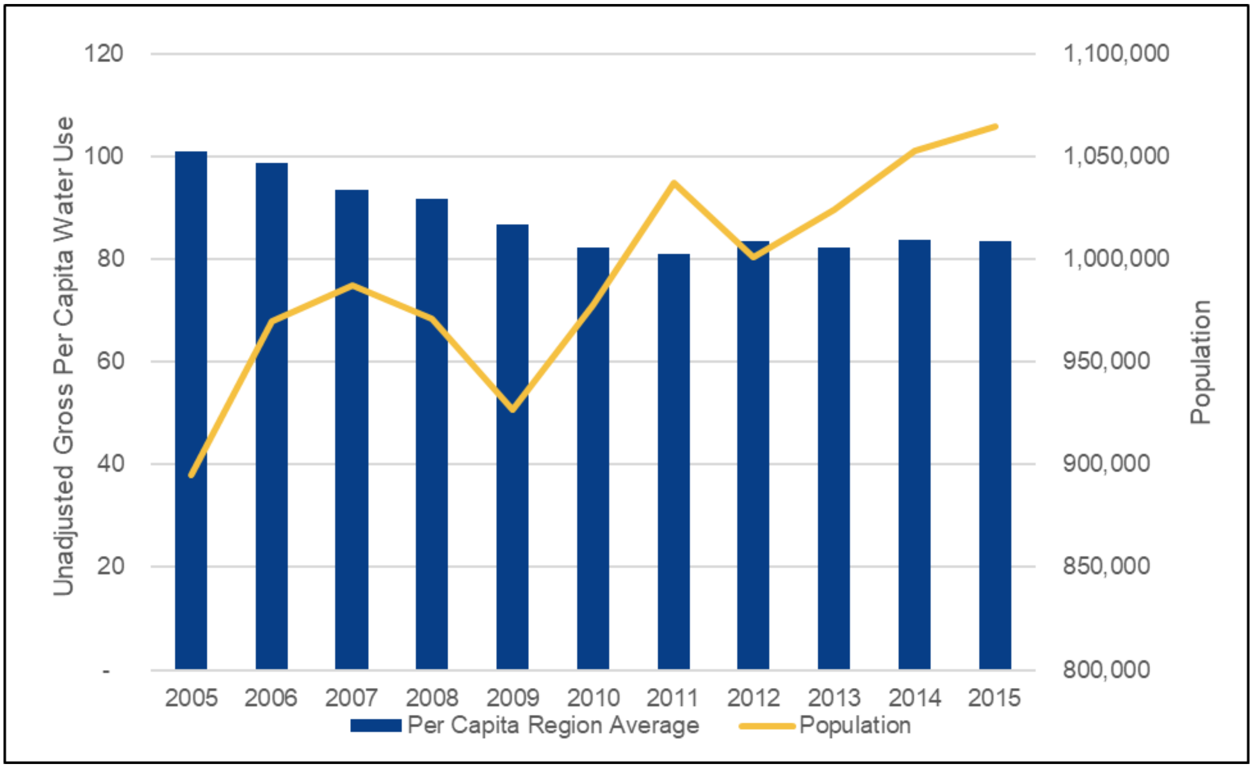

Figure 4-1. *Per capita water use rates in the Southern Planning Region, 2005-2015*

1.1 Public Supply

The PS sector includes all water users that receive water from public water systems and private water utilities. The PS sector may include non-residential customers such as hospitals and restaurants that are connected to a utility potable distribution system. Water conservation in the PS sector will continue to be the primary source of water savings in the District. Public supply systems lend themselves most easily to the administration of conservation programs since they measure each customer's water use and can focus, evaluate, and adjust the program to maximize savings potential. The success of the District's water conservation programs for PS systems to date is demonstrated by the 15.8 mgd in savings that has been achieved within the District since programs began in 1991. Within the region, it is estimated that savings for the PS category could be almost 7.67 mgd by 2040, if all water conservation programs presented below are implemented (See Table 4-3).

1.1.1 Water Conservation Potential in the Southern Planning Region

The Water Conservation Tracking Tool (AWE Tool) (Alliance for Water Efficiency, 2019) was used to estimate water conservation potential in the Southern Planning Region. This tool is built to assist utilities in determining the costs and benefits of passive and active conservation. It was chosen for use in measuring conservation in the Southern Planning Region due to its customizability and user friendliness given that it is based in Microsoft Excel.

1.1.2 Assessment Methodology

Water savings and costs were estimated using the AWE Tool on a utility-by-utility basis. Individualized water conservation projections were developed for the nine utilities that comprise approximately 90 percent of the total water use for the region and were separated into two categories: passive and active. The nine utilities included in the analysis are Manatee, Sarasota, and Charlotte counties, the cities of Sarasota, Bradenton, Punta Gorda, North Port and Venice, and the Englewood Water District.

Passive Conservation

Passive water conservation refers to water savings that occur as a result of users implementing water conservation measures in the absence of utility incentive programs. These are typically the result of building codes, manufacturing standards, and ordinances that require the installation of high-efficiency plumbing fixtures and appliances in new construction and renovations. Passive water conservation has been observed as a major contributor to decreasing per capita water use across the country. Projections were developed using the AWE Tool along with information from property appraiser databases, Public Supply Annual Reports, and census data. The AWE Tool calculates passive water conservation savings for toilets, showerheads, clothes washers, and dishwashers. There are two components in the AWE Tool's passive water conservation savings calculation:

- Natural Replacement Savings: This accounts for water savings that occur as a result of the natural fixture and appliance replacements during the planning horizon. This occurs as older devices reach the end of their service lives or are otherwise replaced by newer, more efficient models. Passive replacement rates assumed by the AWE Tool can be found below in Table 4-2.
- Water Savings Adjustment Factor: Newer homes built over the planning horizon are more efficient in their indoor water use than existing older homes. When newer homes are combined with existing homes, the ratio of high-efficiency to low-efficiency fixtures and appliances will increase as compared to the ratio in the 2015 baseline from which demands were based.

Active Conservation

Active water conservation encompasses a variety of measures, practices, and programs sponsored or encouraged by utilities and municipal governments which result in water use reductions. By their nature, active water conservation programs are typically funded and administered by PS utilities or other regional entities. Using the AWE Tool and other data from Public Supply Annual Reports, previously co-funded local conservation projects, "Determination of Landscape Irrigation Water Use in Southwest Florida" by Michael D. Dukes and Mackenzie J. Boyer (2018), and the *Handbook of Water Use and Conservation* by Amy Vickers (2010), the conservation potential and costs for several conservation activities that utilities could implement were estimated. Conservation activities included in the analysis are:

- High-efficiency Toilets (HET) (Residential)
- Smart Irrigation Controllers

- High-efficiency Toilets (HET) (Industrial/Commercial)
- High-efficiency Showerheads
- Landscape and Irrigation Evaluations/Audits
- Rain Sensors
- Soil Moisture Sensors

For indoor activities, the AWE Tool estimates the number of older, inefficient fixtures available for replacement in a given year after factoring in passive replacement. A participation rate is applied to this number, and the result is divided over the number of years in the planning horizon to calculate the estimated annual number of replacements. Subsequently, the annual savings and costs are determined. A similar approach is taken for outdoor conservation activities. Rather than basing the annual number of replacements on the number of inefficient fixtures, it is based on a subset of the number of dwelling units within a given service area. This subset is the number of high users that are likely over irrigating. The participation rate is then applied to the number of high users and divided by the number of years in the planning horizon to obtain the number of implementations for each outdoor activity. For additional input parameters used in the estimation, see Table 4-2.

Table 4-2. *Input parameters used in AWE Tool conservation estimation*

Conservation Activities	Participation Rates	Passive Replacement Rates
• High-efficiency Toilets (HET) (Residential) • Smart Irrigation Controllers • High-efficiency Toilets (HET) (Industrial/Commercial) • High-efficiency Showerheads • Landscape and Irrigation Evaluations/Audits • Rain Sensors • Soil Moisture Sensors	• 30 percent participation for all activities • For outdoor activities, participation rate is applied to a subset of users called "high users" [1] • High users considered to be 4 percent of residential customers, except for rain sensor activity[2] and the City of Punta Gorda[3]	• 4 percent per year for toilets (25-year life) • 12 percent per year for showerheads (8-year life) • 7.1 percent per year for clothes washers (14-year life) • 6.7 percent per year for dishwashers (15-year life)

[1] Participation rates for outdoor conservation activities were based in part on "Determination of Landscape Irrigation Water Use in Southwest Florida" by Michael D. Dukes and Mackenzie J. Boyer (2018).
[2] Percentage of high users was kept higher at 15 percent for rain sensors to reflect the fact that rain sensors are a low-cost outdoor conservation activity that can be more readily implemented.
[3]Percentage of high users was set at 15 percent for all outdoor conservation activities in the City of Punta Gorda since the per capita water use in this service area is higher and more closely resembles that of the Tampa Bay region, where the aforementioned study (Dukes and Boyer, 2018) was based.

1.1.3 Results

The conservation activities selected for analysis in this RWSP were chosen for their proven effectiveness in conserving water, overall cost effectiveness, and ease of implementation. It is estimated that 7.67 mgd of combined active and passive PS savings could be achieved in the planning region by 2040 (Table 4-3). This equates to a 7.37 percent reduction in projected 2040 PS sector demand. This includes industrial and commercial entities that are connected to PS utilities.

The bulk of savings estimated by the AWE tool are attributable to passive conservation. This component represents approximately 68 percent of the PS savings available in the region. That is a 4.99 percent reduction in 2040 total demand, or nearly 5.19 mgd.

To achieve the projected savings, over 318,000 active program implementations would need to be completed during the planning horizon. The overall cost effectiveness for these programs is $0.90 per 1,000 gallons. Active programs account for approximately 32 percent of the savings available in the region. That is a 2.38 percent reduction in 2040 total demand or nearly 2.48 mgd. The total estimated cost for implemented programs is approximately $14.6 million. Figure 4-2 below depicts the change in demand over the planning horizon for the Southern Planning Region due to passive and active conservation.

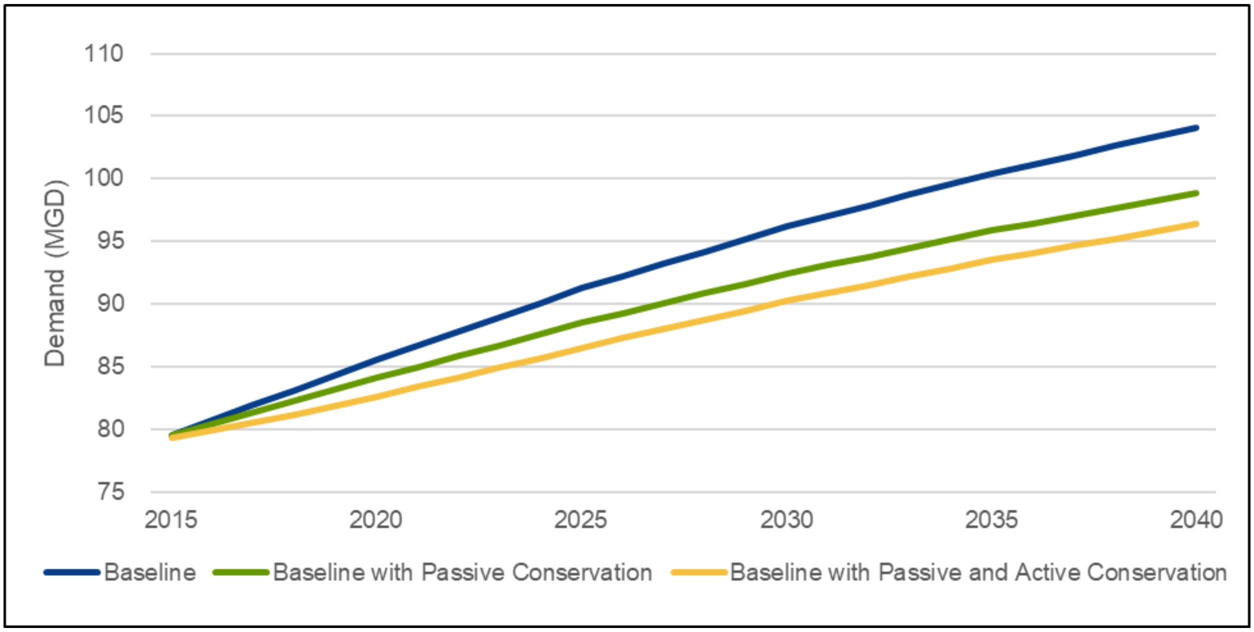

Figure 4-2. *Potential effects of conservation on projected PS demand*

1.1.4 Additional Considerations

Participation rates were kept low to provide conservative estimates and reflect the fact that per capita in the region is already relatively low. The active conservation analysis builds on the passive estimate as it considers only the inefficient stock not already replaced passively. However, it is not comprehensive as there are many other activities that could result in substantial water savings. These active estimates also factor in the effective life of various activities; therefore, for items that have a short life expectancy (e.g., rain sensors), repetitive implementations and reoccurring costs are required just to maintain savings.

The 2017 gross per capita water use of the Southern Planning Region is lower than that of any other District planning region, and so it is to be expected that potential conservation savings is not as great as other areas of the District. Significantly more savings could be possible with the inclusion of ordinances adopting higher indoor efficiency standards and modifications to land development regulations that promote conservation. However, these regulatory mechanisms, while extremely effective, are politically unpalatable in many places and for that reason were left out of this estimate.

1.2 Domestic Self-Supply

The DSS sector includes individual private homes and businesses that are not utility customers and receive their domestic water supply from a well or from a surface supply for uses such as irrigation. DSS wells do not require a District WUP, as the well diameters do not meet the District's requirement for a permit. DSS systems are commonly not metered and, therefore, changes in water use patterns are less measurable than those that occur in the PS sector. Only passive conservation was estimated for DSS systems in this RWSP. Within the region, it is estimated that passive savings for the DSS sector could be 0.34 mgd by 2040 (Table 4-3).

1.2.1 Domestic Self-Supply Assessment Methodology

To calculate DSS passive savings, it was assumed that the DSS sector will experience the same percent savings as the PS sector over the planning horizon. The percent of PS passive savings calculated by the AWE Tool was therefore applied to the SWFWMD total DSS 2040 demand projection for the Southern Planning Region to obtain the passive savings specific to the DSS sector. In other words, the DSS 2040 demand (6.81 mgd) was multiplied by the PS passive savings rate (approximately 5 percent) to yield the DSS passive savings estimate (0.34 mgd).

1.3 Industrial/Commercial Self-Supply

This water use sector includes factories and other industrial enterprises that obtain water directly from surface water and/or groundwater sources through a WUP. Businesses try to minimize water use to reduce pumping, purchasing, treatment, and disposal costs. To date, the District has focused efforts on education, indoor and outdoor surveys, and commercial applications, such as spray valves and HET. The industrial processes being used in this category present unique opportunities for water savings and 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 sector could be 0.03 mgd by 2040 (Table 4-3).

1.3.1 Industrial/Commercial Assessment Methodology

The I/C savings estimate utilized the same methodology outlined in the 2020 Draft Central Florida Water Initiative (CFWI) RWSP. This methodology was based on a study by Dziegielewski et al. (2000) that examined the impact of water audits on improving water efficiency within this sector. The lower-bound savings determined in this study was 15 percent, and this number was used in lieu of the higher estimate to be more conservative. The 15 percent participation rate used in the 2020 Draft CFWI RWSP was also assumed. Therefore, the self-supplied I/C 2040 demand (1.31 mgd) multiplied by both the savings and participation rates (15 percent for both) yields the estimated water savings over the planning horizon for the self-supplied I/C sector within the Southern Planning Region (0.03 mgd).

1.4 Landscape/Recreation Self-Supply

The L/R water use sector 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 PS 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. Within the region, it is estimated that the savings for the L/R water use sector could be 1.25 mgd by 2040 (Table 4-3).

1.4.1 Landscape/Recreation Assessment Methodology

As with the self-supplied I/C sector, the estimate of the water conservation potential of the L/R sector was derived using the same methodology as the 2020 Draft CFWI RWSP. Conservation in this sector primarily comes from updating inefficient sprinkler heads and installing smart irrigation controllers, such as soil moisture sensors or weather-based controllers. Based on two studies by the University of Florida, it was determined that the lower-bound savings from retrofits and smart irrigation controllers are 10 percent and 20 percent, respectively. These values were used along with the 15 percent savings rate also assumed in the 2020 Draft CFWI RWSP to estimate self-supplied L/R water conservation. In other words, the 2040 L/R demand (27.86 mgd) was multiplied by the participation rate (15 percent), and this product was multiplied by each of the savings rates (10 percent and 20 percent). The sum of these final two numbers equates to the total L/R savings over the planning horizon (1.25 mgd). The 1-in-10 2040 demand projections were used instead of the 5-in-10 projections to be more conservative.

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

Table 4-3 summarizes the potential non-agricultural water conservation savings in the Southern Planning Region. This table shows that, through the implementation of all conservation measures listed above for the PS, DSS, I/C, and L/R water use sectors, it is anticipated that approximately 9.29 mgd could be saved by 2040 at a total projected cost of $14.6 million. This is a 6.63 percent reduction in total demand.

Table 4-3. *Potential non-agricultural water conservation savings in the Southern Planning Region*

Sector	2040 Demand (mgd)	Savings (mgd)	Potential Reduction in Demand (%)	Average Cost Effectiveness ($/kgal)
Public Supply (PS) Total	104.06	7.67	7.37%	-
PS Passive	-	*5.19*	*4.99%*	-
PS Active	-	*2.48*	*2.38%*	*$0.90[1]*
DSS	6.81	0.34	4.99%	-
I/C	1.31	0.03	2.25%	-
L/R	27.86	1.25	4.50%	-
Total	**140.04**	**9.29**	**6.63%**	**-**

[1]Total cost efficiency is weighted by each project's percent share of total savings in relation to the cost.

2.0 Agricultural Water Conservation

The Florida Department of Agriculture and Consumer Services (FDACS) develops conservation projections as part of the Florida Statewide Agricultural Irrigation Demand (FSAID5) projections. Those conservation projections were based on historical trends (1973 to 2013) in irrigation of water applied per acre per year. The historical trend of the ratio was used to predict future irrigation conservation through 2040. The trend accounts primarily for gains in irrigation system distribution uniformity. This method is limited in that it does not completely account for existing regulatory constraints (e.g. SWUCA rules) that have resulted in increased water use efficiency thus limiting future water conservation savings potential. However, future savings could still come from developing new technology, sensor-based automation, and scheduling changes.

This RWSP uses the trend as a percent reduction (approximately 13 percent) in 2040 demand. The county-by-county savings percentages derived from FSAID5 data were applied to the 2040 agricultural demands shown in Table 3-2 which are District specific demand projections and lower than FSAID5 demands. Results are shown below in Table 4-4.

Table 4-4. *Potential agricultural water conservation savings in the Southern Planning Region*

County	Projected 2040 demand (mgd)	Savings as a percentage (derived from FSAID5)	Agricultural Conservation Potential by 2040 (mgd)
Charlotte	10.30	13.11%	1.35
DeSoto	45.09	12.62%	5.69
Manatee	51.34	13.05%	6.70
Sarasota	2.92	10.96%	0.32
Total	**109.65**		**14.06**

These estimates should be considered potential conservation and should not be treated as "water supply" or directly removed from agricultural water demand estimates. Substantial investments will be necessary to realize these savings. District investment paired with other government assistance programs like FDACS and Natural Resources Conservation Service could accelerate the rate at which these savings occur. Water resource benefits from the Facilitating Agricultural Resource Management Systems (FARMS) Program are categorized as water resource development (WRD) or water conservation (gains in efficiency). Benefits associated with WRD (primarily tail water recovery) projects are estimated to be 13.58 mgd during the planning horizon. Additional information on the FARMS Program and its potential impact on water resources is located in Chapter 5 and 7.

Section 3. Reclaimed Water

Reclaimed water is defined by the Florida Department of Environmental Protection (FDEP) as water that is beneficially reused after being treated to at least secondary wastewater treatment standards by a wastewater treatment plant (WWTP). Reclaimed water can be used to accomplish a number of goals, including decreasing reliance on potable water supplies, increasing groundwater recharge and restoring natural systems. Figure 4-3 illustrates the reclaimed water infrastructure, utilization, and availability within the District in 2015, as well as planned utilization that is anticipated to occur by 2025 as a result of funded projects. Existing and funded projects are expected to result in reclaimed water increases of more than 14 mgd, bringing utilization within the planning region to approximately to 50 mgd by 2025. Appendix 4-1 contains anticipated 2025 reclaimed water utilization.

The benefit that can be obtained from the use of reclaimed water is governed by the concepts of utilization and water resource benefit. Utilization is the percent of treated wastewater from a WWTP that is utilized in a reclaimed water system. The utilization rate of a reclaimed water system varies by utility. Typically, only 50 to 70 percent of treated wastewater flows go to reclaimed water customers. The highest utilization rates occur in utilities in urban areas where large industries and numerous residential customers can be supplied. Utilization is also limited by seasonal supply and storage. A utility cannot expand its reuse system beyond peak flow demand, which occurs during dry periods when demand is highest, without experiencing shortages. For example, a reclaimed water system with a 1.0 mgd average annual flow normally is limited to supplying 0.5 mgd (50 percent utilization) on an annual basis. This is because during the dry season, demand for reclaimed water for irrigation can more than double.

Reclaimed water can be used for agricultural, residential, golf course, and other public access irrigation use

The six main options to increase utilization beyond 50 percent include seasonal storage, system interconnects, an interruptible customer base, environmental enhancement/recharge, potable reuse, 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 “offline” 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.

Environmental enhancement and recharge involve using excess reclaimed water to enhance wetland habitat, meet MFLs or recharge the UFA to achieve water resource benefits. Potable reuse involves purifying reclaimed water to a quality for it to be used as a raw water source for potable supplies. Supplementing reclaimed water supplies with other water sources such as stormwater and groundwater for short periods to meet peak demand enables systems to serve a larger customer base.

Water resource benefit is the amount of potable-quality groundwater or surface water that is replaced by reclaimed water usage or the amount of reclaimed water used for environmental enhancement. 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 approximately 330 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) that amount. In this example, the benefit rate would be 41 percent (330 gpd benefit for 804 gpd reclaimed water utilization). Different types of reclaimed water use have different benefit potentials. For example, a power plant or industry using 1.0 mgd of potable water for cooling or process water will, after converting to reclaimed water, normally use approximately the same quantity. In this example, the benefit 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 is approximately 65 percent. The District is actively cooperating with utilities to identify ways to increase reclaimed water utilization and benefit. For example, efficiency can be further enhanced with practices such as individual metering coupled with water-conserving rates, efficient irrigation design, and irrigation restrictions.

The District’s goal is to achieve a 75 percent utilization rate of all WWTP flows and benefit efficiency of all reclaimed water used of 75 percent by the year 2040. This goal is intended to reduce the overuse of reclaimed water and increase potable and groundwater benefits. Opportunities may exist for utilization and benefit 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.

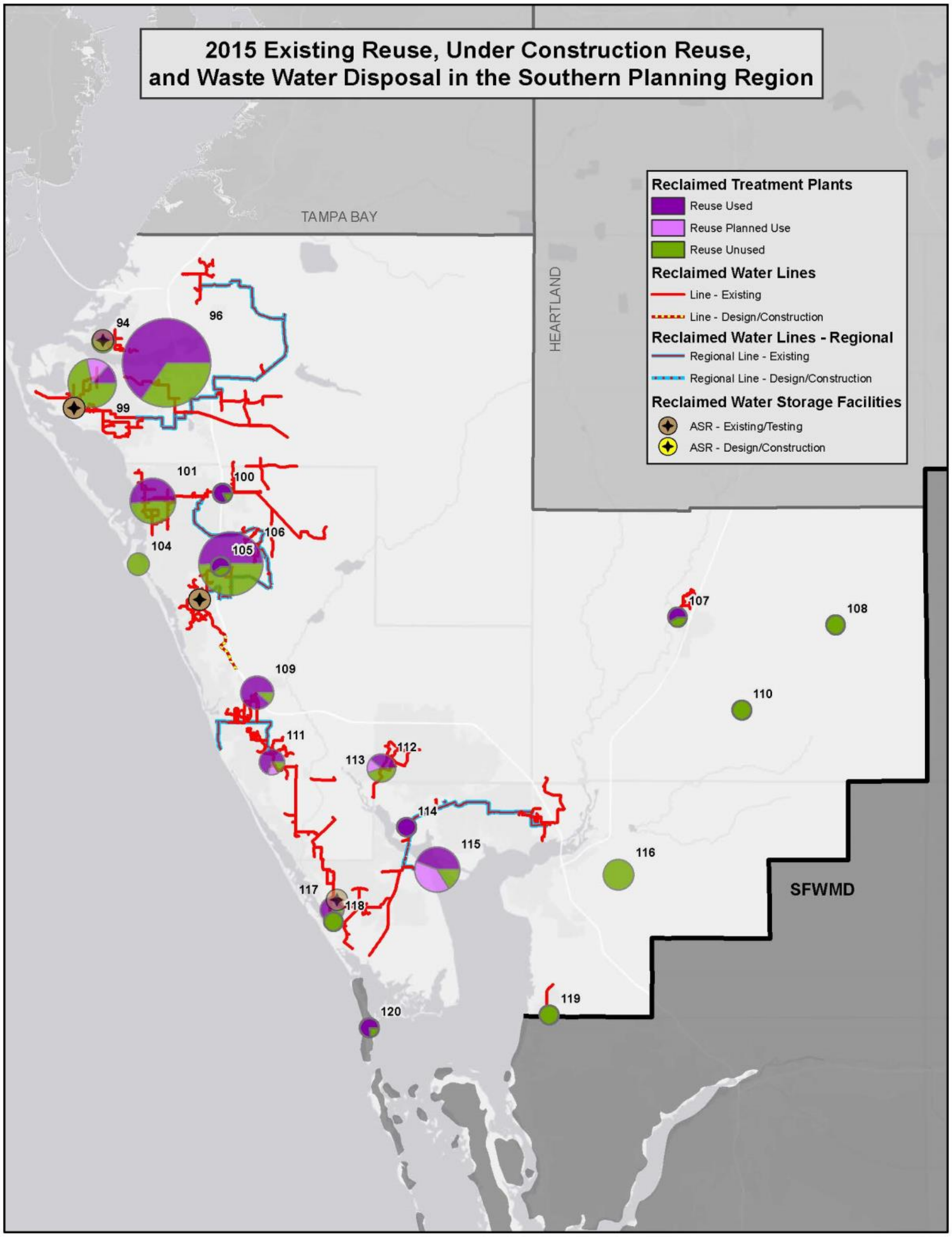

Figure 4-3. *Southern Planning Region reclaimed water map (information on numbered facilities is available at http://www.swfwmd.state.fl.us/conservation/reclaimed/)*

1.0 Potential for Water Supply from Reclaimed Water

Table 4-5 provides information on the current and future availability of reclaimed water in the planning region and the potential to achieve potable-quality water benefits through 2040. In 2015, there were 26 WWTPs in Manatee, Sarasota, Charlotte and DeSoto counties that collectively produced approximately 68 mgd of treated wastewater. Of that quantity, approximately 35 mgd was used, resulting in nearly 25 mgd (70 percent efficiency) of benefits to traditional water supplies. Therefore, only 52 percent of the available wastewater produced in the planning region was utilized for irrigation cooling, or other beneficial purposes. By 2040, it is expected that the anticipated 75 percent reclaimed water utilization rate could be exceeded. Efficiency by the end user is anticipated to average more than 75 percent through a combination of measures such as customer selection, metering, volume-based rates and education. As a result, by 2040, it is estimated that 64.88 mgd of the 85.66 mgd of wastewater water that will be produced in the planning region will be beneficially used. This will result in 48.67 mgd of benefits, of which 23.90 mgd are additional post-2015 benefits (75 percent efficiency).

Table 4-5. *2015 actual versus 2040 potential reclaimed water availability, utilization and offset (mgd) in the Southern Planning Region*

County	2015 Availability, Utilization and Benefit[1]				2015 to 2040 Potential Availability, Utilization and Benefit[2]			
	Number of WWTPs in 2015	WWTP Flow in 2015	Utilization in 2015 (52%)	Potable-Quality Water Benefit in 2015 (70%)	2040 Total WWTP Flow	2040 Utilization (75%)[3]	2040 Potable-Quality Water Benefit (75%)[3]	Post-2015 Benefit
Manatee	5	29.89	15.85	11.15	38.29	28.72	21.54	10.39
Sarasota	9	26.12	13.99	9.57	31.70	23.77	17.83	8.26
Charlotte	9	10.74	5.04	3.54	14.21	11.30	8.48	4.94
DeSoto	3	1.42	0.66	0.51	1.46	1.09	0.82	0.31
Total	**26**	**68.17**	**35.54**	**24.77**	**85.66**	**64.88**	**48.67**	**23.90**

[1]Estimated at 70 percent Regionwide average.
[2]See Table 4-1 in Appendix 4.
[3]Unless otherwise noted.

Section 4. Surface Water

The major river/creek systems in the planning region include the Braden, Manatee, Myakka and Peace rivers; Myakkahatchee, Shell, Prairie, and Joshua creeks; and Cow Pen Slough. Major PS utilities use the Braden, Manatee, and Peace rivers, and Myakkahatchee and Shell creeks. The Braden and Manatee rivers and Shell Creek have in-stream dams that form reservoirs for storage. The potential yield for all rivers will ultimately be constrained by their minimum flows once they are established; however, yields associated with rivers that have in-stream impoundments also depend on the degree of structural alteration that has occurred and the habitat that is supported by the flows. The City of Bradenton utilizes the Evers Reservoir on the Braden River for PS and diverted an average of 5.5 mgd per year for the period 2011 to 2018. Manatee County withdrew an average of 29.5 mgd from 2013 to 2018 from Lake Manatee, which is an in-stream impoundment on the Manatee River. The City of Punta Gorda's average withdrawal from the Shell Creek reservoir from 2011 to 2018 was 5.0 mgd.

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 a river was not yet established or a hydrodynamic model was not available, planning-level minimum flow criteria were 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 more detailed explanation of the methodology is included in the Chapter 4 Appendix 4-2.

2.0 Overview of River/Creek Systems

2.1 Manatee River

The Braden River is a major water source for the City of Bradenton

The Manatee River watershed is located almost completely within Manatee County and encompasses nearly 330 square miles, including 83 square miles of the Braden River system. The river originates in northeast Manatee County and flows 45 miles to its mouth at the southern end of Tampa Bay. A dam was constructed on the river in 1966, impounding approximately six miles of the river's middle reach, forming Lake Manatee. Withdrawals from the reservoir began soon after construction. Since tidal influences reach approximately 20 miles upstream from the mouth of the river nearly to the dam, no stream-gauging stations are in place downstream of the dam. Lake Manatee is operated as a public water supply reservoir by the Manatee County Utility Department. The adjusted annual average flow for the period from 1982 to 2018 is 107 mgd (166 cubic feet per second [cfs]). However, this value might not be completely reliable. The utility holds water in the reservoir during the dry season and releases large quantities during the wet season due to the limited storage capacity of the reservoir.

This skews the flow distribution and affects the calculated potential withdrawal amounts. A citrus grove is permitted to withdraw 0.06 mgd from the East Fork of the Manatee River. Total average annual diversions from 2007 to 2018 were 25 mgd. Based on existing withdrawals and the planning level minimum flow criteria, no additional water is potentially available from the river.

2.2 Braden River

The Braden River discharges to the tidal reaches of the Manatee River approximately eight miles south of Tampa Bay. From its confluence with the Manatee River, the river extends seven miles southeasterly and then approximately 12 miles easterly to its headwaters. The upper reaches consist of channelized tributaries in central Manatee County. A water supply reservoir, Ward Lake (38 acres), was created in 1938 by damming the river just south of State Road 70. The reservoir was enlarged in 1985 and renamed the Bill Evers Reservoir (230 acres). The river is tidally influenced below the dam. The adjusted average annual discharge from 1993 to 2018 at the Braden River was 57 mgd (88.2 cfs). Bradenton Utilities is permitted to withdraw an average of 6.95 mgd. Average annual withdrawals from 2011 to 2018 were 5.5 mgd. Based on existing withdrawals and planning level minimum flow criteria, an additional 0.6 mgd is potentially available from the river.

2.3 Cow Pen Slough

The Cow Pen Slough watershed encompasses approximately 63 square miles in Sarasota County and 9.5 square miles in Manatee County. Land use in the upper part of the watershed is primarily agricultural and primarily urban in the lower part. Runoff from the watershed is conveyed through 14 miles of improved channel and outfalls into Dona Bay. Historically, a large portion of the upper watershed discharged into the Myakka River. In the 1960s, the slough was channelized to improve conditions for agricultural development. This alteration resulted in the diversion of flows from the Myakka River and has contributed to excess freshwater flows entering Dona Bay, which has disrupted the natural freshwater/saltwater regime in the estuary. Two flood-control structures are located on Cow Pen Slough, one just north of Laurel Road and the other just south of State Road 72. Minimum flows have been adopted for Cow Pen Slough.

It is anticipated that future environmental restoration efforts in the watershed will focus on preventing the excess freshwater flows from entering Dona Bay. Through the diversion and capture of these excess flows, opportunities for water supply development will be created, which will help to advance environmental restoration efforts. There is limited flow data available on Cow Pen Slough. As part of the District’s efforts to establish MFLs, flow measurements on the Slough were initiated in 2003. Flows from 1985 to 2018 were estimated to average 38.5 mgd (59.6 cfs) and were based on a model calibrated to the flows in the Myakka River. No permitted withdrawals exist on Cow Pen Slough. The peer review panel for the Cow Pen Slough MFL recommended against direct withdrawals from the Dona Bay/Shakett Creek System until such time that additional studies can be conducted in the small tributaries (Salt Creek and Fox Creek), which provide the majority of flow to the original 16-square-mile watershed below Cow Pen Slough Canal. Accordingly, the established minimum flow prohibits withdrawals from Dona Bay/Shakett Creek below the CPS-2 flood control structure; however, it allows for diversion of the channelized flows from Cow Pen Slough above CPS-2. Based on the established MFL, 38.5 mgd of water supply is potentially available; however, available quantities could be reduced if excess flows are redirected during future environmental restoration efforts.

2.4 Myakka River

The Myakka River extends 69 miles from its mouth at Charlotte Harbor, northeast to its origins in northeast Manatee County, and has a watershed of approximately 598 square miles. Major tributaries are Myakkahatchee Creek (Big Slough Canal), Deer Prairie Slough/Creek, and Owen Creek. Two lakes of significant size, Upper and Lower Myakka lakes, are located along the Myakka River and have a combined surface area of 1,380 acres. A portion of the river has been designated an Outstanding Florida Water (OFW) and the segment through Sarasota County was designated a Florida Wild and Scenic River.

Lower Myakka Lake, one of two lakes along the Myakka River

The Myakka River watershed has undergone extensive hydrologic alteration. Over the past few decades, inflows from irrigation water applied to agricultural lands are believed to have contributed to excess water entering Flatford Swamp and other areas of the river. Along the middle portion of the river, small dams were constructed on the Upper and Lower Myakka lakes. Other flow alterations, including those at Tatum Sawgrass, Vanderipe Slough, Clay Gully, Cow Pen Slough, and the Blackburn Canal, have shifted the timing of flows, drastically reduced storage areas and diverted large quantities of water out of the watershed. Seventy-three percent of the river's annual flow occurs during the wet season, and the river has a broad, seasonally inundated floodplain. Historically, during the drier periods of the year, there was no flow in the upper Myakka River. However, in the last several decades, inflows from irrigated agricultural lands have significantly increased the dry-season flow of the river and it no longer ceases flowing in the dry season. The adjusted annual average flow from 1965 to 2018 at the Myakka River near Sarasota is 159.8 mgd (247.2 cfs). This includes up to an average of 32.4 mgd (50 cfs) of excess flow that has been estimated to occur during the year as a result of irrigation of agricultural lands and other land use changes.

As part of efforts to restore environmentally impacted areas in the upper Myakka River watershed, it will be necessary to prevent excess surface water flows from entering Flatford Swamp. The District is looking at the diversion and capture of these excess flows before the Myakka River enters Flatford Swamp and use it as recharge to help recover the SWIMAL in the SWUCA. There are currently no permitted withdrawals from the river. Based on the lower Myakka River minimum flow, an additional 32.4 mgd of water supply is potentially available from the river; however, implementation of a Flatford Swamp Hydrologic restoration project would reduce future surface water flows.

2.5 Myakkahatchee Creek (Big Slough Canal)

The Myakkahatchee Creek (Big Slough Canal) is a tributary to the lower Myakka River. The Myakkahatchee Creek watershed covers approximately 195 square miles, with the largest segments in Manatee and Sarasota counties. Smaller portions of the watershed are also located in DeSoto and Charlotte counties. A tributary of the Myakka River, Myakkahatchee Creek is a channelized drainageway for more than 20 miles, with the lower portion of the watershed situated in the City of North Port. In the upper reaches, land use is predominantly pasture. Near the outlet, land use is urban and residential and the many canals draining the urban areas are fitted with control structures.

The annual average flow in Myakkahatchee Creek from 1981 to 2018, which was derived and measured at the structure near the withdrawal point upstream of the US 41 crossing, is 31 mgd (47.9 cfs). The City of North Port is permitted to withdraw from 2.08 to 6.0 mgd from Myakkahatchee Creek based on flow conditions. Total average withdrawals on the Myakkahatchee Creek from 2010 through 2018 were 1.3 mgd. The City may also withdraw up to 2.4 mgd from the Cocoplum Waterway tributary. The City's treatment facility is equipped with ASR storage and a brackish groundwater RO system used to maintain finished water quality.

2.6 Peace River

The Peace River originates in the Green Swamp and flows south to Charlotte Harbor. The Peace River watershed encompasses 1,800 square miles. There are two main tributaries in the upper watershed. Peace Creek drains approximately 225 square miles in the northeast part of the watershed, serving as an outlet for several lakes near Haines City and the City of Lake Alfred. Saddle Creek Canal drains 144 square miles in the northwest portion of the watershed in Polk County, where the dominant drainage feature is Lake Hancock. Numerous lakes are present in the area north of Bartow, ranging in size from a few to approximately 4,600 acres. In this area, surface water drainage is ill-defined. South of Bartow, to approximately Fort Meade, the land surface has been considerably altered by phosphate mining activities. Major tributaries south of Fort Meade include Horse, Joshua, and Charlie creeks.

Horse Creek near Arcadia, a major tributary of the Peace River

The major withdrawal from the Peace River is for PS by the PRMRWSA. The PRMRWSA operates a regional water supply facility in southwest DeSoto County. The facility has two off-stream reservoirs and 21 ASR wells that provide a combined 13 billion gallons of storage for seasonal and drought period reliability. Consistent with minimum flow methodology, annual flow was calculated by summing flow at the Peace River at Arcadia, Horse Creek near Arcadia, and Joshua Creek at Nocatee for the reference period 1975 through 2018. Adjusted annual flow was 762.1 mgd (1,179 cfs). The PRMRWSA is permitted to withdraw 80 mgd annual average and 258 mgd max daily from the river, subject to minimum flows availability. Total average annual withdrawals from approximately 2011 to 2018 were 28 mgd. Surface water availability in Table 4-6 was calculated using revised flow criteria that were eventually adopted by the District's Governing Board in 2010.

Projects are being developed and implemented to divert and store water from the upper Peace River during high-flow periods for release to meet minimum flows during low-flow periods. These projects include the completion and implementation of the Lake Hancock Lake Level Modification Project, and the planned 2020 development of a reservation for water stored in the lake to help achieve minimum flows in the river. Flow assumptions used for the reservation and minimum flow recovery may be adjusted in the future.

All available surface water in the Peace River is allocated to the Southern Planning Region in Table 4-6, because more water is physically present and available downstream; however, future withdrawals from the river in the Heartland Planning Region are possible and likely. To maximize development of additional water supplies from the river, future withdrawals will need to be closely coordinated with the PRMRWSA and other users. Based on the minimum flow criteria, an additional 2.2 mgd of water supply is potentially available from the river.

2.7 Shell Creek

The Shell Creek/Prairie Creek watershed encompasses 400 square miles and empties into the lower Peace River near where the river enters Charlotte Harbor. It is the largest sub-basin in the Peace River watershed. In 1964, a dam was constructed on Shell Creek which created an 835-acre in-stream reservoir used for municipal supply by the City of Punta Gorda. The adjusted annual average discharge from 1974 to 2013 at the reservoir is 228.8 mgd (354.1 cfs). Punta Gorda Utilities is permitted for average annual withdrawals of approximately 8.1 mgd. Several withdrawals for agricultural irrigation are permitted on Shell Creek for a total annual average withdrawal of 0.50 mgd. Average annual diversions from 2007 to 2018 were 3.75 mgd. Minimum flows are scheduled for completion in 2020. Based on existing withdrawals and planning level minimum flow criteria, an additional 14.4 mgd of water is potentially available from the river.

Prairie Creek

3.0 Potential for Water Supply from Surface Water

Table 4-6 summarizes the potential availability of water from rivers in the planning region. The estimated additional surface water that could potentially be obtained from rivers in the planning region ranges from approximately 108.3 mgd to 196.4 mgd. The lower end of the range is the amount of surface water that has been permitted, but is currently unused (156.2 mgd minus 47.9 mgd), and the upper end includes permitted but unused quantities (108.3 mgd) plus the estimated remaining unpermitted available surface water (88.1 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. Although Table 4-6 depicts available water quantities at the more downstream gauges, it is possible and likely that some of the water will be developed in upstream portions of the watersheds.

Table 4-6. *Summary of current withdrawals and potential availability of water from rivers/creeks in the Southern 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		
							Avg	Min	Max
Manatee River @ Dam	Yes	107	10.7	35.0	24.8	0.0			
Braden River @ Dam	Yes	57	7.6	7.0	5.5	0.6	365	365	365
Cow Pen Slough @ I-75[7]	Yes	38.5	38.5	0.0	0.0	38.5	355	280	365
Myakka River @ Sarasota[8]	No	159.8	32.4	0.0	0.0	32.4	342	271	365
Myakkahatchee Creek upstream of Diversion	Yes	31	3.1	4.5	1.3	0.0			
Peace River @ Treatment Plant[9]	No	784	98.34	96.74	24.9	2.1	365	365	365
Shell Creek @ Dam	Yes	228.8	22.9	8.6	3.8	14.4	340	255	365
TOTAL				156.2	47.9	88.1			

[1] Mean flow based on recorded U.S. Geological Survey (USGS) flow plus reported WUP withdrawals added back in when applicable. Maximum period of record used for rivers is 1965 to 2018. Flow records for Manatee River (1982 to 2018), Braden River (1993 to 2018), and Myakkahatchee Creek (1981 to 2018), and Peace River (1985 to 2018), and Shell Creek (1974 to 2018) are shorter. Cow Pen Slough was estimated based on flow data for watersheds of similar areas (1985 to 2018).
[2] Based on 10 percent of mean flow for all water bodies with the following exceptions: minimum flow criteria were used to calculate potentially available quantities for Cow Pen Slough, Peace River and Myakka River.
[3] Based on individual WUP permit conditions, which may or may not follow current 10 percent diversion limitation guidelines.
[4] Based on average reported withdrawals during 2007 to 2018. Myakkahatchee Creek 2007 to 2018 data is taken from USGS gauge Big Slough at West Price Blvd near North Port.
[5] Equal to remainder of 10 percent of total flow after permitted uses allocated, with minimum flow cutoff for new withdrawals of P85 and maximum system diversion capacity of twice median flow (P50) with these exceptions: Peace River, Myakka River and Cow Pen Slough estimated by subtracting permitted withdrawal limits from estimated available flow prior to withdrawal. Early estimates on the proposed MFL for the lower Manatee River predict no potentially available flow will be available.
[6] Based on estimated number of days that any additional withdrawal is available considering current permitted quantities and withdrawal restrictions. The minimum and maximum are the estimated range of days that additional withdrawals would have been available in any particular year.
[7] Dona Bay/Shakett Creek flows have been increased significantly through channelization (Cow Pen Slough Canal) of upland wetlands that used to flow to the Myakka into the headwaters of Shakett Creek. Adjusted average annual flow is for the channelized portion of Cow Pen Slough above the CPS-2 structure. Potentially available flow quantities allow for withdrawal of all flows above CPS-2, which would reduce unnatural discharges to the Dona Bay/Shakett Creek system. Excess flows may be redirected as part of environmental restoration efforts, which could reduce surface water flows.
[8] Myakka River flows have increased over time due to augmentation resulting from agricultural irrigation and watershed alterations. Potentially available flow prior to withdrawal equals the sum of the daily excess flows (capped at 130 cfs) and 10 percent of the remaining daily flows at the Myakka River near Sarasota gauge from June 21 to the end of February. From March 1 through June 20, withdrawals from the river are limited to the excess flows capped at 130 cfs. Implementation of Flatford Swamp Hydrologic Restoration project could reduce future surface water flows.
[9] All available surface water is shown in Southern Planning Region, because calculation was based on flows at furthest downstream gauge; however, future withdrawals in the Heartland Planning Region are possible and likely.

Section 5. Brackish Groundwater Desalination

Brackish groundwater suitable for water supply is available from two general sources within the District; in the UFA and intermediate aquifer system along coastal areas, and inland at greater depths within the Lower Floridan aquifer (LFA) below MCU II. The coastal brackish groundwater is found as a depth-variable transition between fresh and saline waters. Figure 4-4 depicts the generalized location of the freshwater/saltwater interface (as defined by the 1,000 mg/L isochlor) in the Avon Park high production zone of the UFA in the southern and central portions of the District. Generally, water quality declines to the south and west of the District.

Outside of the immediate coastal zone, brackish water sources in the LFA originate from mixing with relic seawater or contact with evaporitic and organic-rich strata. Recent hydrogeologic investigations in Polk County have found groundwater below MCU II to be mildly brackish and reasonably confined from the UFA, suggesting development of the source may be feasible. At greater depths the groundwater is saline, so future projects must address potential upwelling of saline groundwater to supply wells that could deteriorate water quality over time.

Brackish groundwater is defined as groundwater having impurity concentrations greater than drinking water standards (i.e., total dissolved solids (TDS) concentration greater than 500 mg/L), but less than seawater (SWFWMD, 2001). Seawater has a TDS concentration of approximately 35,000 mg/L. Brackish water treatment facilities typically use source water that slightly or moderately exceeds potable water standards. Raw water with TDS values less than 6,000 mg/L is preferable for treatment due to recovery efficiency and energy costs. Groundwater with TDS greater than 10,000 mg/L generally exceeds feasibility because treatment would require high-pressure pumps and Reverse Osmosis (RO) membranes that are more costly to operate. Many treatment facilities will blend fresher water or recirculate some RO permeate to maintain a consistent raw water quality for efficient operation. Pure RO permeate can have very low TDS and may be corrosive to pipe metals and prior mineral deposits, so bypass blending of some raw water into the RO permeate is common for buffering and increasing the total yield.

While RO is the most common brackish water treatment technology, electrodialysis reversal (EDR) systems may also be viable and are in use within the District at the T. Mabry Carlton facility in Sarasota County. The EDR method uses an electrical current to pull ionic minerals outward from water flowing through a gel membrane, and the electrical current is frequently reversed to prevent buildup in the membrane. It is recommended that both RO and EDR systems be considered in brackish water supply project conceptualization and feasibility studies.

Both RO and EDR treatment systems generate a concentrate byproduct that must be disposed of through methods that may include surface water discharge, deep-well injection, or dilution at a WWTP. Surface water discharges require a National Pollutant Discharge Elimination System (NPDES) permit and may be restrained by TMDL limitations. In some cases, brackish water treatment 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 is becoming more prevalent. Deep-well injection may not be permittable in some areas with unsuitable geologic conditions. An additional but costly disposal option 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 solids might have economic value for various industrial processes.

The Florida Legislature declared brackish groundwater an alternative water source in 2005 (Senate Bill 444). However, it remains a groundwater withdrawal and must occur in a manner that is consistent with applicable rules, regulations, and District water use management strategies. Factors affecting the development of supplies include the hydrologic 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, recognizing brackish groundwater as an AWS and allowing for assistance with construction projects. Since then, the District has co-funded five brackish groundwater treatment projects in the cities of North Port, Oldsmar, Tarpon Springs, Clearwater, and Punta Gorda. Each City has a regionally interconnected water supply system. The District is also co-funding two additional brackish groundwater projects for the Polk Regional Water Cooperative (PRWC) that are under design. The funding is intended to incentivize the development of integrated, robust, multijurisdictional systems that are reliable, sustainable, and utilize diverse water sources. While the District's regional water supply development processes have traditionally been based on meeting increasing demand projections, several brackish groundwater projects have been pursued for other needs: to blend permeate with treated surface water in order to meet finished water quality standards, to maintain viability of existing wellfields with deteriorating water quality, and to provide seasonal source substitution to meet an MFL. Future projects might also incorporate indirect potable reuse. The District recognizes the importance of maintaining the viability of existing supplies, but also encourages the consideration of alternate options based on economics and long-term regional benefit. A phased approach to brackish groundwater development is recommended that includes hydrogeologic evaluations to determine project viability, design phases that help refine the economic and permitting feasibility, and construction procured through a competitive bidding process.

1.0 Potential for Water Supply from Brackish Groundwater

Because brackish groundwater withdrawals from the UFA in the SWUCA have the potential to exacerbate saltwater intrusion, requests for brackish groundwater will be evaluated similarly to requests for fresh groundwater withdrawals. Proposed withdrawals, either fresh or brackish, cannot impact UFA water levels in the most impacted area (MIA) of the SWUCA. Groundwater withdrawals have been evaluated by this criterion since the early 1990s and, since that time, there has been no net increase in quantities of water permitted from the UFA in the MIA. Requests for new withdrawals outside the MIA will be granted only if it is demonstrated that the withdrawals have no effect on groundwater levels in the UFA in the MIA. As discussed in the SWUCA recovery strategy, if a proposed withdrawal impacts groundwater levels in the MIA or impacts other MFL water bodies, it may be possible to receive a permit for the requested quantity if a net benefit can be achieved. A net benefit is an action an applicant can take to offset the projected effects of the withdrawal by an amount equal to the effect plus a 10 percent improvement. A net benefit can be achieved through means such as retiring existing groundwater withdrawals. Until recovery is achieved and any need for additional recovery is determined, entities seeking additional water in coastal areas should consider brackish groundwater from the UFA as an option only after other sources of water, including conservation, have been fully explored and implemented.

One of the benefits of using brackish groundwater in the planning region, especially as part of a regional system, is the potential to use it conjunctively with existing surface water sources. During normal or excess rainfall years, the region would make use of its abundance of surface water sources. Production from brackish groundwater wellfields would be reduced during these periods to minimize environmental impacts. During drought periods when river flows are below minimums, and storage within reservoir and ASR storage facilities are reduced, production from brackish groundwater wellfields would be maximized to meet demands of the region.

There are 13 brackish groundwater desalination facilities operated by utilities in the planning region that report water use to the District. In 2018, the combined withdrawal of the reporting facilities was approximately 25 mgd, with a finished supply of 19 mgd. The withdrawals occur from the lower permeable zone of the intermediate aquifer system and the upper portion of the UFA. The largest brackish groundwater facility is at the T. Mabry Carlton facility in Sarasota County, which is an EDR system and has a 12 mgd treatment capacity. The facility began a renovation in 2019 which should be completed in 2021, so capacity is temporarily reduced. The PRMRWSA has an emergency permit allocation to use 4 mgd from the Carlton Wellfield facility. The raw water from Sarasota County's University Wellfield has brackish quality but is treated by dilution with imported water sources. In 2013, the City of North Port commenced operation of a 1.5 mgd brackish facility co-located at the Myakkahatchee Creek facility. This facility is used for blending with treated surface water to improve finished water quality. The facility has been withdrawing surface and brackish groundwater at a relatively constant 50/50 rate. The City of Punta Gorda is constructing a 4.0 mgd RO facility co-located at the Shell Creek facility, due online in 2020. The facility will also be used for blending with seasonally variable surface water and may also assist with meeting future MFLs on the creek.

Concentrate disposal challenges have limited brackish groundwater production at some locations. The RO facility at the City of Venice is limited to 50 percent treatment efficiency due to the allowable discharge concentrations into the Intracoastal Waterway. The City is applying for modifications to its discharge permit that will allow improvements to the facility's efficiency.

The location of these facilities and other existing and proposed brackish groundwater desalination facilities in the region and District are shown in Figure 4-5.

The ultimate availability of brackish groundwater in the planning region 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 water supply in the planning region has not been undertaken. As an alternative, the availability of brackish groundwater for water supply planning purposes was estimated by the unused capacity at existing facilities and facilities under development. The unused capacity of existing/ongoing facilities was calculated by subtracting the permittee's 2013 water withdrawals from either the permit capacity or treatment capacity, whichever was less. Using the lower value helps account for utilities that have more than one wellfield or treatment facility under their permit or have additional fresh groundwater available. The unused capacity was reduced by each utility's treatment efficiency to determine water available to meet demands. The treatment efficiency was calculated as the ratio of finished supply per the total withdrawal. The values of each facility are shown in Table 4-7.

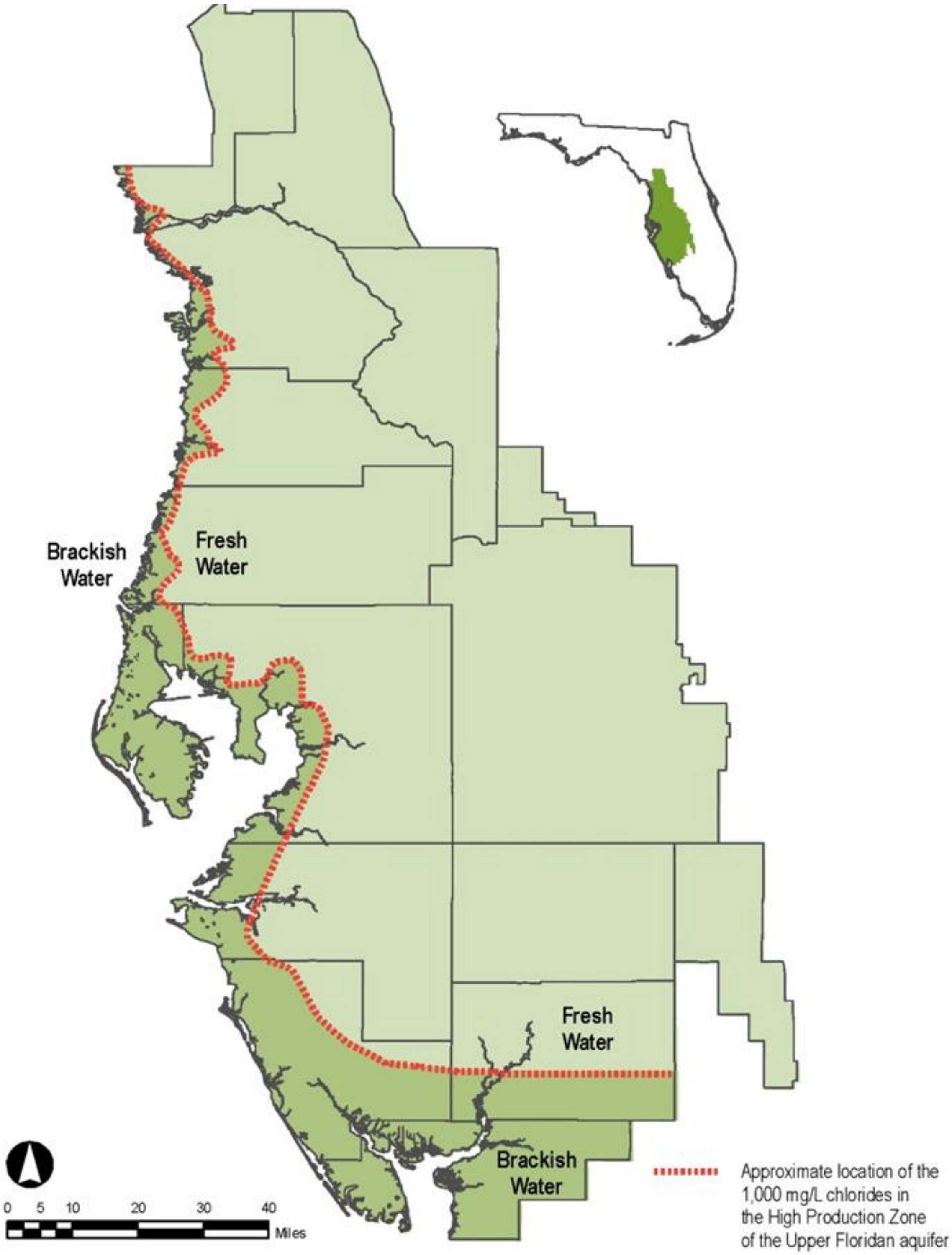

Figure 4-4. *Generalized location of the freshwater/saltwater interface*

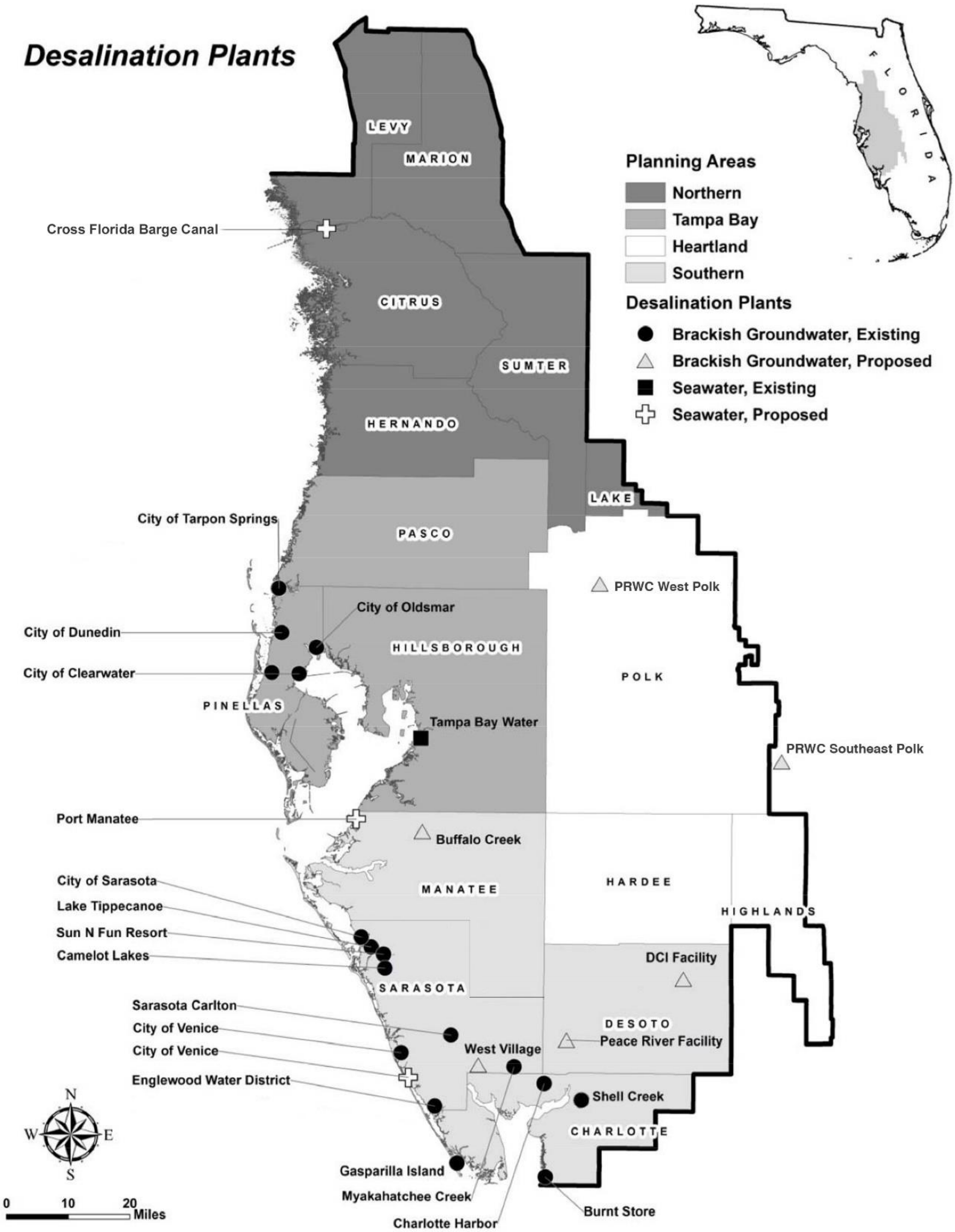

Figure 4-5. *Location of existing and potential seawater and brackish groundwater desalination facilities in the District*

Table 4-7. *Brackish groundwater desalination facilities that are existing or under development in the Southern Planning Region*

Name of Utility	County	Brackish GW Treatment Capacity (mgd)	Annual Average Permitted Withdrawal (mgd) [1]	2018 Total Withdrawals (mgd)	2018 Finished Supply (mgd)	Estimated Available Supply [2] (mgd)	Source Aquifer	Raw Water Quality TDS (mg/L)	Concentrate Discharge Type [3]
Existing Facilities									
Sarasota County (Carlton and Venice Gardens WTPs) [4]	Sarasota	14.75	13.74	3.676	2.926	8.011	Int./UFA	600 - 5,300	Deep Well
City of Venice	Sarasota	4.50	6.864	4.465	2.717	0.021	Int.	960 - 4,700	Surface
City of Sarasota (Verna and Downtown RO WTPs) [5]	Sarasota	12.50	12.043	8.061	6.313	3.119	Int./UFA	700 - 3,500	Surface
City of Punta Gorda (Online 2020)	Charlotte	4.00	8.088	NA	NA	TBD	UFA	500 - 2,100	Deep Well
Buffalo Creek Wellfield (permitted, not developed)	Manatee	TBD	3.95	NA	NA	3.00	Int./UFA	TBD	Deep Well
Englewood Water District	Sarasota	3.00	5.36	3.869	2.892	0.000	Int.	3,100 - 11,000	Deep Well
City of North Port [6]	Sarasota	1.50	4.40	2.035	1.941	0.000	Int	1,000 - 2,000	WWTP/ Deep Well
CCU/Burnt Store	Charlotte	1.10	3.17	0.536	0.427	0.449	Int.	1,700 - 3,900	Surface
Gasparilla Island	Charlotte	1.10	1.538	1.497	1.153	0.000	Int.	400 - 9,000	Deep Well
Charlotte Harbor	Charlotte	0.75	0.712	0.452	0.343	0.197	Int.	1,400 - 1,700	Surface
Camelot Communities	Sarasota	0.20	0.362	0.324	0.324	0.000	Int.	760 - 950	SWP
Sun-N-Fun RV	Sarasota	0.165	0.186	0.065	0.054	0.108	Int.	100 - 600	Surface
Lake Tippecanoe	Sarasota	0.06	0.05	0.02	0.02	0.03	Int.	< 2,000	SWP

[1] The WUP annual average quantity is the total permit quantity and may include additional sources from fresh groundwater wells under the permit.
[2] Estimated Available Supply is calculated subtracting the 2018 withdrawals from either the Brackish Treatment Capacity or Permit Capacity (whichever is less), then deducting the treatment efficiency (Finished Supply/Withdrawal)
[3] WWTP: wastewater treatment plant, SWP: surface/stormwater pond. The utilities shown have WUPs with the District. Other small RO systems exist for self-supplied users.
[4] The Sarasota County Consolidated Permit #8836 allows a combined total annual average withdrawal of 13.7374 from three wellfields; Carlton, Venice Gardens, and University Parkway. The University Parkway wellfield has brackish quality water but uses blending from other sources rather than desalination to meet potable standards.
[5] The City of Sarasota utilizes the Verna RO Wellfield, Downtown RO Wellfield, and the Bobby Jones Wellfield. The 2018 uses are combined
[6] The City of North Port permit #2923 allows a total annual average withdrawal of 7.1 mgd, divided as 4.4 mgd from the Myakkahatchee Creek facility and 2.7 mgd from the planned West Villages Improvement District brackish wellfield. The desalination facility at Myakkahatchee Creek treats groundwater for blending with surface water from the creek and Cocoplum Waterway, and the permit allows up to 50 percent of the raw water to be sourced from groundwater.

Section 6. Aquifer Storage and Recovery

Aquifers are reservoirs and conveyance systems that can provide tremendous storage capabilities, enabling rapid storage or recharge of captured excess wet season flows. Aquifer Storage and Recovery (ASR) and recharge projects enable the District to smooth out the wet and dry cycles and better manage droughts, which are already challenging. As the impacts from climate change become more pronounced and population increases, droughts could become even more difficult to manage. Utilization of the aquifer system's reservoir potential is accomplished through an ASR system, direct aquifer recharge (AR) or indirect AR system. Each of the methods has different levels of regulatory constraints that are largely based on the source water quality and the water quality of the receiving aquifer. Each method offers unique opportunities that match up with the various sources and qualities of available water.

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. Water injected into ASR wells must meet Florida's drinking water quality standards. The locations of ASR projects in the District are shown in Figure 4-6. Aquifer Storage and Recover (ASR) may be used for potable, reclaimed, groundwater, 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.

Aquifer Storage and Recovery (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.

Within the District, there are five fully permitted reclaimed water ASR projects and five fully permitted potable water ASR facilities. Recent advancements in pre-treatment technologies and Underground Injection Control regulations addressing arsenic mobilization issues in the aquifer (which were previously limiting) provide a viable means for successful completion of ASR projects.

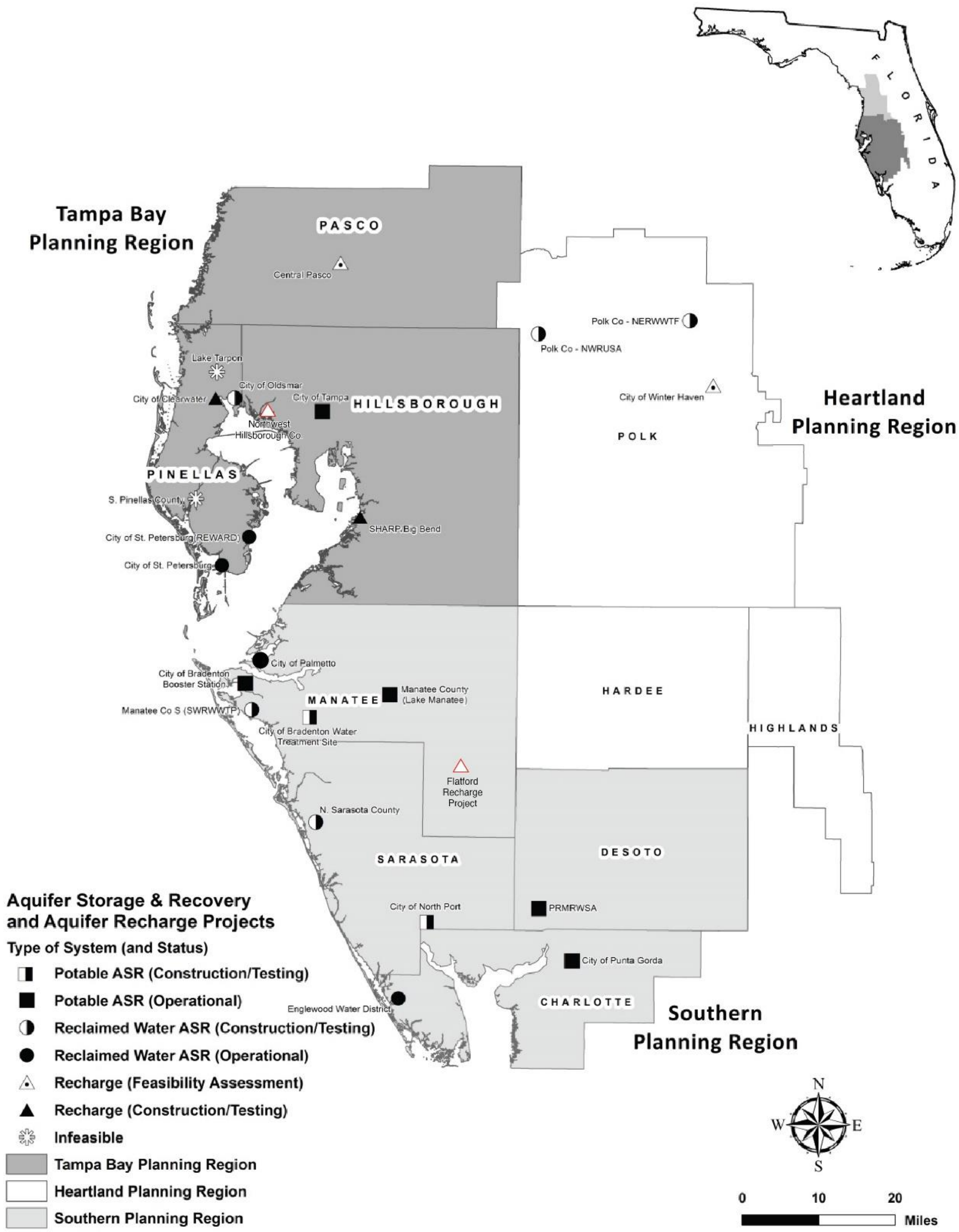

Figure 4-6. *Location of aquifer storage and recovery and aquifer recharge projects in the District that are operational or under development.*

Projects under development are those the District is co-funding and are either (1) actively in the planning, design, or construction phase, or (2) not yet in the planning phase but have been at least partially funded through fiscal year (FY) 2019, or (3) have been completed since the year 2015 and are included to report on the status of implementation since the previous RWSP.

1.0 Aquifer Storage and Recovery Hydrologic and Geochemical Considerations

The science behind ASR has advanced significantly since the first project at Manatee County's reservoir site. The focus in the early years was on the hydrologic conditions that control the rate of injection/recovery and degree of mixing with elevated TDS in the receiving zone. Early studies of the geochemical processes focused on the liberation of low concentrations of naturally occurring radionuclides at the Lake Manatee ASR site. Because the concentrations were below the drinking water standards, ASR projects proceeded while continuing to check for this issue. None of the ASR projects checked ever exceeded the radio-nuclide standards.

While checking the radionuclides for the City of Tampa ASR project, the first incidence of arsenic at concentrations greater than the drinking water standards were found, and geochemical processes became important to understand. Extensive research efforts to understand the cause of arsenic mobilization and methods to control it were successful, and multiple strategies to handle the arsenic mobilization are now available. Geochemical considerations have led to the reduction of oxidants such as dissolved oxygen (DO) and chlorine in the injection water, either through physical or chemical methods.

Hydrologic conditions that maximize the recoverability of the injected water include a moderately permeable storage zone that is adequately confined above and below by less permeable layers with fairly good to moderate water quality. The permeability of the storage zone is important, since low permeability would limit the quantity of water that could be injected, while 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 water in adjacent zones from being captured during recovery. Poor native water quality in the storage zone will limit the percentage of usable water that can be recovered 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 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 Aquifer Storage and Recovery Permitting

Permits to develop ASR systems must be obtained from the District, the FDEP, the Department of Health (DOH) and possibly the U.S Environmental Protection Agency (EPA) if an aquifer exemption is requested. The District is responsible for permitting 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 permitting the injection and storage portion of the project, and the DOH is responsible for overseeing the quality of the water delivered to the public. Operational potable ASR systems within the District include those developed by the cities of Tampa, Bradenton, and Punta Gorda, as well as by Manatee County and the PRMRWSA.

Significant clarifications of ASR regulations, as they apply to public water supply systems storing treated drinking water underground, were issued by the EPA in 2013. The 2013 guidance allows the FDEP to evaluate ASR systems on a case by case basis to determine if mobilization of arsenic and subsequent recovery and treatment of the water can be done in a manner that does not endanger the aquifer. The facility would need to verify that no existing user would be impacted through either property ownership or use of institutional controls such as local ordinances prohibiting wells within a specified area around the ASR wells. The use of the ASR water re-treatment upon recovery to remove arsenic prior to distribution may be necessary. Re-treatment to remove arsenic has been successfully implemented by several public drinking water systems and, to date, arsenic concentrations have been within the drinking water standards prior to distribution to the public.

3.0 Aquifer Storage and Recovery and Arsenic

When the last RWSP was under development in 2015, permitting of potable water ASR facilities in Florida, although hindered by the mobilization of naturally occurring arsenic in the aquifer, was possible on a case by case basis under a zone of discharge approach. Reclaimed water ASR projects, however, cannot have a zone of discharge for any primary drinking water standards; therefore, the issue of using a similar zone of discharge for arsenic mobilization has not been decided by FDEP. Since the last RWSP, effective solutions to the arsenic mobilization issue continue to be developed. The City of Palmetto successfully managed arsenic mobilization using a chemical oxygen scavenger. Bradenton is presently running a pilot project that removed DO from the injection water via a vacuum degasification tower. DO control offers one method of achieving an operation permit for ASR and recharge facilities. DO control can be achieved through physical removal, chemical scavenging or direct use of groundwater as a source for injection. Projects are currently testing chemical scavenging as a method for arsenic control.

Another method of achieving an operation permit is the attenuation of arsenic through removal during successive cycles of operation. The City of Tampa has seen arsenic concentrations consistently diminish over the years since startup in 1996. Most of the City's wells are now within the drinking water standard for arsenic and those that exceed it are just barely over the limit for a brief period during recovery. In 2013, the City received their operation permit and is now fully permitted. All sites show the similar attenuation with cycling suggesting that this may be an option to achieve an operation permit. Facilities that pursue this path will need to be capable of re-treating the water upon recovery to remove the mobilized arsenic. This option also requires control of the area adjacent to the ASR wells, either through ownership or through institutional controls, such as an existing ordinance prohibiting wells from withdrawing from the ASR storage zone.

Most ASR projects in the District are located in coastal areas where water in the UFA 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.

Section 7. Aquifer Recharge

1.0 Aquifer Recharge

Natural recharge of rainfall infiltration to the surficial aquifer and underlying aquifers is the primary source maintaining aquifer levels. Aquifer recharge (AR) is the intentional process of beneficially using excess water to directly or indirectly recharge aquifers to achieve improved aquifer levels or water quality improvements (reduced saltwater intrusion). Aquifer recharge (AR) may be accomplished by using wells or rapid infiltration basins (RIBs). In order to maximize environmental and water supply benefits, AR projects will generally target the fresher portions of the aquifer.

Successful AR projects will improve groundwater levels. Water level improvement may result in (1) improving local groundwater quality, (2) mitigating or offsetting existing drawdown impacts due to withdrawals, (3) providing storage of seasonally-available waters and thereby augmenting water supplies, and (4) potentially allowing additional new permitted groundwater withdrawals in areas of limited water supply. AR project success criteria can include demonstration of the level to which aquifers have been restored and demonstrated improvements to aquifer water quality and/or increases in available water supply for existing and future users.

Sources of water for use in AR projects are often available seasonally and may include high-quality reclaimed water, surface water, and stormwater. A total volume of 738 mgd of reclaimed water was used statewide in 2015 (FDEP, 2015) for water uses including residential, industrial, recreational (golf courses), water treatment plants, rapid infiltration basins, and spray field applications.

Each individual AR project will have distinctively different construction specifications, regulatory requirements and operational maintenance considerations. The hydrogeologic setting of an area often determines which AR approach can be used.

1.1 Direct Aquifer Recharge

Direct AR uses wells to inject water meeting applicable FDEP water quality standards into an aquifer. Direct AR water recovery may occur through other wells constructed in the area. However, direct AR projects are often designed to improve aquifer conditions.

Characterization of the targeted aquifer for direct AR is fundamental in the design, operation, and maintenance of a direct AR system. Understanding the permeability and the degree of aquifer confinement above and below the injection interval, along with a characterization of the difference in water quality between the injection source water and the ambient groundwater in the injection interval and existing aquifers above and below, is critical to direct AR project success. Direct AR system designs must address the potential for mobilization of naturally occurring arsenic on a site-specific basis. If not addressed in the design of a direct AR project, the related and undesirable geochemical reactions may occur when the injection water reacts with the aquifer. Properly designed projects can avoid or manage these reactions through the adjustment of injection water chemistry, such as the removal of DO. In certain circumstances, the FDEP may allow these chemical reactions to occur if an adequate property area is controlled by ownership and it can be demonstrated the reaction is limited to the controlled area and will not require any other users of the aquifer to implement additional treatment to continue their use.

Recent experience with operational ASR projects incorporating oxygen degasification systems and post treatment stabilization have proven that metals mobilization can be minimized and controlled by reducing the DO content in the injection source water, in addition to maintaining a negative oxygen reduction potential. AR projects will need to function in the same manner. Groundwater flow resulting from injection and the natural groundwater flow gradient will have the potential to move dissolved metals down gradient. For this reason, it will be important to establish necessary aquifer monitoring and institutional controls to guard against public access to potentially contaminated groundwater, if metals are mobilized.

1.2 Indirect Aquifer Recharge

Indirect AR is when water is applied to land surfaces where it can infiltrate and recharge the aquifer. Indirect AR can be accomplished by using a variety of techniques, including spray fields, recharge wetlands, large-scale drain fields, and RIBs. This recharge approach is used in areas where there is a good connection between the surface and source aquifer for water supply. Water applied to the surface must meet minimum water quality standards approved by the FDEP. Infiltration capacity and permeability of the soil, presence of drainage features, depth to the water table, local hydrogeology, locations of nearby drinking water wells, as well as locations of nearby wetlands and lakes are all important to identify, test and characterize to determine the feasibility of indirect AR. In favorable regions, indirect AR can provide additional natural water quality treatment to the water as it percolates through sediments during infiltration, in addition to subsequently increasing aquifers levels. It is estimated by the District that 20 mgd of available reclaimed water (Districtwide) was being applied through RIBs for indirect AR as of 2015 (FDEP, Reuse Inventory of 2015).

Section 8. Seawater Desalination

Seawater is defined as water in any sea, gulf, bay or ocean having a total dissolved solids concentration of 35,000 mg/L or more (SWFWMD, 2001). Seawater can provide a stable, drought proof water supply that may be increasingly attractive as the availability of traditional supplies diminish and advances in technology and efficiency continue to reduce costs. There are five principal elements to a seawater desalination system that require extensive design considerations: an intake structure to acquire the source water; pretreatment to remove organic matter and suspended solids; RO desalination to remove dissolved minerals and microscopic constituents; post-treatment to stabilize and buffer product water and prepare it for transmission; and concentrate disposal 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 volume of water withdrawn may significantly exceed the amount treated if concentrate dilution is necessary. The intake design and operation must address environmental impacts, because much of the District’s near-shore areas have been designated as either OFW or aquatic preserves. Ecological concerns include the risk of impingement and entrainment of aquatic life at the intake, entrainment of sediments and oils, and perturbation to seagrasses and hard-bottom communities.

The pretreatment of source water is imperative to protect the sensitive RO membranes from fouling prematurely from organic carbon and particulates, and this may be the most critical design element. A pretreatment system may require coagulation and/or microfiltration technology similar to the treatment of fresh surface water. A robust pretreatment may seem duplicative, but lessons learned from Tampa Bay Water and other facilities have demonstrated the importance of pretreatment to the long-term viability of the facility.

High-pressure RO membrane treatment is the most widely accepted seawater desalination 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 the dissolved minerals from fouling the membrane's surface. The membranes are susceptible to fouling or damage from dissolved organic matter and fine suspended particles, which is why an effective pretreatment method is necessary. The pressurization step can be energy intensive. Seawater treatment requires pressures from 600 to 1,000 psi, compared to brackish groundwater systems (with <10,000 mg/l TDS) operating at 30 to 250 psi (FDEP, 2010). Most large-capacity seawater facilities have energy recovery systems that use turbines driven by high-pressure flow exiting the RO membranes to boost pressure to the pumps feeding the source water. Energy recovery systems reduce electrical demands, alleviate redundant pumping capacities, lower operational costs, and reduce the facility's carbon footprint.

RO systems use high pressure and semi-permeable membranes to desalinate seawater

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 corrode piping and add unwanted metals into the finished 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 NPDES permit from the 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.

The co-location of desalination facilities with coastal electric power stations can significantly enhance their financial feasibility. Co-location produces cost and environmental compliance benefits by utilizing existing intake structures and 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 the FDEP report entitled, *Desalination in Florida: Technology, Implementation, and Environmental Issues* (www.dep.state.fl.us/water/default.htm).

1.0 Potential for Water Supply from Seawater Desalination

Two options for large-scale seawater desalination facilities in the planning region have been identified as part of the planning efforts of the District and the PRMRWSA. The options would be located at Port Manatee in Manatee County, on lower Tampa Bay, and on an industrial site by the Venice Airport in Sarasota County. Both options are conceptualized as having capacities of 20 mgd, based on economies of scale, and would circulate over 400 mgd of water in order to dilute discharge concentrate at a 20 to 1 ratio.

The Port Manatee site is advantageous because of its proximity to existing potable water transmission systems and a shipping channel where the intake and discharge structures would be located. The tidal flushing present in this portion of Tampa Bay may also benefit the permissibility of the discharge. The Venice Airport site is also located near existing potable distribution systems and would be close to high water demand areas. The seawater intake would be located on the C-1 Canal, a five-mile section of the Intracoastal Waterway, and the discharge would be through a dispersed outlet system into the Gulf of Mexico. The dilution pumping and discharge may provide a net environmental benefit by increasing circulation through the C-1 Canal, which was excavated in the 1960s and has exhibited poor water quality. The conceptual costs for the two options were included in the PRMRWSA Master Plan Update and are presented in Chapter 5. The total potential quantity of water supply from seawater desalination in the planning region is 40 mgd.

Section 9. Stormwater

The FDEP and the WMDs define stormwater as the flow of water which results from, and which occurs immediately following, a rainfall event and which is normally captured in ponds, swales, or similar areas for water quality treatment or flood control. Development of the natural landscape can result in significant changes to the characteristics of stormwater flows. Stormwater runoff can provide considerable volumes of water that can be captured and beneficially used, resulting in water supply, AR, water quality, and natural system benefits. Rule 62-40, Florida Administrative Code (F.A.C.), defines “stormwater recycling” as the capture of stormwater for irrigation or other beneficial use. The reliability of stormwater can vary considerably depending upon climatic conditions and storage capability. Therefore, the feasibility of effectively utilizing stormwater as an AWS source often relies on the ability to use it in conjunction with another source (or sources) in order to decrease operational vulnerability to climatic variability (i.e., “conjunctive use”). Stormwater represents a potentially viable AWS at the local level, particularly for reclaimed water supplementation and irrigation water uses.

In the SWUCA, the District FARMS Program has had much historical success in developing tailwater recovery systems for agricultural operations to utilize stormwater supplies to reduce demands for fresh groundwater. A major future opportunity for stormwater development is the ability for local governments and utilities to partner with the Florida Department of Transportation (FDOT) on stormwater capture and harvesting projects. Presently, FDOT’s Efficient Transportation Decision Making Process (ETDM) gives the WMDs and other agencies an opportunity to provide comments during the Planning Screen phase of a project. When FDOT projects advance to the Project Development and Environment (PD&E) phase, FDOT uses Environmental Look Arounds (ELAs) to proactively look for cooperative and regional stormwater management opportunities. ELAs can assist the districts, other agencies, and local utilities with identifying sources of stormwater for activities such as reclaimed water augmentation and MFL recovery.

Section 10. 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 2015 through 2040. The table shows that the total quantity available could be as high as 315.42 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 2040 and demands calculated for the 2015 base year (Table 3-7). The projected additional water demand in the planning region for the 2015 to 2040 planning period is approximately 44.39 mgd. It is possible that the demand for environmental restoration will be higher because preliminary studies undertaken in support of the minimum flow for Shell Creek indicate that actual flows in the creek are below proposed minimums. Therefore, a recovery strategy will be required. The quantity of water needed for restoration will be determined once minimum flow studies for Shell Creek have been completed.

As shown in Table 4-8, up to an additional 315.42 mgd is potentially available from water sources in the planning region to meet the overall additional projected demand of 44.39 mgd. 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 2040.

Table 4-8. *Potential additional water availability in the Southern Planning Region through 2040 (mgd)*

County	Surface Water[1]		Reclaimed Water	Desalination		Fresh Groundwater		Water Conservation		Total
	Permitted Unused	Available Unpermitted	Benefits	Seawater	Brackish Groundwater (Permitted Unused)	Surficial and Intermediate	Upper Floridan[2] Permitted Unused	Public Supply	Agricultural	
Charlotte	4.70	14.40	4.94	-	0.65	4.10	3.22	2.28	1.35	35.64
DeSoto	90.00	2.20	0.31	-	0.00	1.20	0.34	0.00	5.69	99.74
Sarasota	3.16	70.90	8.26	20.00	11.26	3.80	3.30	2.59	0.32	123.59
Manatee	8.70	0.60	10.39	20.00	3.00	3.40	0.86	2.80	6.70	56.45
Total	**106.56**	**88.10**	**23.90**	**40.00**	**14.91**	**12.50**	**7.72**	**7.67**	**14.06**	**315.42**

[1] All available surface water from the Peace River is shown in DeSoto County, because the calculation was based on flows in DeSoto County; however, future withdrawals from the Peace River in Hardee and Polk counties are possible.
[2] Groundwater that is permitted but unused for public supply. Based on 2018 Estimated Water Use (SWFWMD, 2019).

Chapter 5. Overview of Water Supply Development Options

The water supply development (WSD) component of the Regional Water Supply Plan (RWSP) requires the Southwest Florida Water Management District (SWFWMD) (District) to identify water supply options from which water users can choose to meet their individual needs. In addition, the District is to determine the associated costs of developing these options. As discussed in Chapter 4, sources of water potentially available to meet projected demands in the planning region include fresh groundwater, water conservation, reclaimed water, surface and stormwater, brackish groundwater desalination, Aquifer Storage and Recovery (ASR) and Aquifer Recharge (AR), and seawater desalination. 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.

The RWSP Executive Summary presents statutory guidance on how water supply entities are to incorporate WSD options from the District's RWSP into their water supply planning and development of their comprehensive plans.

Part A. Water Supply Development Options

The District conducted preliminary technical and financial feasibility analyses of the options included in this chapter. The analyses provide reasonable estimates of the quantity of water that could be developed and the associated costs of development. The District referenced cost information for the options to the appropriate document or applied a cost index to update the value from the 2015 RWSP. The following sections include a description of several representative options for each source 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.

Where applicable, water supply options developed through the work of additional regional planning efforts are incorporated into this chapter, such as technical memorandums related to the 2020 update of the (PRMRWSA Integrated Regional Water Supply Master Plan. 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 the PRMRWSA 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 WSD, 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. Fresh Groundwater Options

The development of additional fresh groundwater from the Upper Floridan aquifer (UFA) in the planning region will be limited as a result of environmental impacts from excessive withdrawals and planned reductions in withdrawals that are part of the SWUCA recovery strategy. In particular, groundwater withdrawals cannot impact water levels in the SWUCA Most Impacted Area (MIA).

Priority will be given to reducing groundwater withdrawals, when possible, in order to contribute to water level recovery in the area.

Future requests for groundwater from the UFA and the intermediate aquifers will be evaluated based on the projected impacts of the withdrawals on existing legal users and water resources, including those with established minimum flows and levels (MFLs). Requests for withdrawals of groundwater from the UFA for new uses will be considered only if the requested use is reasonable and beneficial, incorporates maximum use of conservation, and there are no available alternative sources of water. If all these conditions are met and the withdrawals are projected to impact water levels in the MIA, it will be necessary for those impacts to be offset prior to issuance of a WUP.

Section 2. Water Conservation Options

1.0 Non-Agricultural Conservation

The District identified a series of conservation activities that are appropriate for implementation by the public supply (PS) sector. However, while this analysis only estimates active conservation savings and costs for PS, some of these activities can also be implemented by the domestic self-supply (DSS), industrial/commercial (I/C), and landscape/recreation (L/R) water use sectors. A complete description of the criteria used in selecting these activities and the methodology for determining the water savings potential for each activity are described in detail in Chapter 4.

Some readily applicable conservation activities are not addressed due to the wide variance in implementation costs and the site-specific nature of their implementation. Two such measures are water-conserving rate structures and local codes/ordinances, which have savings potential, but are not addressed as part of the 2020 RWSP. The District strongly encourages these measures and, when properly designed, 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 WUP application or renewal process. Below is a description of each non-agricultural water conservation option. Savings and costs for each conservation activity evaluated in the 2020 RWSP are also summarized in Table 5-1 below. These savings and costs are also depicted in Figure 5-1 and Figure 5-2, respectively.

Table 5-1. *Conservation activity options for PS sector*

Conservation Activity	2040 PS Savings (mgd)	Average Cost Effectiveness ($/k gal)	Total Cost
Residential			
High-efficiency Toilets (HET)	0.40	$2.27	$3,269,134
High-efficiency Showerheads	0.30	$0.65	$1,359,792
Landscape and Irrigation Evaluations/Audits	0.48	$0.71	$2,356,883
Smart Irrigation Controllers	0.43	$0.89	$2,287,402
Rain Sensors	0.17	$1.26	$1,485,042
Soil Moisture Sensors	0.43	$0.89	$2,287,402
Non-residential			
High-efficiency Toilets (HET)	0.26	$1.74	$1,600,547
Total Public Supply	**2.47**	**$0.90[1]**	**$14,646,202**

[1]Total cost efficiency is weighted by each project's percent share of total savings in relation to the cost.

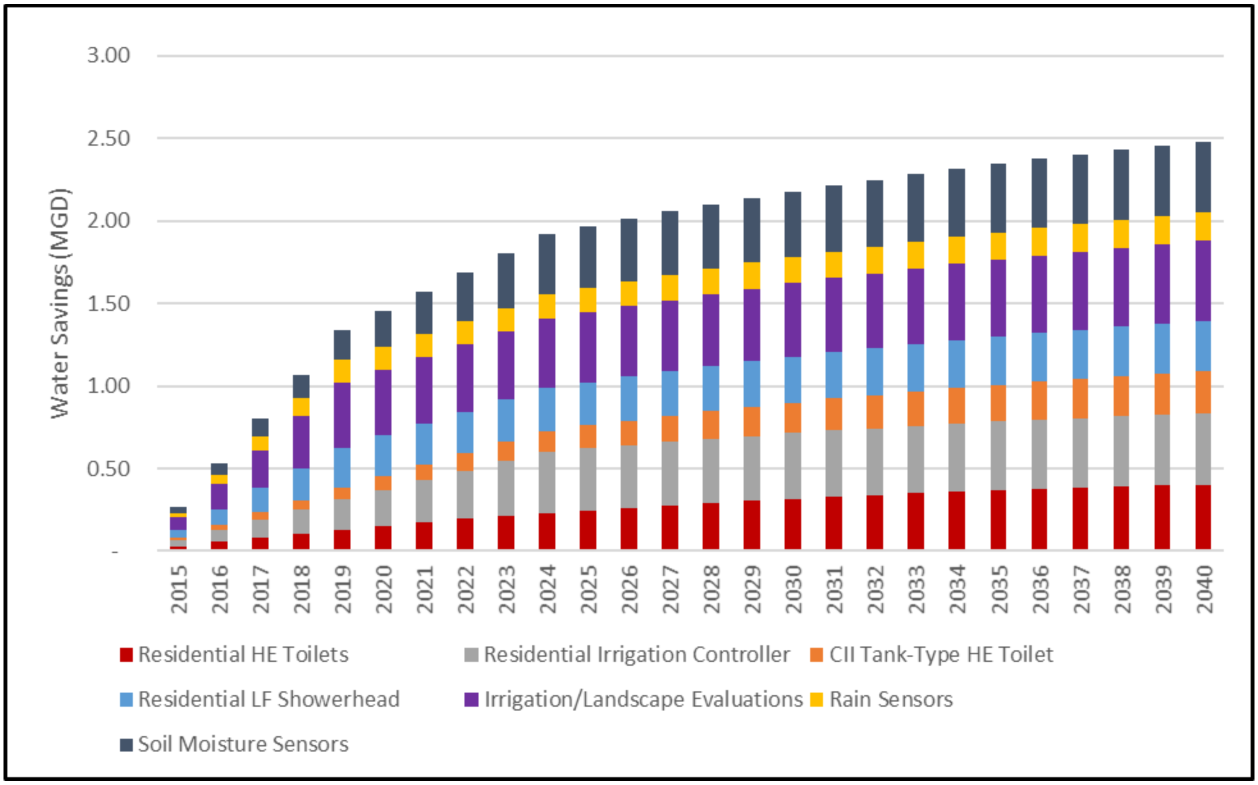

Figure 5-1. *Total active water savings in the Southern Planning Region by conservation type*

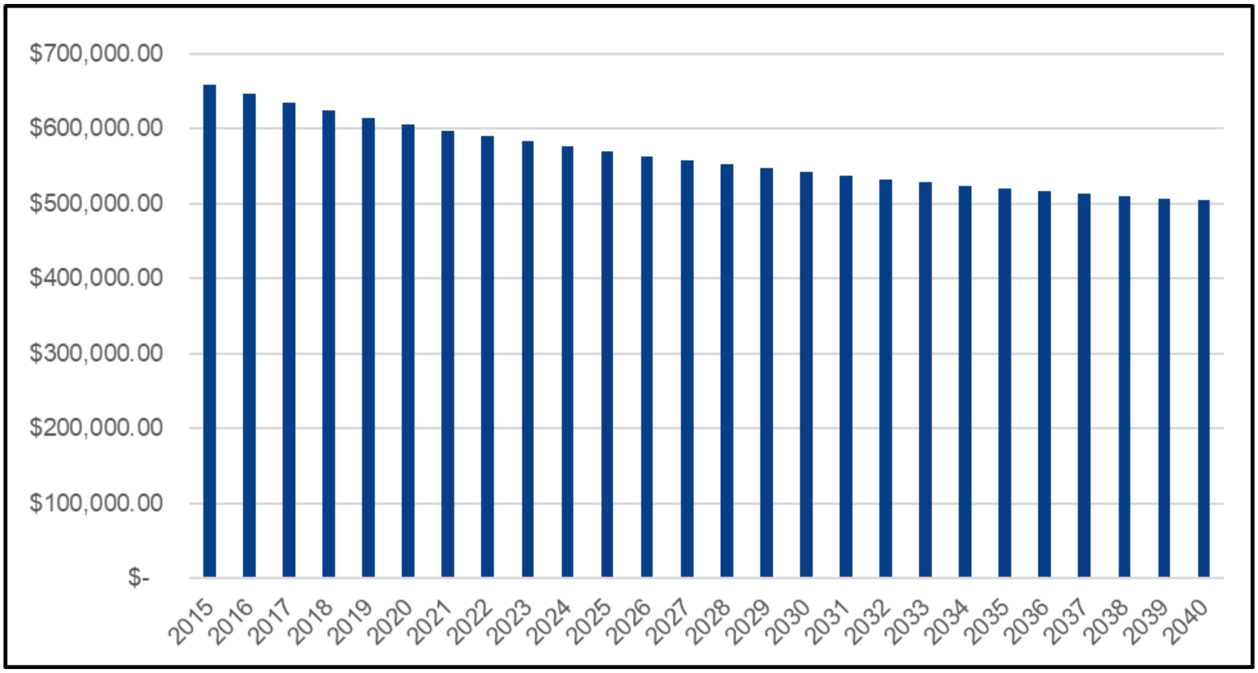

Figure 5-2. *Total cost of active conservation in the Southern Planning Region*

1.1 Description of Non-Agricultural Water Conservation Options

1.1.1 High-Efficiency Showerheads

This practice involves installing U.S. Environmental Protection Agency (EPA) WaterSense®-labeled, high-efficiency showerheads. This is a low-cost conservation option that is easy to implement for both residential and I/C users. Savings figures shown in this chapter reflect upgrading 2.5 gallons per minute (gpm) showerheads to a 2.0 gpm WaterSense®-labeled version.

1.1.2 High-Efficiency Toilets Rebates (Residential)

High-efficiency toilet (HET) rebate programs offer $100 rebates as an incentive for replacement of inefficient high-flow toilets with more water-efficient models. HET's use 1.28 gallons per flush (gpf) as opposed to older, less efficient models that could use 3.5 gpf or more, depending on the age of the fixture. Savings estimated in this plan are based on converting a 3.5 gpf to a 1.28 gpf model. HETs and dual-flush toilets (DFT) are WaterSense® labeled by the EPA. Also, gradually

Toilet replacements were identified as a major source of conservation potential.

becoming more popular on the marketplace are 0.8 gpf models, which offer a 50% savings compared to 1.6 gpf models that are currently required by building code.

1.1.3 High-Efficiency Toilets (Industrial/Commercial)

Similar to the residential HET retrofit programs, a non-residential fixture replacement program provides financial incentives to water customers to encourage conversion of higher flush volume toilets to HET models. These measures apply to office buildings, sports arenas, hospitals, schools, dormitories, and other commercial facilities.

1.1.4 Landscape and Irrigation Evaluations/Audits

Water-efficient landscape and irrigation evaluations (evaluations) generate water savings by evaluating individual irrigation systems, providing expert tips on opportunities to increase water efficiency, optimizing run times, pointing out broken heads and leaks, and sometimes offering targeted rebates or incentives based on those recommendations. Evaluations can focus on three areas: operation, repair, and design. They are normally only available to high-use accounts that have inground irrigation systems and are likely over-watering.

Residential irrigation evaluations were identified as a major potential source of water conservation.

1.1.5 Rain Sensors

Section 373.62, Florida Statutes (F.S.), requires all new automatic landscape irrigation systems to be fitted with properly installed automatic shutoff devices. This is typically a rain sensor. As with showerheads, rain sensors are an easily implemented, low-cost conservation option. They are often paired with a landscape and irrigation evaluation/audit but can also be given away to homeowners with irrigation systems.

1.1.6 Smart Irrigation Controllers

“Smart” irrigation controllers go a step further than rain sensors. This technology automatically adjusts irrigation runtimes according to the needs of the local landscape. It is often based on temperature, climate, rainfall, soil moisture, wind, slope, soil, plant type, and more. This data is obtained by an on-site evapotranspiration (ET) sensor or through the internet. Some units can be operated by smart phone and can incorporate a weather forecast to anticipate coming rain. As an example, winter season run times may be automatically dialed down 30 percent from summer run times.

1.1.7 Soil Moisture Sensors

Soil moisture sensors have been available on the market for approximately 10 years, and costs have come down considerably since they were first released. These devices override (prevent) scheduled irrigation events when enough moisture is present at the site, thus reducing water usage by skipping irrigation cycles.

2.0 Agricultural Water Conservation Options

Nearly 40 percent of irrigated agricultural acreage and 30 percent of agricultural water use in the District occurs in the planning region. As the largest consumer of water in the region, there is great potential to increase the efficiency of agricultural water use. The District has a comprehensive strategy to reduce agricultural groundwater 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 200 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 Facilitating Agricultural Resource Management Systems (FARMS) and other programs are described below.

2.1 Facilitating Agricultural Resource Management Systems

The District, in cooperation with the Florida Department of Agriculture and Consumer Services (FDACS), initiated the FARMS Program in 2003. The FARMS Program provides cost-share reimbursement for the implementation of agricultural best management practices (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. The FARMS Program is a public/private partnership among the District, 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 FARMS Program achieves resource benefits through two main types of projects: alternative water supply and conservation through precision irrigation. These types of projects will be discussed below. The goal for the FARMS Program is to offset 40 mgd of groundwater use for agriculture within the SWUCA.

2.2 Facilitating Agricultural Resource Management Systems Conservation Potential

Districtwide, as of September 2019, FARMS has funded more than 200 projects with agricultural cooperators, for a total estimated reduction in groundwater use of more than 28 mgd. In the Southern Planning Region, there are 104 projects with an estimated reduction in groundwater use of more than 21.7 mgd. While the rate of FARMS participation has varied over time, difficulties within the citrus industry has resulted in a decreasing participation trend. This historical funded project information (2004 to 2019) was used to develop a long-term trend line as a means of estimating potential future program activity. Even with the decreasing participation trend, during the current planning horizon from fiscal year (FY) 2015 through FY2040, if the current trends in agriculture and District cooperation continue, the FARMS program has the potential to reduce groundwater use by nearly 24 mgd through development of alternative water supplies and more than 1.6 mgd through precision irrigation or other groundwater conservation BMPs. Within the Southern Planning Region, the District projects that alternative water supplies could save more than 13.5 mgd and conservation BMPs could save nearly 0.5 mgd over the same planning horizon of FY 2015 through FY 2040.

Table 5-2. *FARMS Conservation Potential within the Southern Planning Region*

Project type	Potential resource benefit (mgd)	Estimated costs	Cost Benefit (cost per 1,000 gallons saved)
Alternative water supply (tailwater recovery)	13.5	$35,000,000	$1.51
Conservation	0.5	$790,000	$0.94

Typical FARMS Project #1. Tailwater Recovery

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 appurtenances are needed to connect the pond to the existing irrigation system. The use of these ponds for irrigation offsets a portion of the groundwater used to irrigate the commodity and can improve water quality of the downstream watershed by reducing the concentration of mineralized groundwater applied to fields.

An example of a tailwater recovery project is the DeSoto Land Investment project in DeSoto County. The farm is permitted to withdraw up to 0.498 mgd of groundwater to irrigate citrus. The goal of the project is to reduce groundwater withdrawals through the use of a tailwater recovery/surface water collection reservoir. The project includes two surface water pump stations, filtration and infrastructure necessary to operate and connect the reservoir to an existing irrigation system. The projected reduction in groundwater withdrawals is 37 percent, or 0.185 mgd of its permitted quantities.

Typical FARMS Project #2. Precision Irrigation Systems

Precision irrigation systems allow for the automatic remote control of irrigation pumps based upon information derived from soil moisture sensors that measure and monitor discrete sub-surface moisture levels. The system enables the grower to maintain soil moisture within optimized ranges, which reduces the potential for overwatering and prevents under-watering 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.

An example of precision irrigation in the Southern Planning Region is A&A Blueberries. The farm is a 50-acre blueberry farm just north of Arcadia. It is permitted for 0.204 mgd for supplemental irrigation. The FARMS Program funded a precision irrigation project that included automated pump control, weather stations with soil moisture sensors, and automated valve control. It is estimated that the project will reduce groundwater use by approximately 10 percent or about 0.02 mgd.

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.

2.3 Mobile Irrigation Laboratory

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

2.4 Best Management Practices

Best Management Practices (BMPs) are individual agricultural practices or combinations of practices that, based on research, field testing, and expert review, have been determined to be the most effective and practical means for maintaining or improving the water quality of surface and groundwaters and conserving groundwater resources. Best Management Practices (BMPs) typically are implemented in combination to prevent, reduce, or treat pollutant discharges off-site. Best Management Practices (BMPs) must be based on sound science, be technically feasible, and be economically viable. In Florida, agricultural BMPs are detailed in crop-specific BMP manuals developed by the FDACS in cooperation with a wide spectrum of stakeholders within the community specific to that crop. Best Management Practice (BMP) manuals are available on the FDACS website and are used to evaluate a farm's intent to implement practices that conserve groundwater, protect water quality, reduce nutrient impacts, control erosion, and implement integrated pest management to reduce environmental impacts.

Section 3. Reclaimed Water Options

The planning region encompasses a diverse mix of rural and urban land uses that provide opportunities for urban, industrial and agricultural reclaimed water use. In addition, opportunities for storage of excess reclaimed water in brackish aquifers in coastal areas and in old mine pits in the wet season for use during dry periods are abundant in the region. 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 (ASR):** 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 WUP exchanges
- **Natural System Enhancement/Recharge:** introduction of reclaimed water to create/restore natural systems and enhance aquifer levels (indirect potable reuse)

- **Saltwater Intrusion Barrier:** injection of reclaimed water into an aquifer in coastal areas to create a salinity barrier
- **Storage:** reclaimed water storage in ground storage tanks and ponds
- **Streamflow Augmentation:** 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
- **Potable reuse:** purification of reclaimed water to meet drinking water standards prior to introduction into a potable raw water source.

The beneficial utilization of reclaimed water has for decades been a key component of water resource management within the District. For the past several years, Districtwide reclaimed water utilization has been at around 50 percent for non-potable purposes such as landscape irrigation, agricultural irrigation, aesthetic uses, groundwater recharge, industrial uses, environmental enhancement, and fire protection purposes.

Recently, as drought and long-term water shortages have occurred within other states and countries, reclaimed water has been investigated as a potable source. The “unintentional” use of reclaimed water as a potable source is not new, as many surface water sources that are used for potable raw water supplies have upstream wastewater/reclaimed water discharges. For instance, much of the flow of the Trinity River in Texas during the dry season comes from Dallas and Fort Worth wastewater treatment plants and the Trinity River is the main source of drinking water for the City of Houston. However, what is relatively new is the discussion of “direct potable reuse” with little to no lag time between discharge of purified water from a reclamation facility and use as raw water by a potable water facility.

Several high-profile projects have been investigated in western states and in other countries which involve the process of treating reclaimed water to state and federal drinking water standards so that it can be recycled for potable water supply uses. Three notable potable reuse projects that have been implemented using purified water are the Big Springs Texas Water Supply Project, the Las Vegas/Southern Nevada Water Supply Authority augmentation of Lake Meade, and the Singapore NEWATER Project.

Although direct potable reuse is not currently being implemented by utilities within the District, there is increasing interest in the concept and it is included as a viable future water supply option in this RWSP.

The District developed four reclaimed water options (Table 5-3) for the planning region with input from utilities and other interested parties. The District determined the quantity of reclaimed water available for each option based on an analysis of wastewater flows anticipated to be available in 2040 at a utilization rate of 75 percent or greater (Chapter 4 Appendix, Table 4-1). The District recognizes 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. The options are listed in Table 5-3.

Flow and capital cost data for 39 funded reclaimed water construction projects identified as being under development (FY2015 to FY2020) within the District were used to develop a representative cost per 1,000 gallons supplied and capital cost for each option. The data show that for the 39 new reclaimed water supply projects anticipated to come online between 2015 and 2025, the average capital cost is approximately $10.27 million for each 1 mgd supplied. This figure was used in cost calculations for individual reclaimed water options, unless specific cost data were available.

Reclaimed water tank in Englewood

Table 5-3. *List of reclaimed water options for the Southern Planning Region*

Option Name and Entity	County	Type	Supply (mgd)	Benefit (mgd)	Capital Cost (Millions)
Manatee Co. to FPL Power Plant Reuse	Manatee	System Expansion	4.00	4.00	$30.20
Sarasota Co. to Braden River MFL & IPR Reuse	Sarasota, Manatee	Potable Reuse, Streamflow Augmentation	3.00	3.00	$23.50
Manatee Co.-FPL and Gilley Creek MFL and IPR Reuse	Manatee	Potable Reuse, Streamflow Augmentation, System Expansion	7.00	7.00	$37.00
Punta Gorda IPR & Shell Creek MFL Reuse	Charlotte	Potable Reuse, Streamflow Augmentation	2.75	2.50	$34.40
Total			**16.75**	**16.50**	**$ 125.10**

The use of italics denotes SWFWMD estimations.
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 gallons per day (gpd).

Section 4. Surface Water/Stormwater Options

As shown in Chapter 4, Table 4-6, capturing and storing water from river/creek systems during times of high flow has the potential to meet the 2040 demand. Based on planning level criteria, approximately 196.4 mgd could be developed for water supply if all the rivers/creeks in the planning region described in Chapter 4 were developed to their full potential. A number of rivers of significant size, including the Peace, Braden, Manatee, Myakka, and Shell Creek, are located partially or completely within the planning region. Except for the Myakka River, all of these rivers are currently used for water supply. The Peace River is the most prominent drainage feature in the region, draining portions of Polk, Hardee, DeSoto and Charlotte counties. It has the highest flow of all the rivers in the region with a mean annual flow of 762 mgd (1,179 cubic feet per second [cfs]). Although portions of the Myakka River have been designated an Outstanding Florida Water (OFW) and a Wild and Scenic River, the watershed has experienced numerous alterations that have affected flows. These alterations include agricultural activities, drainage projects, and flood control projects. It is possible that water supply projects could be developed on the Myakka River that would help to restore the river and surrounding natural systems. Table 5-4 is a list of surface water/stormwater options developed in earlier RWSPs by the District and costs have been updated.

A number of surface water/stormwater options with the potential to meet the PRMRWSA's demands in the future were identified and evaluated in its Integrated Regional Water Supply Plan update completed in 2019. That update provided costs for the various options. The following are several of those options.

1.0 Surface Water/Stormwater Options

Surface Water/Stormwater Option #1. New Flatford Swamp Net Benefit Groundwater Recovery Concept

- Entities Responsible for Implementation: PRMRWSA, District

The District has progressed in planning a concept to passively recharge excess flows within the upper Myakka River watershed at Flatford Swamp, which is estimated to be approximately 10 mgd annual average daily flow (AADF) from the upper Myakka system at buildout. Excess flows from Coker/Ogelby Creek, Myakka River at Taylor Road, and Maple Creek will be diverted from Flatford Swamp to the UFA's Avon Park High-Permeability Zone. Once the pilot study is completed by the District, groundwater modeling should be completed to confirm the percent of recharge water achievable for groundwater credits. Discussions with the District would be required to fully understand the methodology to be developed for quantifying the Net Benefit that could be realized from this AR project coupled with public water supply. To justify the Authority's partial use of the Net Benefit derived from operating the Flatford Swamp AR program, it may be necessary for the Authority to operate the Flatford Swamp AR system on behalf of the District. Assuming a 5 mgd AADF freshwater supply can be obtained, a 10 mgd UFA wellfield near Myakka City could be constructed that is operated to produce a 5 mgd AADF water supply for the region. This is anticipated to require up to 10 production wells averaging 1 mgd each and conventional water treatment facilities capable of treating up to 10 mgd of fresh groundwater. This report is assuming the fresh groundwater will need to be treated for sulfur through aeration and disinfected prior to distribution. For conveyance, approximately 20 miles of 24-inch transmission main could tie into the Authority's transmission system. See Table 5-4 for a summary of this option's potential costs.

Table 5-4. *Flatford Swamp Net Benefit option costs*

Quantity Available (mgd)	Capital Cost	Cost/mgd	Annual O&M/1,000 gal	Cost/1,000 Gallons
5	$113,400,000	$22,680,000	$1.00	$5.04

Surface Water/Stormwater Option #2. Cow Pen Slough

- Entities Responsible for Implementation: PRMRWSA, Sarasota County

This option consists of capturing excess flow from Cow Pen Slough for storage in an off-stream reservoir and would also provide an environmental benefit by restoring the natural freshwater/saltwater regime in the Dona Bay estuary. Sarasota County has begun to implement this diversion in two phases. Phase 1, termed the Dona Bay Conveyance Improvements, encompasses the Cow Pen Slough flow diversion system to the wetland detention areas and Pinelands wetland area. Sarasota County is currently designing Phase 2, which is a storage facility planned to restore the former Venice Minerals borrow pit area. Phase 2 will create an approximate 370-acre wet detention area with water level control structures that will receive flows downstream of the Pinelands wetland area via a 72-inch pipeline to the Venice Minerals reservoir site. Beyond the currently planned projects by Sarasota County, creation of a 5 mgd water supply could be achieved as stated in the 2015 RWSP by adding a Venice Minerals Reservoir Pump Station with surface water main to the T. Mabry Carlton Reserve site for treatment. The surface water quality is seasonally variable in salinity, likely requiring a high-pressure membrane treatment process. Management of the concentrate produced from the membrane treatment process would need to be considered. Expansion of the Venice Minerals Reservoir capacity and expanding the water treatment capacity could allow for up to 5 mgd each of additional finished water, totaling an approximate 15 mgd of finished water. See Table 5-5 for a summary of this option's potential costs.

Table 5-5. *Cow Pen Slough option costs*

Quantity Available (mgd)	Capital Cost	Cost/mgd	Annual O&M/1,000 gal	Cost/1,000 Gallons
5	$82,800,000	$16,560,000	$2.05	$5.00

Issues:

As Sarasota County restoration work and studies continue, more information will be available to better quantify excess flows within Cow Pen Slough. Ultimately, the quantity of water supply available from Cow Pen Slough will be determined through the permitting process.

Surface Water/Stormwater Option #3. Peace River Facility Surface Water System Expansion

- Entities Responsible for Implementation: PRMRWSA

With this option, reliability modeling conducted by the Authority has reflected a 15 mgd additional yield in finished water capacity by constructing 138 mgd of additional Peace River diversion pumping for a total of 258 mgd, conveyance to a new 6 billion gallon (bg) Reservoir for additional raw water storage for a total of 12.5 bg in the reservoir system, and a Peace River Facility (PRF) treatment capacity expansion of 24 mgd. This project provides maximum utilization of the additional harvesting opportunity of freshwater flows now allowed by the Authority's recently issued 50-year WUP. A conceptual siting study analyzed three potential sites for a new 6 bg Reservoir on the RV Griffin Reserve and concluded that the primary constraint of siting the new reservoir is mitigation for impacts to existing wetland habitats and floodplain compensation. See Table 5-6 for a summary of this option's potential costs.

Table 5-6. *Peace River Facility Surface Water System Expansion option costs*

Quantity Available (mgd)	Capital Cost	Cost/mgd	Annual O&M/1,000 gal	Cost/1,000 Gallons
15	$332,200,000-339,500,000	$22,146,667-22,633,333	$0.99-1.00	$4.94-5.03

Surface Water/Stormwater Option #4. Peace River Facility Treatment Plant Capacity Expansion Phase II

- Entities Responsible for Implementation: PRMRWSA

The Authority is planning to increase their current PRF rated treatment capacity of 51 mgd by 4.5 mgd to 55.5 mgd and add 12 new ASR wells to create additional wellfield recovery capacity to the reservoir system. Additional plant improvements are expected to include adding additional alum storage capacity, adding an additional high service pump, and adding a third sludge press; however, other minor improvements, as needed, will be determined when this project begins in 2024. If the partially treated water ASR project, as explained above, is successfully permitted, expansion of the Authority's ASR wellfield becomes an economically sensible option to increase this water storage resource. See Table 5-7 for a summary of this option's potential costs.

Table 5-7. *Peace River Facility Treatment Plant Capacity Expansion Phase II option costs*

Quantity Available (mgd)	Capital Cost	Cost/mgd	Annual O&M/1,000 gal	Cost/1,000 Gallons
4.5	$32,300,000	$7,177,778	$0.81	$2.09

2.0 System Interconnect/Improvement Options

The system interconnect/improvement options are critical components of water supply distribution systems that involve the construction of pipelines and booster pumping stations. Development of these options will facilitate the regionalization of potable water supply systems by providing transmission of water from areas of supply to areas of demand. These options will also increase rotational and reserve capacity and provide redundancy of water supplies during emergency conditions.

The PRMRWSA is developing the Regional Integrated Loop System as a series of transmission pipelines to regionally transfer water from existing and future alternative supplies to demand centers within the PRMRWSA's service area. Five of the Loop System phases are complete or under construction as of 2020 (Phases 1, 1A, 2, 3A, and 3B). The PRMRWSA revisited their loop system in the Integrated Water Supply Master Plan Update (2020). The phasing is updated to develop segments over the current or future planning horizons to transfer regional water supplies within the four-county service area. The future phases are listed in no particular order of implementation in Table 5-8.

Table 5-8. *Regional Integrated Loop System estimated costs by future phase*

Regional Integrated Loop System Phase	Project Description	Estimated Capital Cost
Phase 2B	Approximately 10 miles from the Charlotte County line near Serris Boulevard to North Port Myakkahatchee Creek WTP	$57,877,000
Phase 2C	Approximately 14-mile extension from North Port Myakkahatchee Creek WTP to Sarasota County Carlton WTP	$61,388,000
Phase 2D	Approximately 12.5-mile branch from North Port Myakkahatchee Creek WTP to EWD's System at Keyway Road and S.R. 776.	$32,446,000
Phase 3C	Approximately 6.5 miles from Clark Road to the vicinity of Fruitville Road in Lakewood Ranch.	$57,603,000
Phase 3C Extension	Approximately 10.8-mile extension from the terminus of Phase IIIC to the Pump Station at University and Lockwood Ridge.	$28,688,000
Phase 4	Approximately 15 miles from Burnt Store WTP to Phase IA Pipeline near Ridge Road and Highway 17.	$36,114,000

Section 5. Brackish Groundwater Desalination Options

Options proposing to withdraw brackish groundwater from the UFA may not be permittable in many areas of the planning region due to their potential to exacerbate existing resource problems that have resulted from historical groundwater withdrawals. 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 stressed water resources, including the SWUCA Saltwater Intrusion Minimum Aquifer Level. Brackish groundwater obtained from the intermediate aquifer system may be a more viable source of water supply. Additionally, some UFA quantities may result from "net benefit" activities that improve recharge to water resources or retire groundwater withdrawals from other uses.

The PRMRWSA and PS utilities have identified numerous brackish groundwater project options, despite issues with source availability, because the projects typically allow a phased expandability and can work conjunctively with more seasonal alternative water sources. The options identified include the following:

Brackish Groundwater Option #1. Peace River Facility Brackish Wellfield

- Entity Responsible for Implementation: PRMRWSA

The PRF, located in the RV Griffin Reserve in DeSoto County, is a large-scale surface water treatment facility that includes an off-stream reservoir and ASR system. Evaluations of test and monitor well data near the facility indicate that water quality and production of groundwater may be sufficient for the development of a supply wellfield. In 2010, the PRMRWSA commenced a detailed feasibility analysis for developing brackish groundwater sources at the facility. The investigation evaluated three groundwater production zones, and found the Avon Park (1,300 to 1,500 feet below surface at the locality) to be the most viable production zone with productivity rates of 3 to 5 mgd and total dissolved solids concentrations between 5,000 and 6,000 mg/l. The intermediate aquifer system was less productive but contained better quality water that could provide a secondary source for raw water blending. A Reverse Osmosis (RO) system and an injection well would be constructed at the PRF and used conjunctively with the existing surface water treatment and regional transmission systems. The project cost includes a clear well for blending control. See Table 5-9 for a summary of this option's potential costs.

Table 5-9. *Peace River Facility Brackish Wellfield option costs*

Quantity Produced (mgd)	Capital Cost	Cost/mgd	O&M Cost/1,000 gallons	Cost/1,000 gallons
5.5	$58,300,000	$10,600,000	$2.07	$3.96

Brackish Groundwater Option #2. City of Venice Reverse Osmosis Facility Expansion

- Entity Responsible for Implementation: City of Venice

The City of Venice operates a RO facility that was originally designed to produce 4.5 mgd of finished water. Many of the City's wells are located close to the Intracoastal Waterway and withdrawal water from the Hawthorne aquifer. The facility and wellfields are located in the MIA, and additional withdrawals would require appropriate mitigation. The existing RO system operates at 50 percent recovery by design, due to concentrate water quality limits regulated for their surface water discharge permit issued in 1997. The City has worked with the Florida Department of Environmental Protection to expand the water quality limits based on historic facility operations and monitoring, which would allow the City to improve the treatment efficiency. Improving the system recovery would increase capacity and/or reduce withdrawals needed for current demand.

In 2018, the City completed a process efficiency study that was required as a special condition of their WUP. The study identified a feasible option to increase efficiency to 75 percent. The option would install a second-pass RO component for half of the existing membranes. The upgraded half would meet current demands and the other half of the RO system would stand by for peak demands. The total treatment capacity would be increased by 1.46 mgd, without additional wells or increased WUP capacity.

The facility improvement option is shown in Table 5-10, below. It includes the inter-stage booster pumps and second-pass RO membranes for half of the existing facility. The system would use the current disposal method of surface water discharge.

Table 5-10. *City of Venice RO Facility Expansion option costs*

Quantity Produced (mgd)	Capital Cost	Cost/mgd	O&M Cost/1,000 gallons	Cost/1,000 gallons
1.2	$3,300,000	$2,750,000	$0.24	$0.55

<u>Brackish Groundwater Option #3. DeSoto County Brackish Wellfield at the DeSoto Correctional Institute</u>

- Entity Responsible for Implementation: PRMRWSA, DeSoto County

DeSoto County currently owns and operates a wellfield located at the DeSoto Correctional Institute (DCI) permitted for 0.8 mgd. The location offers the potential to develop additional supply to serve local and regional needs. The planning-level costs shown in Table 5-11 were developed for the draft PRMRWSA Integrated Regional Water Supply Plan 2020 update. The conceptual design includes additional production wells situated in the intermediate aquifer system and the upper zones of the UFA, a RO facility, a deep well injection system, 10 miles of 16-inch transmission main, and booster pumping. The Authority anticipates the transmission main may be connected to the portion of Desoto County’s system that is currently supplied by the Authority by 2024. Approximately $6.3M of the cost shown will be offset if DeSoto County proceeds to add this pipeline in advance.

Table 5-11. *DeSoto Brackish Wellfield option costs*

Quantity Produced (mgd)	Capital Cost	Cost/mgd	O&M Cost/1,000 gallons	Cost/1,000 gallons
5.0	$78,500,000	$15,700,000	$2.24	$5.04

<u>Brackish Groundwater Option #4. Manatee County Buffalo Creek Brackish Wellfield</u>

- Entity Responsible for Implementation: Manatee County

Manatee County is planning to develop a 3 mgd RO facility and wellfield located adjacent to the Buffalo Creek golf course. Approximately eight wells would withdraw water from the intermediate aquifer system and the upper zones of the UFA. The facility will dispose of RO concentrate in Class 1 deep well at the adjacent North Regional Water Reclamation Facility. The conceptual costs shown in Table 5-12, below.

Table 5-12. *Manatee County Buffalo Creek Brackish Wellfield option costs*

Quantity Produced (mgd)	Capital Cost	Cost/mgd	O&M Cost/1,000 gallons	Cost/1,000 gallons
3.0	$38,300,000	$12,766,667	$2.45	$4.72

Section 6. Seawater Desalination Options

Seawater desalination options for the planning region were evaluated for locations compatible with adjacent land uses and coastal environments, proximity to existing potable water transmission infrastructure, and permissibility of concentrate discharges. There are two project options that were initially identified in the 2015 RWSP.

Seawater Desalination Option #1. Port Manatee

- Entity Responsible for Implementation: PRMRWSA, Manatee County

This option is for the development of a desalination facility at Port Manatee in northwestern Manatee County, on Tampa Bay. The site was chosen because of its industrial nature, proximity to a deep-water channel that could accommodate intake and discharge facilities, and potential to obtain a permit to discharge concentrate. An additional advantage of the site is that it is located approximately 0.5 miles from a point of connection to two potable water lines that are part of Manatee County's water system. The facility would be designed to withdraw up to 440 mgd of seawater for the desalination process. The facility would produce 20 mgd of finished water and 20 mgd of concentrate. See Table 5-13 for a summary of this option's potential costs.

Table 5-13. *Port Manatee Desalination Facility option costs*

Quantity Produced (mgd)	Capital Cost	Cost/mgd	O&M/1,000 Gallons	Cost/1,000 Gallons
20	$271,800,000	$13,550,000	$3.16	$5.58

Seawater Desalination Option #2. Venice

- Entity Responsible for Implementation: PRMRWSA, City of Venice

This option is for a desalination facility located in the general vicinity of the Venice airport. The site was chosen because it is in close proximity to areas of high water demand, has access to a potential intake in the Intracoastal Waterway, and is near a permitted surface water discharge site to the Gulf of Mexico. The site is also located near a water treatment plant that is interconnected to the Sarasota County water system, which could serve as the point of regional distribution for the product water. The water intake would be located within the C-1 Canal, a five-mile section of the Intracoastal Waterway that was excavated in the 1960s and has experienced poor water quality. The withdrawals would theoretically increase circulation in the waterway for a net environmental benefit. See Table 5-14 for a summary of this option's potential costs.

Table 5-14. *Venice Desalination Facility option costs*

Quantity Produced (mgd)	Capital Cost	Cost/mgd	O&M/ 1,000 Gallons	Cost/1,000 Gallons
20	$287,400,000	$14,370,000	$3.17	$5.73

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Chapter 6. Water Supply Projects Under Development

This chapter is an overview of water supply projects that are under development in the Southern Planning Region. Projects under development are those the Southwest Florida Water Management District (District) is co-funding and are either (1) actively in the planning, design, or construction phase, or (2) not yet in the planning phase, but have been at least partially funded through fiscal year (FY) 2019, or (3) have been completed since the year 2015 and are included to report on the status of implementation since the previous Regional Water Supply Plan (RWSP).

The demand projections presented in Chapter 3 show that approximately 44.39 mgd of new water supply will need to be developed during the 2020 to 2040 planning period to meet demand for all use sectors in the planning region. As of 2019, it is estimated that approximately 40 percent of that demand (17.6 mgd) has either been met or will be met by projects that meet the above definition of being "under development." In addition to these projects under development, it is probable that additional water supplies are being developed by various entities in the planning region outside of the District's funding programs.

Section 1. Water Conservation

1.0 Non-Agricultural Water Conservation Projects

1.1 Indoor Water Conservation Projects

Since 2015, the District has cooperatively funded the distribution of approximately 8,746 ultra low-flow or high-efficiency fixtures within the Southern Planning Region. These programs have cost the District and cooperating local governments a combined $1,354,904 and have yielded a potable water savings of approximately 214,778 gallons per day (gpd). Table 6-1 provides information on indoor water conservation projects that are under development in the planning region.

1.2 Outdoor/Other Water Conservation Projects

Since 2015, the District has cooperatively funded three projects in the Southern Planning Region that reduce potable water line flushing. These line looping projects reduce potable water flushing by eliminating distribution system dead-ends and rerouting water to higher demand areas. In addition, one soil moisture sensor rebate program has been funded. These programs have cost the District and cooperating local governments a combined $1,744,484 and have yielded a potable water savings of approximately 146,611 gpd. Table 6-1 also provides information on outdoor water conservation projects that are under development.

Table 6-1. *Water conservation projects under development in the Southern Planning Region*

Cooperator	Project Number	General Description	Savings (gpd)	Devices Rebates	Total Cost[1]	District Cost	$/1,000 gal Saved
Indoor Projects							
Manatee County	N623	Toilet Rebate	29,093	1,524	$225,755	$112,860	$2.17
City of Venice	N625	Toilet Rebate	4,569	318	$48,099	$24,050	$2.94
Manatee County	N725	Toilet Rebate	24,816	1,323	$198,625	$99,312	$2.23
Manatee County	N806	Toilet Rebate	23,945	1,228	$184,421	$92,211	$2.15
City of Venice	N808	Toilet Rebate	4,028	302	$53,217	$26,609	$3.69
Manatee County	N877	Toilet Rebate	23,760	1,228	$184,987	$92,493	$2.17
Manatee County	N982	Toilet Rebate	26,380	1,000	$151,000	$75,500	$1.60
City of Venice	N992	Toilet Rebate	4,990	249	$58,900	$29,450	$3.29
City of Palmetto	Q073	Toilet Rebate	41,827	325	$40,000	$20,000	$0.27
Manatee County	Q111	Toilet Rebate	26,380	1,000	$151,000	$75,500	$1.60
City of Venice	Q126	Toilet Rebate	4,990	249	$58,900	$29,450	$3.29
Indoor Total			*214,778*	*8,746*	*$1,354,904*	*$677,435*	*$1.76*[2]
Outdoor/Other Projects							
City of North Port	N680	Line-Looping	26,851	NA[3]	$419,093	$163,579	$3.80
City of Arcadia	N815	Line-Looping	28,267	NA[3]	$313,391	$235,044	$2.70
Braden River Utilities	Q020	Soil Moisture Sensor Rebate	55,000	600	$308,000	$154,000	$2.29
City of North Port	N979	Line-Looping	36,493	NA[3]	$704,000	$352,000	$4.69
Outdoor/Other Total			*146,611*	*600*	*$1,744,484*	*$904,623*	*$3.24*[2]
Total			**361,389**	**9,346**	**$3,099,389**	**$1,582,058**	**$2.36**[2]

[1] The total project cost may include variable project specific costs including marketing, education and administration.
[2] Total cost efficiency is weighted by each project's percent share of total savings in relation to the cost.
[3] This is a construction project that includes the removal of auto flushers and installation of a new pipeline.

2.0 Agricultural Water Conservation Projects

The District's largest agricultural water conservation initiative, the Facilitating Agricultural Resource Management Systems (FARMS) Program is not included in this section because the District classifies the program as water resource development. Program details, including projects under development, are contained in Chapter 7, Water Resource Development.

2.1 Institute of Food and Agricultural Sciences Research and Education Projects

The District provides funding for Institute of Food and Agricultural Sciences (IFAS) to investigate a variety of agriculture/ urban issues that involve water conservation. These include, but are not limited to, development of tailwater recovery technology, determination of crop water use requirements, evaluation of alternative irrigation methods, field irrigation scheduling, frost/freeze protection, residential irrigation, and urban water use. IFAS conducts the research, then provides the results to the agricultural community. The District has funded research on strawberries, citrus, tomatoes, potatoes, peaches, biofuel grasses, turf grass, peppers, blueberries, and various landscape and nursery ornamental plants and trees. Of the 58 research projects, 48 have been completed. Completed projects include 10 projects dealing with urban landscape issues and 38 involving various agricultural commodities. While the research projects are not specific to each planning region, they are specific to a commodity group that has a strong presence in each region. The research will help develop best management practices that will conserve water Districtwide. Specific benefits to the planning region are dependent on the commodities dominant in that planning region. The 10 ongoing projects are described in Table 6-2.

Research on agricultural frost/freeze protection is one of many projects conducted by IFAS to improve water conservation measures

Table 6-2. *List of water conservation research projects*

Project	Total Project Cost + District Cooperator	Total Project and Land Cost	Funding Source	Planning Region(s)[1]
Leaching Fraction-Adjusted Irrigation Impact on Nutrient Load and Plant Water Use	$81,320	$81,320	District	All
Florida Automated Weather Network Data Dissemination and Education	$100,000	$100,000	District	All
Blueberry Water Allocation and Irrigation Scheduling Using Evapotranspiration-based Methods	$ 210,000	$ 210,000	District	All
Reduction of Water Use for Citrus Cold Protection	$21,000	$21,000	District	All
Effect of Water Scheduling and Amounts on Growth of Young Citrus Trees in High Density Plantings	$168,623	$168,623	District	All
New Practical Method for Managing Irrigation in Container Nurseries	$165,310	$165,310	District	All
Effect of Composting at Animal Stock Facilities on Nutrients in Groundwater	$175,000	$175,000	District	All
Evaluating Fertigation with Center Pivot Irrigation for Water Conservation on Commercial Potato Production	$400,000	$400,000	District	All
Evaluation of Water Use & Water Quality Effects of Amending Soils & Lawns with Compost Material	$60,000	$60,000	District	All
Evaluation of Nitrogen leaching from reclaimed water applied to lawns, spray fields, and rapid infiltration basins.	$294,000	$294,000	District	All
Total	**$1,675,253**	**$1,675,253**		

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

Section 2. Reclaimed Water

1.0 Reclaimed Water Projects: Research, Monitoring and Education

In addition to funding reclaimed water projects, the District also supports reclaimed water research and monitoring which is central to maximizing reclaimed water use and 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 6-3 is a list, description, and summary of the benefits and costs that have been or will be realized by the five reclaimed water projects currently under development and another two estimated to experience additional future supply growth. It is anticipated that these seven projects will be online by 2025. Table 6-4 includes general descriptions and a summary of 10 research projects for which the District has provided more than $1,026,000 in funding. The District has also committed to developing a comprehensive reclaimed water education strategy. All reclaimed water construction projects funded by the District require education programs that stress the value and benefits of efficient and effective water use regardless of the water source. To provide reclaimed water information to a broader audience, the District has developed a webpage that is one of the top Internet sources of reuse information including Geographic Information System (GIS) and other data. 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.

Reclaimed water pipes

Table 6-3. *Reclaimed water projects under development in the Southern Planning Region*

Cooperator	General Project Description	Reuse (mgd)			Customer (#)		Costs	
		Produced	Benefit	Storage	Type	Total	Total	District[1]
Charlotte County								
Charlotte County	Trans/Pump N556	2.23	1.34	NA	Res, Rec, Com, GC	TBD	$9,430,000	$4,715,000
Riverwood	Growth of Flows	0.03	0.02	NA	Res, GC	TBD	Prior	Prior
Manatee County								
City of Bradenton	Growth of Flows to Lakewood Ranch	4.26	4.26	NA	Res	TBD	Prior	Prior
City of Bradenton, BRU	Trans, N711	1.00	1.00	11.4	Res, Rec, Com, GC	TBD	$4,600,000	$2,300,000
DeSoto								
City of Arcadia	Trans, Store N881	0.10	0.09	0.60	GC	1	$300,000	$225,000
Sarasota County								
West Villages Improvement District	Trans N920	0.25	0.19	NA	Res	620	$712,000	$356,000
City of North Port	Trans N667	0.36	0.22	NA	Res, Com, Rec, GC	TBD	$1,320,000	$660,000
Total	**7 Projects**	**8.23**	**7.12**	**12.00**		**621**	**$16,362,000**	**$8,256,000**

[1] Costs include all revenue sources budgeted by the District.

Table 6-4. *Descriptions and summary of reclaimed water research projects co-funded in the District*

Cooperator	General Project Description	Costs[1]	
		Total	District[2]
WateReuse Foundation	Water Treatment Study L112	$500,000	$275,000
WateReuse Foundation	Water Quality Study P872	$520,000	$282,722
WateReuse Foundation	Pathogen Study P173	$216,000	$34,023
WateReuse Foundation	Research Cost Study P174	$200,000	$70,875
WateReuse Foundation	Research Study ASR P175	$393,000	$72,410
WateReuse Foundation	Storage Study P694	$300,000	$100,000
WateReuse Foundation	Soil Aquifer Treatment P695	$200,000	$66,667
WateReuse Foundation	Wetlands Study P696	$200,000	$66,667
WateReuse Foundation	Nutrient Study P698	$305,100	$16,700
WateReuse Foundation	Nutrient II P966	$380,000	$41,666
Total (Districtwide)	**10 Projects**	**$3,214,100**	**$1,026,730**

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

Section 3. Surface Water/Stormwater

1.0 System Interconnect/Improvement Projects

The regional integrated loop system projects are a series of transmission pipelines and associated storage and pumping stations being developed to regionally transfer and deliver water from existing and future alternative supplies to demand centers within the PRMRWSA four-county service area. The system also provides reserve capacity for emergency transfers and maximizes the use of surface water in the SWUCA. Three phases of the loop system were completed prior to 2015, and two are under construction and scheduled for completion by 2022 or sooner. The two ongoing phases are described in Table 6-5. The layout, timing, and conceptual costs of other future phases were recently updated for the PRMRWSA's Water Supply Master Plan Update and are discussed in Chapter 5, Water Supply Development Options.

System Interconnect/Improvement Project #1. Regional Loop System Phase 1

The Phase 1 project consists of approximately 6 miles of 24-inch transmission pipeline to interconnect a distribution station in southern DeSoto County on US 17 with Punta Gorda's Shell Creek water treatment facility in Charlotte County. The project includes 3,500 linear feet of subaqueous crossing of Shell Creek installed by directional drilling. With the concurrent construction of the City's new Reverse Osmosis (RO) facility, the project will provide DeSoto County with a reliable back-up water supply. The project will also allow the City to meet demands when Shell Creek withdrawals are limited by expected minimum flows. The project was initially designed in 2007 but then postponed, and a design update commenced in 2014. Construction began in 2018 and the project is scheduled for completion by December 2020.

System Interconnect/Improvement Project #2. Regional Loop System Phase 3B

The Phase 3B project will extend from the Phase 3A northern terminus at a meter station along Cow Pen Slough that serves Sarasota County's Preymore neighborhood, approximately five miles northward to Clark Road (SR 72) in Sarasota County, where a new transmission connection will send up to 7 mgd to the County's pump station #5. A future Phase 3C expansion and booster station would extend the Loop System into Manatee County. The Phase 3B pipeline is 48-inches in diameter and will be capable of sending an additional 17 mgd through the future connection. The project design work commenced in 2016, construction began in 2019, and completion is scheduled for 2021.

Table 6-5. *Regional Loop System project cost/share by phase*

Interconnect Project Name	Total Capital Cost	District Share	Description
PRMRWSA Regional Loop System Phase 1 Interconnect	$12,000,000	$6,000,000	24-inch interconnect from the US-17 booster station in DeSoto County to Punta Gorda's Shell Creek Water Treatment Facility (WTF) in Charlotte County.
PRMRWSA Regional Loop System Phase 3B Interconnect	$16,700,000	$8,100,000	48-inch interconnect to extend the current Loop System northern terminus from the Preymore meter station along Cow Pen Slough, northward approximately 5 miles to Clark Road (SR 72) in central Sarasota County.

Section 4. Brackish Groundwater Desalination

Brackish Groundwater Desalination Project #1. City of Punta Gorda Brackish Groundwater Project

The City of Punta Gorda's Brackish Groundwater project consists of the design, wellfield testing study, third-party reviews, permitting, and construction of a 4 mgd brackish groundwater RO facility collocated at the City's existing 10 mgd Shell Creek surface water treatment facility. The facility components include a water blending station, 2 mg storage tank, raw water supply wellfield, and a concentrate disposal well. The City's primary purpose for the new facility is to create a high-quality blending source for treated surface water from Shell Creek, which at times exceeds drinking water standards for TDS. Additional benefits include creating a reliable backup regional water supply to DeSoto County through the PRMRWSA's Loop System Phase 1 Interconnect, meeting demands while allowing for flow reductions on Shell Creek to meet expected minimum flows, and mediation of arsenic issues with the City's ASR wells by converting them to brackish supply wells. The project commenced in 2014 and is scheduled for completion in 2021. See Table 6-6 for a summary of this project's potential costs.

Table 6-6. *City of Punta Gorda Brackish Groundwater project cost/share*

Quantity Produced (mgd)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
4.0	$39,400,000	$15,650,000	$9,850,000	$3.89

Brackish Groundwater Project #2. City of North Port West Village Brackish Wellfield

- Entity Responsible for Implementation: City of North Port

The City of North Port is utilizing a previously constructed and capped brackish groundwater wellfield to create a Southwest Water Treatment Plant which will serve the West Villages Improvement District that is rapidly growing. The groundwater wellfield is permitted for an average and peak withdrawal rate of 2.7 mgd. Assuming 25 percent RO treatment losses, the finished water capacity is anticipated to be 2.03 mgd. The City has stipulated in their Capital Improvement Plan (CIP) that the developer for the West Villages Improvement District is required to design, permit, and construct the water treatment plant and dedicate it to the City. Construction is expected to be complete in 2022. The construction costs shown in Table 6-7 are a budgetary estimate provided by the developer.

Table 6-7. *City of North Port West Village Brackish Wellfield option costs*

Quantity Produced (mgd)	Capital Cost	Cost/mgd	Cost/1,000 gallons	O&M Cost/1,000 gallons
2.03	$26,000,000	$12,800,000	$TBD	$1.12

Section 5. Aquifer Storage and Recovery Projects

There are two potable and two reclaimed water ASR projects under development in the Southern Planning Region. Figure 4-6 shows ASR project locations in the District.

PRMRWSA Partially Treated Surface Water Aquifer Storage and Recovery Project #1. Peace River Manasota Regional Water Supply Authority (N854)

The PRMRWSA partially treated surface water project consists of the design, permitting and construction of a 20 MGD pump station, new electrical building and ancillary piping. Uncoupling the ASR system's source water from the requirement of full treatment would eliminate the need to rely on excess treatment capacity for recharging the ASR system, thereby allowing the treatment capacity that is currently reserved for ASR storage to be reallocated toward meeting customer demands. See Table 6-8 for a summary of this project's potential costs.

Table 6-8. *PRMRWSA Partially Treated Surface Water ASR (N854) project cost/share*

Quantity Produced (mgd)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
0	$8,300,000	$4,150,000	$N/A	$N/A

Reclaimed Water Aquifer Storage and Recovery Project #2. Braden River Utilities ASR Feasibility (N912)

The Braden River Utilities Reclaimed Water ASR Feasibility study is for construction and cycle testing of two sites each including an ASR well, two storage zone monitoring wells, and one upper zone monitoring well; partial infrastructure consisting of a simplified control system; and temporary piping, pumps, and other associated infrastructure. The benefit of this project is the optimization of reclaimed water supplies through increasing wet-weather storage, reducing reliance on groundwater, and contributing to the recovery of the most impacted area (MIA) of the SWUCA. The two sites would provide approximately a combined 3 to 4 mgd injection and recovery capacity. Feasibility at these two sites could also result in the development of four additional sites in the future with peak injection capacity of 19 mgd. The ASR wells will be located within the Braden Utilities service area. The project is currently working through Florida Department of Environmental Protection (FDEP) Underground Injection Control permitting issues associated with reclaimed water ASR projects. See Table 6-9 for a summary of this project's potential costs.

Table 6-9. *Braden River Utilities ASR (N912) project cost/share*

Quantity Produced (mgd)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
TBD	$5,995,000	$2,997,500	TBD	TBD

Potable Water Aquifer Storage and Recovery Project #4. City of Bradenton Surface Water ASR-2 (N435)

The City of Bradenton ASR project consists of design, third party review, permitting, construction and testing of one potable water ASR well, associated monitoring wells and surface facilities. The project includes a vacuum degasification tower to remove dissolved oxygen as an arsenic management technique. The project is currently undergoing cycle testing with fully treated surface water. Results from the first cycle tests are pending. The project is located at the Bill Evers Reservoir site. See Table 6-10 for a summary of this project's potential costs.

Table 6-10. *City of Bradenton Surface Water ASR-2 (N435) project cost/share*

Quantity Produced (mgy)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
NA	$4,700,000	$2,350,000	TBD	TBD

Reclaimed Water Aquifer Storage and Recovery Project #4. City of Venice Reclaimed Water ASR (Q050)

The City of Venice ASR project consists of 30 percent design and third-party review of a system to store and recover at least 25 million gallons per year (mgy) of reclaimed water at the City's Eastside Advanced Wastewater Reclamation Facility. At a planning level, two production wells (1 mgd capacity each) will be constructed. See Table 6-11 for a summary of this project's potential costs.

Table 6-11. *City of Venice Reclaimed Water ASR (Q050) project cost/share*

Quantity Produced (mgy)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
NA	$165,000	$82,500	TBD	TBD

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Chapter 7. Water Resource Development Component

This chapter addresses the legislatively required water resource development (WRD) activities and projects that are conducted primarily by the District. The intent of WRD projects is to enhance the amount of water available for regional-beneficial uses and natural systems. Chapter 373.019, Florida Statutes (F.S.), defines WRD as: *"Water resource development" means 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[24], F.S.). The District is primarily responsible for implementing WRD; however, additional funding and technical support may come from state, federal, and local entities.

Part A. Overview of Water Resource Development Efforts

The District classifies WRD efforts into two 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 discussed in Section 1, below. The second category includes more narrowly defined "projects," which are regional projects designed to create an identifiable supply of water for existing and/or future reasonable-beneficial uses. These projects are discussed in Section 2.

Section 1. Data Collection and Analysis Activities

The District budgets significant funds annually to implement the WRD data collection and analysis activities, which support the health of natural systems and water supply development. Table 7-1 displays the fiscal year (FY) 2020 budget and anticipated five-year funding levels for Districtwide data collection and analysis activities. Approximately $40.8 million will be allocated toward these activities annually for a five-year total of approximately $204 million. Because budgets for the years beyond FY2020 have not yet been developed, but are projected to be fairly constant, future funding estimates for activities are set equal to FY2020 funding. Funding for these activities is primarily from the Governing Board's allocation of ad valorem revenue collected within the District. In some cases, additional funding is provided by water supply authorities, local governments, and the U.S. Geological Survey (USGS). The activities listed in Table 7-1 are described in subsections 1.0 through 5.0, below.

Table 7-1. *WRD data collection and analysis activities (Districtwide)*

	WRD Data Collection and Analysis Activities	FY2020 Funding	Anticipated 5-Year Funding	Funding Partners
1.0	**Hydrologic Data Collection**			SWFWMD, other WMDs, USGS, FDEP, FWC
1.1	Surface Water Flows and Levels	$2,715,842	$13,579,210	
1.2	Geohydrologic Data Well Network (includes ROMP)	$3,149,091	$15,745,455	
1.3	Meteorologic Data	$278,408	$1,392,040	
1.4	Water Quality Data	$1,003,524	$5,017,620	
1.5	Groundwater Levels	$891,391	$4,456,955	
1.6	Biologic Data	$1,502,627	$7,513,135	
1.7	Data Support	$3,776,719	$18,883,595	
2.0	**Minimum Flows and Levels Program**			SWFWMD
2.1	Technical Support	$1,718,986	$8,594,930	
2.2	Establishment	$678,495	$3,392,475	
3.0	**Watershed Management Planning**	$7,456,686	$37,283,430	SWFWMD, Local Cooperators
4.0	**Quality of Water Improvement Program**	$743,025	$3,715,125	SWFWMD
5.0	**Stormwater Improvements: Implementation of Storage and Conveyance BMPs**	$16,927,435	$84,637,175	SWFWMD, USGS
	TOTAL	**$40,842,229**	**$204,211,145**	

1.0 Hydrologic Data Collection

The District has a comprehensive, hydrologic conditions monitoring program that includes the assembly of information on key indicators such as rainfall, surface, and groundwater levels, and water quality and stream flows. The program includes data collected by District staff and permit holders, as well as data collected as part of the District's cooperative funding program with the USGS. This data collection 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. This data collection also supports District flood control structure operations, water use and environmental resource permitting and compliance, minimum flows and levels (MFL) evaluation and compliance, the Surface Water Improvement and Management (SWIM) program, the SWUCA recovery strategy, modeling of surface water and groundwater systems, and many resource evaluations and reports.

The categories of hydrologic data that are collected and monitored by District staff are discussed below. The District also evaluates the hydrologic data submitted by Water Use Permit (WUP) holders to ensure compliance with permit conditions and to assist with monitoring and documenting hydrologic conditions.

1.1 Surface Water Flows and Levels. This includes data collection at the District's 808 surface water level gauging sites, and cooperative funding with the USGS for discharge and water-level data collection at 129 river, stream and canal sites. The data is available to the public through the District's Water Management Information System (WMIS), and through the USGS Florida Water Science Center Web Portal.

1.2 Geohydrologic Data Well Network. The Geohydrologic Data Well Network is a monitor well network that supports various projects throughout the District including the Central Florida Water Initiative (CFWI), Water Resource Assessment Projects, Water Use Caution Areas (WUCAs), recovery strategies, the Springs Team, sea level rise and other salt-water intrusion assessments, and development of alternative water supplies. The network includes the Regional Observation and Monitor-well Program (ROMP) which has been the District's primary means for hydrogeologic data collection since 1974. Data from monitor well sites are used to evaluate seasonal and long-term changes in groundwater levels and quality, as well as the interaction and connectivity between groundwater and surface water bodies. During construction of new monitor well sites, valuable hydrogeologic information is collected including the lithology, aquifer hydraulic characteristics, water quality, and water levels.

1.3 Meteorologic Data. The meteorologic data monitoring program consists of measuring rainfall totals at 171 rain gauges, most of which provide near real-time data. Annual funding is for costs associated with measurement of rainfall, including sensors, maintenance, repair and replacement of equipment. Funding allows for the operation of one District evapotranspiration (ET) station for reference near Lake Hancock, and for District participation in a cooperative effort between the USGS and all five Florida water management districts to map statewide potential and reference ET using data measured from the Geostationary Operational Environmental Satellites (GOES). The program also includes a collaborative effort between the five WMDs to provide high-resolution radar rainfall data for modeling purposes.

1.4 Water Quality Data. The District's Water Quality Monitoring Program (WQMP) collects data from water quality monitoring networks for springs, streams, lakes, and coastal and inland rivers. Many monitoring sites are sampled on a routine basis, with data analysis and reporting conducted on an annual basis. The WQMP develops and maintains the Coastal Groundwater Quality Monitoring Network, which involves sample collection and analysis from approximately 380 wells across the District to monitor saltwater intrusion and/or the upwelling of mineralized waters into potable aquifers.

1.5 Groundwater Levels. The District maintains 1,618 monitor wells in the data collection network, including 856 wells that are instrumented with data loggers that record water levels once per hour, and 762 that are measured manually by field technicians once or twice per month.

1.6 Biologic Data. The District monitors ecological conditions as they relate to both potential water use impacts and changes in hydrologic conditions. Funding for biologic data collection includes support for routine monitoring of approximately 150 wetlands and a five-year assessment of over 400 wetlands to document changes in wetland health and assess level of recovery in impacted wetlands. Funding also supports an effort to map the estuarine hard bottom of Tampa Bay, as well as Surface Water Improvement and Management (SWIM) program efforts for mapping of seagrasses in priority water bodies including Tampa Bay, Sarasota Bay, Charlotte Harbor, and the Springs Coast area.

1.7 Data Support. This item provides administrative and management support for the WQMP, hydrologic and geohydrologic staff support, the District's chemistry laboratory, and the District's LoggerNet data acquisition system.

2.0 Minimum Flows and Levels Program

Minimum Flow and water levels are ecologically based, hydrologic standards that are used for permitting and planning decisions concerning how much water may be withdrawn from or near a water body without causing significant harm to water resources or ecology of the area. Chapter 373.042, F.S., requires the state water management districts or the Florida Department of Environmental Protection (FDEP) to establish MFLs for aquifers, surface watercourses, and other surface water bodies to identify the limit or level at which further withdrawals would be significantly harmful. Rivers, streams, estuaries, and springs require minimum flows; while minimum levels are developed for lakes, wetlands, and aquifers. MFLs are adopted into District rules, Chapter 40D-8, Florida Administrative Code (F.A.C.), and are used in the District's WUP and water supply planning programs.

Reservations are rules that reserve water from use by permit applications, as necessary for the protection of fish and wildlife or public health and safety. Reservations are adopted into District rules, Chapter 40D-2, F.A.C., pursuant to Chapter 272.223, F.S., and are also used for water use permitting and water supply planning.

The District's processes for establishing MFLs and reservations include opportunities for interested stakeholders to review and comment on proposed MFLs or reservations and participate in public meetings. An independent scientific peer review process is used for establishing MFLs for flowing water bodies, MFLs for all water body types that are based on methods that have not previously been subjected to peer review, and for establishing reservations. Stakeholder input and peer review findings are considered by the Governing Board when deciding whether to adopt proposed MFLs and reservations. District monitoring programs provide data for evaluating compliance with the adopted MFLs and reservations, determining the need for MFLs recovery or prevention strategies and assessing the recovery of water bodies where significant harm has occurred.

The District has planned to monitor and assess the status of 210 adopted MFLs, including MFLs for 23 river segments, 10 springs or spring groups, 127 lakes, 41 wetlands, seven wells in the Northern Tampa Bay Water Use Caution Area, and the Upper Floridan aquifer (UFA) in the Most Impacted Area (MIA) of the SWUCA and in the Dover/Plant City Water Use Caution Area (DPCWUCA). The District is scheduling the establishment or reevaluation of 96 additional MFLs and one reservation through FY2029. The District's annual MFL Priority List and Schedule and Reservations List and Schedule is approved by the Governing Board in October, submitted to FDEP for review in November, and subsequently published in the Consolidated Annual Report. The approved and proposed priority lists and schedules are also posted on the District's Minimum Flows and Levels Documents and Reports webpage at: https://www.swfwmd.state.fl.us/projects/mfl/documents-and-reports

3.0 Watershed Management Planning

The District addresses flooding problems in existing areas by preparing and implementing Watershed Management Plans (WMPs) in cooperation with local governments. The WMPs define flood conditions, identify flood level of service deficiencies, and evaluate best management practices (BMPs) to address those deficiencies. The WMPs include consideration of the capacity of a watershed to protect, enhance, and restore water quality and natural systems while achieving flood protection. The plans identify effective watershed management strategies and culminate in defining floodplain delineations and constructing selected BMPs.

Local governments and the District combine their resources and exchange watershed data to implement the WMPs. Funding for local elements of the WMPs is provided through local governments' capital improvement plans and the District's Cooperative Funding Initiative. Additionally, flood hazard information generated by the WMPs is used by the Federal Emergency Management Agency to revise flood insurance rate maps. This helps better define flood risk and is used extensively for land use planning by local governments and property owners. Since the WMPs may change based on growth and shifting priorities, the District also cooperates with local governments to update the WMPs, when necessary, giving decision-makers opportunities throughout the program to determine when and where funds are needed.

4.0 Quality of Water Improvement Program

The Quality of Water Improvement Program (QWIP) was established in 1974 through Section 373.207, F.S., to restore groundwater conditions altered by well drilling activities for domestic supply, agriculture, and other uses. The program'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 prevents mineralized groundwater from contaminating surface water bodies. Thousands of wells constructed prior to current well construction standards were often deficient in casing, which interconnected aquifer zones and enabled poor-quality mineralized water to migrate into zones containing potable-quality water.

Plugging wells involves filling the abandoned well with cement or bentonite. 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 reimbursement amount, the proper plugging method, and to collect groundwater quality and geologic data for inclusion in the District's database. The emphasis of the QWIP is primarily in the SWUCA where the UFA is confined. Historically, the QWIP has proven to be a cost-effective method to prevent waste and contamination of potable ground and surface waters.

5.0 Stormwater Improvements: Implementation of Storage and Conveyance Best Management Practices

The District's WMPs and SWIM programs implement stormwater and conveyance BMPs for preventative flood protection to improve surface water quality, particularly in urban areas, and to enhance surface and groundwater resources. The BMPs involve construction of improvements identified and prioritized in the development of WMPs. Most of the activities are developed through cooperative funding with a local government entity, Florida Department of Transportation, or state funding. As stormwater is a primary contributor of water quality degradation in older urban areas, the District seeks opportunities to retrofit or improve these systems to reduce impacts to receiving waters. FY2020 funding includes new storage and conveyance projects in the Tampa Bay area, particularly in Hillsborough and Pasco counties, as well as several continuing Tampa Bay projects.

Section 2. Water Resource Development Projects

As of FY2020, the District has 20 ongoing projects that meet the definition of water resource development "projects." The projects are listed in Table 7-2, below, along with their funding to date, total costs, participating cooperators, the estimated water quantity to be become available, and the planning region benefitted by the project. The total cost of these projects is approximately $190 million and a minimum of 65 mgd of additional water supply will be produced or conserved.

These projects include feasibility and research projects for new alternative water supply (AWS), Facilitating Agricultural Resource Management Systems (FARMS) projects to improve agricultural water use efficiency, and environmental restoration projects that assist MFLs recovery. 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; and some projects have received state and federal funding provided through mechanisms described in Chapter 8. The operation and maintenance costs for developed infrastructure will be the responsibility of local cooperators, unless otherwise noted in the project descriptions provided in this section.

Table 7-2. *Water Resource Development projects, costs, and District funding*

Water Resource Development Projects		Prior District Funding through FY2019	Total Project Cost (District + Cooperator)	Funding Source	Water to Become Available	Planning Region of Benefit
1) Alternative Water Supply Feasibility Research and Pilot Projects						
1.1	South Hillsborough Aquifer Recharge Program (SHARP) (N287)	$1,382,500	$2,765,000	SWFWMD, Hillsborough County	2 mgd	TBPR
1.2	Bradenton Aquifer Protection Recharge Well (N842)	$1,500,000	$5,050,000	District, City of Bradenton	5 mgd	SPR
1.3	PRMRWSA Partially Treated Water ASR (N854)	$495,500	$8,300,000	District, PRMRWSA	0 mgd	SPR
1.4	Southern Hillsborough Aquifer Recharge Project (SHARP) Phase 2 (N855)	$4,500,000	$9,700,000	District, Hillsborough County	4 mgd	TBPR
1.5	Braden River Utilities ASR Feasibility (N912)	$2,736,250	$5,995,000	District, Braden River Utilities	TBD	SPR
1.6	Hydrogeologic Investigation of Lower Floridan Aquifer in Polk County (P280)	$11,375,000	$12,000,000	SWFWMD	TBD	HPR
1.7	Optical Borehole Imaging Data Collection from LFA Wells (P925)	$100,200	$167,000	District, USGS	NA	HPR
1.8	Sources/Ages of Groundwater in LFA Wells (P926)	$368,300	$555,800	District, USGS	NA	HPR

Water Resource Development Projects		Prior District Funding through FY2019	Total Project Cost (District + Cooperator)	Funding Source	Water to Become Available	Planning Region of Benefit
1.9	City of Venice Reclaimed Water Aquifer Storage Recovery (Q050)	$0	$5,065,000	District, City of Venice	0.17 mgd	SPR
1.10	Direct Aquifer Recharge-North Hillsborough Aquifer Recharge Program Phase 2 (Q064)	$0	$1,500,000	District, Hillsborough County	TBD	TBPR
1.11	Direct Aquifer Recharge-South Hillsborough Aquifer Recharge Program Phase 3 (Q088)	$0	$13,000,000	District, Hillsborough County	6 mgd	TBPR
2) Facilitating Agricultural Resource Management Systems (FARMS)						
2.1	FARMS Projects	$40,780,456	$71,791,225	SWFWMD, FDACS, State of FL, private farms	29 mgd	All
2.2	Mini-FARMS Program	$616,237	$150,000 (annual)	SWFWMD	2 mgd	All
3) Environmental Restoration and Minimum Flows and Levels (MFL) Recovery						
3.1	Lower Hillsborough River Recovery Strategy (H400)	$5,464,712	$10,857,462	SWFWMD, City of Tampa	3.1 mgd	TBPR
3.2	Lower Hillsborough River Pumping Facilities	$394,512	$4,850,044	SWFWMD, City of Tampa	TBD	TBPR
3.3	Pump Stations on Tampa Bypass Canal (H404)	$486,428	$1,236,428	SWFWMD	3.9 mgd	TBPR
3.4	Haines City Reclaimed Water MFL Recharge & Advanced Treatment Feasibility Study (N888)	$225,000	$357,710	SWFWMD, Haines City	0.7 mgd	HPR
3.5	Lake Hancock Lake Level Modification (H008)	$9,989,166	$10,428,490	SWFWMD, State of FL, Federal	TBD	HPR, SPR
3.6	Aquifer Recharge for SWIMAL Recovery at Flatford Swamp with Natural Systems Enhancement (H089)	$5,044,012	$31,000,000	SWFWMD	10.0 mgd	SPR, HPR

Note: Tampa Bay Planning Region (TBPR); Southern Planning Region (SPR); Heartland Planning Region (HPR)

1.0 Alternative Water Supply Research, Restoration, and Pilot Projects

The following projects are research and/or pilot projects designed to further the development of the innovative AWS described in the Regional Water Supply Plan (RWSP). Included in these projects are feasibility projects for recharging the UFA with excess reclaimed water and the exploration of Lower Floridan aquifer (LFA) zones as a viable water source for inland utilities. These projects may lead to the development and protection of major sources of water supply in the future.

1.1 South Hillsborough Aquifer Recharge Program (SHARP) (N287).

This is an aquifer recharge pilot testing project that will design, permit, construct and test a 2 mgd reclaimed water UFA recharge well in the MIA of the SWUCA. The project will beneficially use reclaimed water and improve aquifer levels in the MIA to help meet the SWIMAL defined in the SWUCA Recovery Strategy.

1.2 Bradenton Aquifer Protection Recharge Well (N842).

The project is for design, permitting, construction, and testing of one recharge well in the Avon Park production zone of the UFA and associated facilities to help prevent nutrient loading to the Manatee River and Tampa Bay and to replenish groundwater in the MIA. The third-party review will provide necessary information to support District funding past the 30% design to final design, permitting, and construction.

1.3 PRMRWSA Partially Treated Water ASR (N854).

The project consists of site feasibility testing, 30 percent design, and third-party review of a partially treated Aquifer Storage and Recovery (ASR) project located at the PRMRWSA ASR facility. Feasibility pilot testing will be implemented using partially treated surface water pumped from Reservoir No. 1 to recharge the UFA at two existing ASR wells and subsequently deliver it back to the raw water reservoir system. The third-party review will provide the necessary information on construction costs and project benefits to support District funding in future years to complete design, permitting, and construction.

1.4 Southern Hillsborough Aquifer Recharge Project (SHARP) Phase 2 (N855).

This project is for a third-party review of the County's 30 percent design, completion of design and permitting, and the initiation of construction for Phase 2 of the South Hillsborough Aquifer Recharge Project (SHARP. Pending third-party review and approval, the project will construct 9,500 feet of transmission mains, two reclaimed water recharge wells (2 mgd each), eight monitoring wells, and associated appurtenances. The SHARP expands upon the county's current recharge project (N287).

1.5 Braden River Utilities ASR Feasibility (N912).

This project will perform a third-party review for reclaimed water ASR feasibility studies at two sites. Pending the review, the project may include the construction of an ASR well at each site, monitoring wells, and partial infrastructure necessary to sufficiently and cost-effectively perform two cycle tests in accordance FDEP permit requirements.

1.6 Hydrogeologic Investigation of LFA in Polk County (P280).

This project explores the LFA in Polk County to assess its viability as an AWS source and to gain a better understanding of the Lower Floridan aquifer characteristics and groundwater quality. Three sites have been identified. At each site, if the tests on the initial exploration monitor well drilled are positive, a test production well may be constructed to conduct an aquifer performance test to obtain transmissivity and leakance information and to determine the quality of the formation water. The data gathered from the wells will improve the District's understanding of this potential AWS source, enhance groundwater modeling of the LFA, and determine the practicality of developing the LFA as an AWS source in areas facing future water supply deficits. Data from this project will also add to the geologic inputs in the Districtwide Regulation Model for the LFA to assess potential withdrawal-related impacts to water resources in the District. If the tests prove that the water quality and quantity are suitable, the water may be used by the PRWC as an additional source of public water supply.

1.7 Optical Borehole Imaging Data Collection from LFA Wells (P925).

This project collects optical borehole imaging data from LFA wells in Polk County. This data will aid in understanding the aquifer characteristics and groundwater quality in Polk County. The USGS is testing and providing the processed data to the District. Currently, nine LFA well sites have been identified for testing.

1.8 Sources/Ages of Groundwater in LFA Wells (P926).

This project collects isotope data from LFA wells from various sites in Polk County. The groundwater analysis will determine the sources and ages of the water from productive zones within the LFA and lower portions of the UFA. This data will aid in understanding the LFA characteristics (including flow paths) and groundwater quality in Polk County. The USGS is testing and providing the processed data to the District. Currently, six LFA well sites have been identified for testing.

1.9 City of Venice Reclaimed Water Aquifer Storage Recovery (Q050).

This project is for the 30 percent design and third-party review of an ASR system to store and recover at least 25 million gallons per year (mgy) of reclaimed water on-site at the City's Eastside Water Reclamation Facility, an advanced wastewater treatment plant. If constructed, ASR would let the City store excess reclaimed water in the wet season, to be used in the dry season when demand exceeds plant flow. The City has self-funded a feasibility study for FY2019, which will clarify project requirements, but its planning level study expects two production wells (1 mgd capacity each).

1.10 Direct Aquifer Recharge-North Hillsborough Aquifer Recharge Program Phase 2 (Q064).

This project includes completion of a direct aquifer recharge feasibility study, which includes the construction and testing of three exploratory wells necessary to evaluate recharge locations for the North Hillsborough Aquifer Recharge Program (NHARP). If approved, the study will aid in the determination of the hydrogeological characteristics and water quality of the targeted Avon Park Formation of the UFA and the approximate depth of the base of the underground source of drinking water in the general vicinity of NHARP.

1.11 Direct Aquifer Recharge-South Hillsborough Aquifer Recharge Program Phase 3 (Q088).

This project is for the third-party review of the County's 30 percent design, completion of design, permitting, construction, testing, and Independent Performance Evaluation for SHARP Phase 3. The Phase 3 project, if approved, will design, permit, construct, and test three recharge wells (2 mgd each) and design and construct well heads, appurtenances, monitoring wells, and approximately 4,000 feet of pipelines to connect the recharge wells to existing reclaimed water transmission mains. This project expands upon the County's current recharge projects resulting in six recharge sites anticipated to recharge approximately 14 mgd collectively.

2.0 Facilitating Agricultural Resource Management Systems Projects

The FARMS Program is an agricultural BMP cost-share reimbursement program consisting of many site-specific projects. The FARMS Program is a public/private partnership developed by the District and the Florida Department of Agriculture and Consumer Services (FDACS). The purpose of the FARMS initiative is to provide an incentive to the District's agricultural community to implement agricultural BMPs that will provide resource benefits including water quality improvement, reduced UFA withdrawals, and enhancements to the water resources and ecology.

The FARMS Program has five specific goals: (1) offset 40 mgd of groundwater within the SWUCA ; (2) improve surface water quality impacted by mineralized groundwater within the Shell, Prairie and Joshua Creek (SPJC) watersheds; (3) improve natural systems impacted by excess irrigation and surface water runoff within the Flatford Swamp region of the upper Myakka River watershed (UMRW); (4) prevent groundwater impacts within the northern areas of the District; and (5) reduce frost-freeze pumpage by 20 percent within the DPCWUCA. These goals are critical in the District's overall strategy to manage water resources.

Shell Creek watershed

2.1 FARMS Cost-Share Projects.

Facilitating Agricultural Resource Management Systems (FARMS) Projects employ many of the agricultural water conservation strategies described in the RWSP to reduce groundwater withdrawals by increasing the Water Use Efficiency (WUE) 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 WUE of their operations. Each project's performance is tracked to determine its effectiveness toward program goals. Since actual use of permitted quantities is dependent on hydrologic conditions, one of the objectives of FARMS projects is to reduce groundwater use regardless of hydrologic conditions. FARMS projects not only offset groundwater use with surface water but also increase the overall efficiency of irrigation water use. The District has routinely budgeted approximately $6 million annually for these projects. A listing of cost-share projects within the planning region that meet the RWSP definition of being under development from FY 2015 through FY 2019 is provided in Table 7-3.

As of September 2019, there were 208 approved FARMS projects including 104 in the Southern Planning Region. These 104 projects are projected to have a cumulative groundwater offset of 21.7 mgd.

2.2 Mini-FARMS Program.

Mini-FARMS is a scaled-down version of the District’s FARMS cost-share reimbursement program to implement agricultural BMPs on agricultural operations of 100 irrigated acres or less to conserve water and protect water quality. Mini-FARMS is intended to assist in the implementation of the SWUCA Recovery Strategy, DPCWUCA Recovery Strategy, the Shell and Prairie Creek WMP, and the District's Strategic Plan. Much like the FARMS projects, the Mini-FARMS Program implements BMPs on agricultural operations to reduce UFA groundwater use and/or improve water quality conditions throughout the District. The maximum cost-share amount available from Mini-FARMS projects is $8,000 per agricultural operation per year, and the maximum cost-share rate is 75 percent of project costs.

From FY2006 through FY2018, the District’s portion of the Mini-FARMS Program has reimbursed 159 water conservation BMP projects. The total cost of the Mini-FARMS projects was $856,086 and the District’s reimbursement was $597,256. The Mini-FARMS Program continues to receive a strong demand from growers within the District, and it is projected that at least $150,000 will be budgeted for projects annually.

2.3 FARMS Irrigation Well Back-Plugging Program.

This program offers financial and technical assistance to well owners within the SWUCA to back-plug irrigation wells that produce highly mineralized groundwater. Back-plugging is a recommended practice to rehabilitate irrigation wells by identifying and restricting the intrusion of highly mineralized groundwater that often occurs from deeper aquifer zones in certain areas of the District. This program is separate from the QWIP, which focuses on proper well abandonment. The program was initiated in 2002 to improve water quality in watershed systems of the SWUCA, and later became an addition to the FARMS Program in 2005. Field investigations indicated that highly mineralized groundwater produced from older or deeper irrigation wells was the most likely source adversely impacting water quality downstream in Punta Gorda’s public supply reservoir. Growers experience several advantages from well back-plugging including elevated crop yields from reduced salts in irrigation groundwater, decreases in soil-water requirements and pumping costs, and reduced corrosion and fouling of irrigation equipment.

A total of 85 wells have been back plugged in the SWUCA through FY2018, with 63 of these wells located in the Shell, Prairie and Joshua Creek (SPJC) priority watersheds. Analytical results for all back-plugged wells indicated conductivity, total dissolved solids, and chloride were decreased by averages of 42 percent, 42 percent, and 58 percent, respectively, with well volume yields retained at an average of 77 percent. Routine water quality monitoring of select back-plugged wells assures that these improvements are sustained long-term.

Table 7-3. *Specific FARMS cost-share projects within the Southern Planning Region funded, FY2015 to FY2019*

Project Description	District Budget FY2015-2019	Benefit (mgd)	Priority Area
4F LLC Gator Farm	$83,153	0.040	SPJC
734 LMC Groves, LLC (ALICO) - Lily Grove	$74,184	0.027	SPJC
A&A Blueberries, LLC	$34,754	0.020	SWUCA
ALICO Bermont Grove - Phase 2	$232,170	0.208	SPJC
Bethel Farms - Hog Bay - Phase 2	$337,952	0.150	SPJC
Bethel Farms, LLLP - Phase 3	$448,500	0.130	SWUCA
Bethel Farms, LLLP - Hog Bay	$163,921	0.060	SPJC
BH Griffin - C & S Grove - Phase 2	$480,152	0.350	SPJC
Chapman Family Partnership, LLLP - Phase 2	$113,250	0.040	SPJC
Crossing Grove	$84,600	0.026	SPJC
Desoto Excavating	$200,000	0.036	SPJC
Dixie Groves and Cattle Company	$249,367	0.120	SPJC
Doe Hill Citrus - Phase 2	$262,000	0.085	SPJC
Family Dynamics, Inc.	$189,525	0.059	SWUCA
FLM - Blossom Grove - Phase 4 - Amend	$523,635	0.198	MIA
Hancock Groves - Phase 5	$21,450	0.035	SPJC
Hi Hat Ranch	$111,151	0.110	MIA
Jack Paul Properties	$503,208	0.144	SPJC
Jack Paul Properties - Phase 2	$295,500	0.112	SPJC
M & V, LLC - Avant Grove	$436,445	0.099	SPJC
Orange Co. JWCD Pump Automation	$178,769	0.070	SPJC
Premier Citrus - Bay Grove	$293,079	0.078	SPJC
Premier Citrus - County Line Grove	$384,435	0.140	SPJC
Premier Citrus - Southeast Groves - Phase 2	$5,744	0.012	SPJC
Premier Citrus - Sun Pure Groves	$712,353	0.164	SPJC
Premier Citrus - West Vero Farms	$34,500	0.043	SPJC
QC Desoto Grove Ventures PRR PH 4	$426,323	0.100	SPJC
QC Pelican Grove, LLC	$560,000	0.160	SPJC
Schwartz Farms	$76,376	0.066	MIA
Varner Groves	$158,384	0.108	SPJC
Wauchula Road Duette	$49,823	0.060	SWUCA
Total	**$7,724,703**	**3.050**	

Notes: Projects were selected by funds budgeted in years FY2015 to FY2019, meeting District RWSP definition of "projects under development." The benefit is based on projected offset.

3.0 Environmental Restoration and Minimum Flows and Levels Recovery Projects

As of FY2020, the District has six ongoing ER and MFL recovery projects that benefit water resources. The Lower Hillsborough River Recovery Strategy, Lower Hillsborough River Pumping Facilities, and Pump Stations on the Tampa Bypass Canal (TBC) projects are in the Tampa Bay Planning Region. The Haines City Reclaimed Water MFL Recharge and Advanced Treatment Feasibility Study and the Lake Hancock Lake Level Modification projects are in the Heartland Planning Region. The Upper Myakka/Flatford Swamp Hydrologic Restoration and Implementation project is in the Southern Planning Region.

3.1 Lower Hillsborough River Recovery Strategy (H400)

The District established revised MFLs for the Lower Hillsborough River in 2007. Because the MFLs were not being met, the District incorporated a recovery strategy for the river into Rule 40D-80.073(8), F.A.C. As part of the recovery strategy, the District entered into a joint funding agreement and additional project-specific agreements with the City of Tampa to assess and implement projects associated with diversion of water from various sources to meet minimum flow requirements in the river.

3.2 Lower Hillsborough River Pumping Facilities and
3.3 Pump Stations on the Tampa Bypass Canal

In accordance with the recovery strategy, the City has diverted water from Sulphur Springs to the base of the Hillsborough River Reservoir Dam, as necessary to support river recovery. In addition, the District and more recently the City have diverted water from the Tampa Bypass Canal to the Hillsborough River Reservoir for subsequent diversion to the lower river. The City assumed responsibility for these diversions from the canal through the reservoir in 2018, with transfers of water from the reservoir to the lower river made using a newly constructed sluice gate in the dam that was cooperatively funded by the District and the City. In 2017, the City, with support from the District, completed the Blue Sink Project, which facilitates diversion of water from Blue Sink to the base of the dam for minimum flow recovery, and use of the sink as a recovery source was initiated in 2018. A project between the District and City associated with investigation of storage or additional supply options was completed in 2018 and identified the proposed Tampa Augmentation Project as a potential source for additional water that may be needed for recovery of the lower river. Permitting, design and permit-required monitoring associated with a project involving potential diversion of water from Morris Bridge Sink for river recovery have also been completed, although project implementation is contingent upon future recovery need assessments.

3.4 Haines City Reclaimed Water MFL Recharge and Advanced Treatment Feasibility Study (N888)

This project is for the evaluation of reclaimed water recharge sites, components, and advanced treatment necessary to assist in meeting MFLs on Lake Eva in the “Ridge Lakes” area of the CFWI.

3.5 Lake Hancock Lake Level Modification (H008)

This project is part of the recovery strategy to restore minimum flows in the upper Peace River, which is one of the four goals defined in the SWUCA Recovery Strategy. The project involved raising the control elevation of the existing outflow structure on Lake Hancock in order to slowly release the water during the dry season to help meet the minimum flow requirements in the upper Peace River between Bartow and Zolfo Springs. Increasing the operating level also helps restore wetland function for several hundred acres of contiguous lands to Lake Hancock and provide recharge to the UFA through exposed sinks along the upper Peace River. Construction is complete and the project is currently in the monitoring phase.

3.6 Aquifer Recharge for SWIMAL Recovery at Flatford Swamp with Natural Systems Enhancement (H089)

Hydrologic alterations and excess runoff have adversely impacted the Flatford Swamp in the upper Myakka watershed, and quantities of water should be removed from the swamp and surrounding areas to restore hydroperiods close to historic levels. The District has conducted evaluations to explore potential beneficial uses of water. In 2016, evaluations began on an injection recharge option that would use excess flow affecting the swamp to recharge the UFA in the vicinity of the MIA of the SWUCA to slow saltwater intrusion. The recharge system would assist with the SWUCA Recovery Strategy's goal of meeting the SWIMAL to help recover and protect groundwater resources in/near the MIA. The ongoing evaluation includes construction of test recharge wells in the Flatford Swamp and the design and permitting of diversion infrastructure for source water.

Chapter 8. Overview of Funding Mechanisms

This chapter provides an overview of mechanisms available to generate the necessary funds to implement the water supply and water resource projects proposed by the District and its cooperators to meet the water supply demand projected through 2040 and restore minimum flows and levels (MFLs) to impacted natural systems.

Table 8-1 shows the projected increase in demand for each planning region for the planning period, as described in Chapter 3 of each volume of the Regional Water Supply Plan (RWSP). The table shows that approximately 209.7 mgd of new water supply is needed to meet user demands and to restore natural systems.

Table 8-1. *Summary of total projected increases in demand (5-in-10) (mgd) by each planning region from base year 2015 to 2040*

Planning Region	Projected Demand Increase
Heartland	38.9
Northern	50.4
Southern	44.4
Tampa Bay	76.0
Total	**209.7**

Note: Summation differences occur due to decimal rounding.

A portion of the total demand shown above will be met by existing permitted quantities; however, new regional infrastructure may be required to deliver permitted quantities to end users, and additional water supply development is necessary to maintain adequate capacity for peak demand periods and continuing growth.

To prepare an estimate of the capital cost for projects needed to meet the portion of demand not yet under development, the District has compiled a list of large-scale water supply development (WSD) projects (Table 8-2). The District anticipates that a large portion of the remaining demand will be met through projects that users will select from the water supply options listed in Chapter 5 of this RWSP.

The amount of funding that will likely be generated through 2040 by the various utility, District, state and federal funding mechanisms is compared to the capital cost of the potential large-scale projects. This comparison allows an evaluation of funding adequacy for support of projects necessary to meet water demands.

Part A. Statutory Responsibility for Funding

Section 373.705, Florida Statutes (F.S.), describes the responsibilities of the Water Management Districts (WMDs) in regard to funding water supply development and water resource 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., further 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 Florida Legislature, direct beneficiaries of WSD projects should generally bear the costs of projects from which they benefit. However, affordability and benefits to natural resources are valid considerations recognized in Section 373.705(4)(a), F.S. for funding assistance from the WMDs:

(4)(a) Water supply development projects that are consistent with the relevant regional water supply plans and that meet one or more of the following criteria shall receive priority consideration for state or water management district funding assistance:

1. *The project supports establishment of a dependable, sustainable supply of water which is not otherwise financially feasible;*

2. *The project provides substantial environmental benefits by preventing or limiting adverse water resource impacts, but requires funding assistance to be economically competitive with other options; or*

3. *The project significantly implements reuse, storage, recharge, or conservation of water in a manner that contributes to the sustainability of regional water sources.*

Currently, the District funds both WSD and Water Resource Development (WRD) projects. As discussed in Chapter 7, the District considers its WRD activities to include resource data collection and analysis as well as projects. In terms of WSD, 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 WSD and WRD 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 variety 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 WSD or treatment capital costs. Impact fees are generally devoted to the construction of source development, treatment and transmission facilities. Base charges generally contribute to fixed customer costs, such as billing and meter replacement. However, a high base charge, or a minimum charge, which covers the cost of the number of gallons of water use, may also contribute to source development, treatment, and transmission construction cost debt service. Volume charges contribute to both source development/treatment/transmission debt service and operation and maintenance (O&M).

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 the PRMRWSA, 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.

While some utility 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 will be added. Projects built late in the 20-year planning period will continue to generate revenues for debt service for many years after the planning period.

Financing through volume-related charges is the most economically efficient means to finance new WSD. 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 (AWS), the impact on ratepayers 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.

Conservation incentivized by block rate structures, in combination with collecting project revenues in advance of construction, can distribute price increases more evenly over time and buffer price fluctuations inherent in common water-pricing practices. This allows customers to adjust water use practices and technology over time. Indexing of prices is another means of distributing price increases over time. If changes to water rates are revenue-neutral, additional conservation can still occur, as the difference between average and marginal price blocks for larger water users increases. There are a number of additional means available to mitigate the impact of higher cost sources to customers. Many of these are addressed in the American Water Works Association's publications Avoiding Rate Shock: Making the Case for Water Rates (AWWA, 2004) and Thinking Outside the Bill: A Utility Manager's Guide to Assisting Low-Income Water Customers (AWWA, 2014).

Section 2. Water Management District

The District's Governing Board provides significant financial assistance for conservation, planning, and alternative water supply (AWS) projects through programs including the Cooperative Funding Initiative (CFI) and other District initiatives. Financial assistance is provided primarily to governmental entities, but private entities also participate in these programs. Portions of state funding are also allocated by the District through state appropriations for the state's Water Protection and Sustainability Program, the District's West-Central Florida Water Restoration Action Plan, the state's Florida Forever Program, the District's Facilitating Agricultural Resource Management Systems (FARMS) Program, and the Florida Department of Environmental Protection (FDEP) funding for the Springs Initiative.

1.0 Cooperative Funding Initiative

The primary funding mechanism is the District's CFI, which includes funding for major regional water supply and water resource development projects and localized projects throughout the District's 16-county jurisdiction. The Governing Board, through its regional sub-committees, jointly participates with local governments and other entities to ensure proper development, use, and protection of the regional water resources of the District. The CFI is a matching grant program and projects of mutual benefit are generally funded 50 percent by the District and 50 percent by the public or private cooperators. Any state and federal funds received for the projects are applied directly against the project costs, with both parties benefitting equally. The CFI has been highly successful. Since 1988, this highly successful program has resulted in a combined investment (District and cooperators) of approximately $3.3 billion for a variety of water projects addressing the District's four areas of responsibility: water supply, natural systems, flood protection and water quality. From fiscal year (FY) 2016 through FY2020, the District's adopted budget included an average of $56.8 million in ad valorem tax dollars for the CFI program, of which $30 million (53 percent) was for WRD and water supply development assistance.

2.0 District Initiatives

Projects funded through the District Initiatives program are of great importance or a regional priority. The District can increase its percentage match and, in some cases, provide total funding for the project. Examples of these initiatives include: (1) the Quality of Water Improvement Program to plug deteriorated, free-flowing wells that waste water and cause inter-aquifer contamination, (2) the Utilities Services Group to conserve water by assisting utilities in controlling their water loss, (3) data collection and analysis to support major District initiatives such as the MFL program, and (4) the FARMS Program and other various agricultural research projects designed to increase the water-use efficiency of agricultural operations, (5) WRD investigations and MFL Recovery projects which may not have local cooperators, and (6) the Water Incentives Supporting Efficiency (WISE) program launched in 2019 offers cost-share funding for a wide variety of water conservation projects (maximum of $20,000 per project) to non-agricultural entities. From FY2016 through FY2020, the District's adopted budget included an average of $24.5 million in ad valorem tax dollars for District Initiatives, of which $9 million (37 percent) was for WRD and water supply development assistance.

The average total commitment from FY2016 through FY2020 for CFI and District Initiatives was approximately $81.3 million. The continued level of investment for these programs depends on various economic conditions, resource demands, and the District's financial resources. However, the District believes its resources are sufficient to ensure the long-term sustainability of the region's water resources moving forward.

Section 3. State Funding

1.0 The Springs Initiative

The FDEP Springs Initiative is a special legislative appropriation that has provided revenue for protection and restoration of major springs systems. The District has allocated Springs Initiative funding to implement projects to restore aquatic habitats, to reduce groundwater withdrawals and nutrient loading within first-magnitude springsheds, and to improve the water quality and quantity of spring discharges. Projects include the reestablishment of aquatic and shoreline vegetation near spring vents, construction of infrastructure necessary to convey wastewater currently treated in septic systems or package plants to a centralized wastewater treatment facility and may increase reclaimed water production and implementation of other Best Management Practices (BMPs) within springshed basins.

The first year of the appropriation was FY2014, when the District received $1.35 million from FDEP to allocate for springs restoration. To date, the District has been allocated over $55.2 million in Springs Restoration funding from FDEP, including $19.25 million for FY2020, of which $7 million will be budgeted in future years. This funding has provided for reclaimed water projects that will provide approximately 4 mgd in additional reuse flows and 5 mg in reclaimed water storage. The projects receiving Springs Initiative funding have primarily been in the Northern Planning Region, where the majority of first and second magnitude springs within the District are located.

2.0 Water Protection and Sustainability Program

Large areas of Florida do not have sufficient traditional water resources to meet the future needs of the state's growing population and the needs of the environment, agriculture and industry. The state's Water Protection and Sustainability Program Trust Fund (WPSPTF) was created in the 2005 legislative session through Senate Bill 444 to accelerate the development of AWS and later recreated in Chapter 373, F.S., as part of the 2009 legislative session. Legislation focused on encouraging cooperation in the development of alternative water supplies and improving the linkage between local governments' land use plans and the WMDs' RWSPs. The program provides matching funds to the District for AWS development assistance. From FY2006 through FY2009, the District received a total of $53.75 million in legislative allocations through the program for water supply development projects. Annual WPSPTF funding resumed in FY2020 with $250,000 allocated to the District.

Program funds are applied toward a maximum of 20 percent of eligible project construction costs. In addition, the Legislature established a goal for each WMD to annually contribute funding equal to 100 percent of the state funding for AWS development assistance, which the District has exceeded annually. The legislation also requires that a minimum of 80 percent of the WPSPTF funding must be related to projects identified in a district water supply plan. The District's RWSP is utilized in the identification of the majority of WPSPTF-eligible projects.

Projects are evaluated for funding based on consideration of the 12 factors described in Subsections 373.707(8)(f) and (g), F.S., and additional District evaluation factors as appropriate. If the Legislature continues to fund the state's WPSPTF, it could serve as a significant source of matching funds to assist in the development of alternative water supplies and regional supply infrastructure in the region.

3.0 The Florida Forever Program

The Florida Forever Act, as originally passed by the Florida Legislature in 1999, established the 10-year $3 billion statewide Florida Forever Program. The Program was extended by the Legislature during the 2008 legislative session, allowing the Program to continue for 10 more years at $300 million annually. Since 1999, the District has allocated $95 million ($81.6 million for land acquisition and $13.4 million for water body restoration) of Florida Forever funding Districtwide in support of WRD. A "water resource development project" eligible for funding is defined in Section 259.105, F.S. (Florida Forever), as a project 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, aquifer storage and recovery (ASR) facilities, surface water reservoirs, and other capital improvements. An example of how the funds were used by the District for WRD 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 expended $35.7 million in ad valorem-based funding to complete the acquisition of lands associated with the Lake Hancock project, acquired on a voluntary basis and through eminent domain proceedings.

4.0 State Funding for the Facilitating Agricultural Resource Management Systems Program

Operating under Chapter 40D-26, Florida Administrative Code (F.A.C.), the FARMS Program, through the District, utilizes additional state funding when available. Since the inception of the program, the District has received $6.4 million in state appropriations and $1.3 million from the Florida Department of Agriculture and Consumer Services (FDACS). No funding was provided by the state from FY2015 through FY2020.

5.0 West-Central Florida Water Restoration Action Plan

The West-Central Florida Water Restoration Action Plan (WRAP) is an implementation plan for components of the SWUCA recovery strategy adopted by 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 SWUCA. 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; however, no new funding has been provided via state appropriation since that time.

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 AWS 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.

Myakka River watershed

Within the District, Federal matching funds from this initiative helped fund the construction of the PRMRWSA reservoir and plant expansion. Funding for Tampa Bay Water's C.W. Bill Young Regional Reservoir came from individual project grant allocations through the State and Tribal Assistance Grants (STAG) program. However, Congress has not funded any individual project STAG grants for several years, so future funding for individual projects through this mechanism is uncertain. Congressional authorization through the Water Resources Development Act aids in the efforts to secure funding for the Peace River and Myakka River watersheds restoration initiatives. District staff considers funding for water supply projects to be a top priority and continues to work with the Office of the Governor, the FDEP, the U.S. Army Corps of Engineers, and the members of the Florida Congressional Delegation to secure federal funding.

1.0 U.S. Department of Agriculture Natural Resources Conservation Service Programs

The National Resources Conservation Service (NRCS) Environmental Quality Incentives Program (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, and tribal environmental laws that encourage environmental enhancement. The program is achieved through the implementation of a conservation plan that includes structural, vegetative, and land management practices. The program is carried out primarily in priority areas where significant resource concerns exist. Agricultural water supply and nutrient management through detention/retention or tailwater recovery ponds can be pursued through this program.

In addition to EQIP, the FARMS Program has partnered with NRCS through the Agriculture Water Enhancement Program (AWEP) and the Florida West Coast Resource Conservation and Development Council (RC&D) to bring additional NRCS cost-share funding to the SWUCA. The AWEP was created by the 2008 Farm Bill with similar goals as the EQIP program, including conserving and/or improving the quality of ground and surface water. The RC&D is a nonprofit organization that promotes sustainable agriculture and local community food systems in Hillsborough, Manatee, Pinellas, and Sarasota counties.

The District's FARMS Program works cooperatively with the NRCS EQIP, AWEP, and RC&D programs on both financial and technical levels, and dual cost-share projects have been coordinated 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. As of FY2018, 41 FARMS projects Districtwide have involved some level of dual cost-share with EQIP, AWEP, and/or the RC&D, 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. For 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.

Section 5. Public-Private Partnerships and Private Investment

As traditional water sources reach their capacity, alternative sources must be developed that involve specialized technical expertise and risky financial investments. The development of such technologies may be beyond the ability and level of tolerance of many water utilities. A range of public/private partnership options are available to provide this expertise and shift the financial risk. These options range from all-public to all-private ownership, design, construction, and facility operation. Investment and competition among private firms desiring to fund, build, or operate WSD projects could 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) public-private partnerships consisting of public utilities or regional water supply authorities contracting with private entities to design, build, or operate facilities (2) cooperative institutions such as irrigation districts contracting with private entities and (3) private entities, which could identify a customer base and become a water supplier to one or more water use types.

1.0 Public-Private Utility Partnerships

Two advantages of public-private partnerships are that (1) competition and economies of scale enjoyed by regional or national construction/operation firms or teams may reduce costs and complete a project in less time, and (2) some of the risk may be shifted to the private firms providing goods and services. As an example, Tampa Bay Water undertook a public-private partnership with Veolia Water, formerly USFilter, to design, build and operate its surface water treatment plant that has been in operation since 2002. Veolia assumed all risks for cost, schedule, plant design and construction, equipment supply, startup services, and facility performance through O&M. The cost savings over the life cycle of the contract is expected to be significant.

Public-private partnerships are becoming more common as water technology and regulation becomes increasingly complex. Increasing numbers of regulated pollutants and new higher-risk technologies drive privatization of some public water supply responsibilities. Partnerships work best where risks are beyond public sector tolerance, a project is new and standalone, construction and long-term operation are combined, there are clearly-defined performance specifications, and there are clearly-defined payment obligations (Kulakowski, 2005). Small utilities may not have the resources or project sizes sufficient to attract private interest but may participate through multi-utility agreements or through a regional water supply entity. A significant benefit of cooperation in larger projects is the economies of scale common in the water supply industry.

2.0 Cooperatives

Cooperatives are arrangements where 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 lengthy transmission systems are required, such as in the western U.S. where surface water is distributed to water districts and for irrigation. Water is usually obtained from a supplier at a cost and then distributed among members by the water district. Members cooperatively fund the construction of transmission and distribution facilities. As groundwater resources become increasingly limited and reclaimed water systems expand, the same type of economic forces that created irrigation and water districts in the west could develop in portions of Florida. Cooperatives may also shift financial risk by entering into design, build, and operate arrangements with contractors. One example of this structure is the Polk Regional Water Cooperative, formed in 2016 to address the development and provision of AWS to its member local governments. Other forms of cooperative institutions in Florida, such as drainage districts and grower cooperatives, have effectively reduced competition and litigation over resources (OPPAGA, 1999).

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

Private Supply Investment is where investors identify an unserved customer base and develop water facilities to meet those needs. This type of investment may facilitate the development of alternative water supplies. Such private financial investment occurs where firm regulatory limits are in place to protect water resources and related environmental features, and further development of traditional sources are not allowable. Although the purpose of the regulatory measures is resource protection, they indirectly create a customer base for alternative source developers.

Part C. 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

- Below is a summary of projected resources that could be generated by the District and state funding programs for WRD and WSD projects. An explanation follows as to how the funding amounts are derived.

- Cooperative Funding Initiative (CFI). With the Governing Board's direction for a continued investment in vital projects to protect the region's water resource needs, the District's most recent long-range plan estimated approximately $1.33 billion in ad valorem tax dollars would be allocated for the CFI from 2021 through 2040. Assuming these funds are used for projects that would be matched by a partner on an equal cost-share basis, this would collectively result in $2.66 billion generated through the program. If the funding allocation of the program remains consistent with the previous five years, approximately $1.41 billion (53 percent) could potentially be utilized for water source development and water supply development assistance. However, the allocation of resources is typically driven by new requests submitted through the CFI program each year, which could significantly influence this funding projection, as the Governing Board may direct more funding for the District's other areas of responsibility (i.e., flood protection, water quality and natural systems). It is important to note that funding does not include state or federal funds, which the District and its partners continue to seek.

- District Initiatives. Also consistent with the District's most recent long-range funding plan, an estimated $579 million in ad valorem tax dollars would be allocated for District Initiatives from 2021 through 2040. If the funding allocation of the program remains consistent with the previous five years, approximately $214 million (37 percent) could potentially be utilized for water source development and water supply development assistance. However, if the Governing Board elects to direct more funding for the District's other areas of responsibility (i.e., flood protection, water quality and natural systems), this funding projection could be significantly influenced. It is important to note that funding does not include state, federal or local funds, which the District continues to seek.

- Springs Initiative. The amount of future state funding for the Springs Initiative cannot be determined at this time. Any funding allocated to this District will be used for projects for the protection and restoration of major springs systems, including projects to reduce groundwater withdrawals and improve stormwater systems.

- Water Protection and Sustainability Trust Fund. The amount of future state funding for this program cannot be determined at this time. As economic conditions improve and the state resumes funding, any funding allocated for this District will be used as matching funds for the development of AWS 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 WRD.

If funding allocations remain consistent with the previous five years, approximately $1.62 billion could potentially be generated or made available to fund the CFI and District Initiative projects necessary to meet the WSD through 2040 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 legislative appropriations.

Section 2. Evaluation of Project Costs to Meet Projected Demand

Of the 209.7 mgd of projected Districtwide demand increases during the 2015 to 2040 planning period to meet the demand for all users and to restore MFLs for impacted natural systems, it is estimated that 46 mgd, or 22 percent of the demand, has either been met or will be met by reclaimed water and conservation projects that are under development. The total District share of cost for the projects currently under development including regional transmission, ASR, and brackish groundwater treatment systems is $490 million.

To develop an estimate of the capital cost of projects necessary to meet demand, the District compiled a list of large-scale WSD projects that have been proposed for development within the 2040 planning timeframe. These projects proposed by the PRMRWSA, Tampa Bay Water, and the Polk Regional Water Cooperative have the potential to produce up to 105 mgd of water supply. The estimated costs and the quantity of water they will produce are listed in Table 8-2. Many of these are AWS projects that would be eligible for co-funding by the District. The table shows the estimated total cost of the 100 to 105 mgd of water supply that will be produced by these projects is up to $1.81 billion.

The PRMRWSA draft 2020 Integrated Regional Water Supply Plan contains several AWS projects, many of which would be eligible for co-funding by the District. The PRMRWSA's priority projects would provide for up to 25 mgd in additional capacity with capital cost estimate of approximately $697 million.

A portion of new water demand in the Northern Planning Region will be met using available quantities of fresh groundwater, for which the District does not provide matching financial resources. The District is planning to assist with AWS options, including reclaimed water and conservation projects, which can help meet future demands in the Northern Planning Region and help prevent negative impacts on water resources from occurring. In other planning regions, additional new demands will be met through the development of AWS and conservation projects chosen by users. The potential water supply project options are discussed in Chapter 5 for each planning region.

Table 8-2. *Proposed large-scale water supply and water resource development projects by 2040 (millions of $)*

Project	Entity to Implement	Quantities (mgd)	Capital Costs
Peace River Facility Surface Water System Expansion and Regional Reservoir	PRMRWSA	15	$332
Phase II Capacity Expansion, New RO Water Treatment Plant, and Regional Loop System	PRMRWSA	10	$365
Aquifer Recharge for SWIMAL Recovery at Flatford Swamp with Natural Systems Enhancement	TBD	10	$31
Southeast Wellfield and West Polk County Lower Aquifer Deep Wells	PRWC	45	$650
Big Bend Desalination	TBW	10-12.5	$244
Enhanced Surface Water Expansion from Alafia River	TBW	10-12.5	$88
New Regional Feed Line to Balm Area	TBW	N/A	$76-97
Subtotal Southern Planning Region		**35**	**$728**
Subtotal Heartland Planning Region		**45**	**$650**
Subtotal Tampa Bay Planning Region		**20-25**	**$408-429**
Total – Districtwide		**100-105**	**$1,786-1,807**

Section 3. Evaluation of Potential Available Funding to Assist with the Cost of Meeting Projected Demand

The conservative estimate of $2.66 billion in cooperator and District financial resources that will be generated through 2040 for funding is sufficient to meet the projected $1.79 to $1.81 billion total cost of the large-scale projects listed in Table 8-2. State and federal funding sources may also assist with any remaining and/or high-end costs for future AWS projects and water conservation measures where fresh groundwater resources are limited. These financial projections are subject to economic conditions that may affect the level of District ad valorem tax revenue and the availability of federal and state funding; however, such conditions may similarly affect future water demand increases.

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