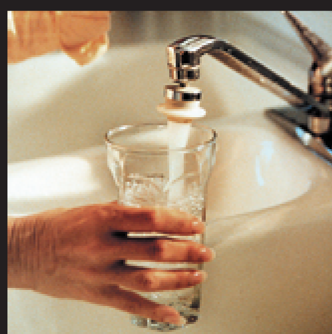
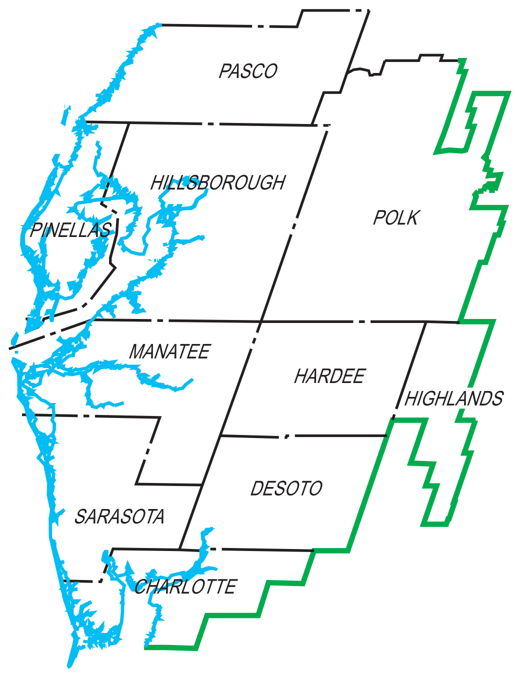
Southwest Florida Water Management District

Regional Water Supply Plan

Board Approved





Southwest Florida
Water Management District

Southwest Florida Water Management District

Regional Water Supply Plan

Web Site: http://www.swfwmd.state.fl.us/

August 2001

Resource Conservation and Development Department
Gregg W. Jones, P.G., Director

Planning Department
Richard S. Owen, AICP, Director

Comments or questions regarding the Regional Water Supply Plan may be provided to District staff via E-mail at *rwsp@swfwmd.state.fl.us*

Contributors

Resource Conservation & Development Department:
Anthony Andrade
Mark Barcelo
Ron Basso
Don Ellison
Sid Flannery
Josie Guillen
Michael Hancock
Sylvia Kent
Bobby Lue
Will Miller
Barbara Pavone
Judi Reed
Don Rome
Kathy Scott
John Thompson
Bart Weiss
Carl Wright

Executive Department:
Dave Moore

Planning Department:
Jay Yingling

Technical Services:
Ron Cohen

General Services Department:
Christine Clark
Dean Rusk
Pati Twardosky
Dwayne Williams
Allen Yarbrough

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES

LIST OF APPENDICES (published separate from this document)

ABBREVIATIONS

AGCP	Agricultural Conservation Partnership
AP	Aquatic Preserves
ASR	Aquifer Storage and Recovery
AWWARF	American Water Works Association's Research Foundation
BEBR	Bureau of Economic and Business Research
BGD	Billion Gallons per day
BMPs	Best Management Practices
CFRSF	Celery Field Regional Storage Facility
CUP	Consumptive Use Permit
CWCFGWB	Central West-Central Florida Ground Water Basin
CWM	Comprehensive Watershed Management
DBOOT	Design, Build, Own, Operate and Transfer
DEP	Department of Environmental Protection
DRI	Developments of Regional Impact
EPA	Environmental Protection Agency
ESWS	Enhanced Surface Water System
ETB	Eastern Tampa Bay
EWU	Estimated Water Use
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FIRM	Flood Insurance Rate Maps
FPL	Florida Power and Light
FS	Florida Statutes
GIS	Geographic Information Systems
GPCD	Gallons Per Capita Per Day
GPD	Gallons Per Day
GPDPH	Gallons Per Day Per Hole
GPM	Gallons Per Minute
HFCAWTF	Howard F. Curren Advanced Wastewater Treatment Facility
HRS	Health and Rehabilitative Services
HSW	HSW Engineering, Inc.
IAC	Industrial Advisory Committee
I/C	Industrial/Commercial
ICI	Industrial Commercial Institutional
IFAS	Institute of Food and Agricultural Sciences
IPEM	Individual Project Evaluation Model
MARS	Manatee Agricultural Reuse System
M/D	Mining/Dewatering
MFLs	Minimum Flows and Levels
MGD	Million Gallons per day
MIA	Most Impacted Area
NGF	National Golf Foundation

ABBREVIATIONS

NGVD	National Geodetic Vertical Datum
NPDES	National Pollution Discharge Elimination System
NRCS	Natural Resource Conservation Service
NTB	Northern Tampa Bay
NWSI	New Water Sources Initiative
OFW	Outstanding Florida Waters
OPPAGA	Office of Program Policy Analysis & Governmental Accountability
PR/MRWSA	Peace River/Manasota Regional Water Supply Authority
PBS&J	Post Buckley Shuh and Jernigan
PG	Power Generation
QWIP	Quality of Water Improvement Program
RDB	Regulatory Data Base
RO	Reverse Osmosis
ROMP	Regional Observation Monitoring Program
RWASR	Reclaimed Water Aquifer Storage and Recovery
RWSA	Regional Water Supply Authority
RWSP	Regional Water Supply Plan
SCADA	Supervisory Control and Data Acquisition
SCHRW	South Central Hillsborough Regional Wellfield
SFWMD	South Florida Water Management District
SJRWMD	St. Johns River Water Management District
STAR	South Tampa Area Reclaimed Project
SWCFGWB	Southern West-Central Florida Ground Water Basin
SWFWMD	Southwest Florida Water Management District
SWUCA	Southern Water Use Caution Area
TBC	Tampa Bypass Canal
TBRWTP	Tampa Bay Regional Water Treatment Plant
TBW	Tampa Bay Water
TDS	Total Dissolved Solids
TECO	Tampa Electric Company
ULV	Ultra-Low Volume
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WMDs	Water Management Districts
WRAP	Water Resource Assessment Project
WRF	Water Reclamation Facility
WSA	Water Supply Assessment
WUCA	Water Use Caution Area
WUDEP	Water Use Demand Estimates and Projections
WUP	Water Use Permit
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

CHAPTER I. INTRODUCTION

This Regional Water Supply Plan (RWSP) is an assessment of projected water demands and potential sources of water to meet these demands for the period from 1995 (the established base year) to 2020. The RWSP is developed for a ten-county area that extends from Pasco County in the north to Charlotte County in the south. The purpose for preparing the RWSP is to provide the framework for future water management decisions in areas of the Southwest Florida Water Management District (SWFWMD or District) where the hydrologic system is stressed due to ground-water withdrawals. The RWSP shows that sufficient, reasonably obtainable water sources (including demand management) exist in the planning region to meet future demands and replace some of the current withdrawals causing hydrologic stress. Because sources within the planning region are sufficient from a technical and economic perspective to meet these demands, sources outside the planning region have not been investigated. The RWSP also identifies potential options and associated costs for developing these sources. Options identified in this report are not intended to represent the District's most "preferable" options for water supply development. They are, however, provided as reasonable concepts that water users in the region can pursue in their water supply planning. Water users can select a water supply option as presented in the plan or combine elements of different options that better suit their water supply needs. Additionally, the plan provides information to assist water users in developing funding strategies to construct water supply development projects.

Requirement for Regional Water Supply Planning

The requirement for regional water supply planning originated from legislation passed in 1997 that significantly amended Chapter 373, Florida Statutes (F.S.). New regional water supply planning requirements were codified in s. 373.0361, F.S., and this RWSP has been prepared pursuant to these provisions. Key components of this legislation included designation of one or more water supply planning regions within the District, preparation of a Districtwide Water Supply Assessment (WSA), and 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 WSA.

The District's WSA was completed and accepted by the Governing Board in June 1998. Four water supply planning regions (northern, west-central, east-central and southern) were identified for purposes of preparing the WSA. Three of the four planning regions generally correspond to the jurisdictional areas of regional water supply authorities (RWSA), (Withlacoochee RWSA for the Northern region, Tampa Bay Water (formerly West Coast RWSA) for the west-central region and Peace River/Manasota RWSA (PR/MRWSA) for the southern region). The fourth planning region includes portions of Polk, Highlands and Hardee counties. For each water supply planning region, existing and reasonably anticipated sources of water were evaluated to determine the adequacy of these sources to meet projected demands. In the WSA, the District concluded that regional water supply planning should be initiated for the west-central, east-central and southern planning regions because *"sources of water are not adequate for the planning period to supply water for all reasonable-beneficial uses and to sustain the water resources and related natural systems"* (373.0361(1), F.S.). Subsequent to completing the

WSA, the District concluded that it would be beneficial to redefine these three regions into one water supply planning region.

CHAPTER II. METHODS

The RWSP was developed in an open public process, in coordination with local governments and utilities, the agricultural community, business and industry representatives, environmental organizations and other affected parties. The District's objective has been to actively involve all stakeholders in the RWSP planning process. The District has accomplished this by involving the Southern Water Use Caution Area (SWUCA) Working Group and by establishing the Northern Tampa Bay (NTB) Input Group for the remainder of the planning region outside the SWUCA. These groups have a diverse membership that represents local governments, water supply utilities, agriculture, the electric power industry, phosphate mining, the construction industry and environmentalists. The District has also involved its standing advisory committees (public supply, agricultural, industrial, green industry and environmental) in the process. Affected parties have also been involved in the development of the RWSP by working with District staff to develop methods for projecting water demand, and assisting with the identification of potential options for water resource and water supply development. Finally, staff have regularly provided status reports to the District Basin Boards and Governing Board during their scheduled public meetings.

The District has coordinated closely with the St. Johns River and the South Florida Water Management Districts in the preparation of the RWSP. Both of these water management districts have concurrently prepared RWSPs for areas adjacent to the District's planning region. In addition, the District coordinated closely with the Florida Department of Environmental Protection (FDEP) to ensure the State's expectations for the RWSP are met. Consistent with this effort, the RWSP reflects: 1) an emphasis on conservation, 2) an emphasis on reclaimed water, 3) the role of constraints and minimum flows and levels, 4) minimizing the need for mitigation of new withdrawal impacts, 5) realistic demand projections, and 6) adherence to the existing state policy on "Local Sources First."

CHAPTER III. ESTABLISHMENT OF MINIMUM FLOWS AND LEVELS

An important consideration in both the calculation of water demand and determination of sources to meet demand is the establishment of minimum flows and levels (MFLs). In regard to demand, the MFLs set in the Northern Tampa Bay (NTB) area resulted in a recovery strategy that mandated cutbacks to ground-water withdrawals of 68 mgd by 2007. These reductions represent demands for water that are currently planned for replacement or are being developed by Tampa Bay Water and are in addition to the projected demands contained in this RWSP. Additional water demand may result from potential reductions in ground- and/or surface-water withdrawals necessary to achieve further water resource and ecological recovery as MFLs continue to be adopted in the planning region. In regard to sources, the establishment of MFLs on water resources in the planning region will determine the amount of water that can be obtained from ground- and surface-water supplies. The quantities of water identified in this RWSP that can be obtained from various sources are consistent with established MFLs based on best available data and are intended to be as or more restrictive than MFLs that will be established in the future.

Since the early 1970s, the District has been engaged in an effort to develop MFLs for water bodies. Beginning with the 1996 legislative changes to the MFL statute, the District has enhanced its program for development of MFLs. A MFL is that level or flow below which additional withdrawals would cause significant harm. The District implements established MFLs primarily through its Water Supply Planning, Water Use Permitting and Environmental Resource Permitting programs, and funding of water resource and water supply development projects that are part of a recovery or prevention strategy.

In accordance with the requirements of Section 373.042, F.S., the District has established a list of priority ground and surface waters for which MFLs will be set. This priority list is based upon the importance of waters to the state or region and the existence of, or potential for, significant harm to the water resources or ecology of the region. As required by Chapter 373.042(2), F.S., the District must update the Priority List and Schedule annually, and submit the schedule for approval to the FDEP.

The District's MFLs approach is designed to be applied to lakes, rivers, isolated wetland systems, and aquifers. The approach assumes that alternative hydrologic regimes exist that, although different from historic conditions, will protect the structure and functions of aquatic and wetland resources from significant harm. The purpose of MFLs is to define this threshold hydrologic regime and allow for water withdrawals while protecting the water resources and ecology from significant harm.

CHAPTER IV. WATER SUPPLY DEVELOPMENT COMPONENT

The Water Supply Development Component of the RWSP is composed of four Sub Chapters. Sub Chapter A details the anticipated future water supply demand through 2020 in each county within the planning region as well as the methods and assumptions used in projecting future demand. Sub Chapter B is a discussion of the sources of water anticipated to be available to meet current and future demands. Sub Chapter C contains a discussion of water supply projects currently under development that the District is co-funding. Finally, Sub Chapter D contains a list of water supply options that could potentially be developed by RWSAs, public utilities, local governments, public/private water users, etc.

Chapter IV. Sub Chapter A. Quantification of Water Supply Needs

Water demand projections were developed consistent with various parameters and methodologies agreed to by the FDEP and the five water management districts. Among the agreed-upon parameters was the base year of 1995 from which demand would be projected. The year 1995 was selected as the base year because it was considered to be a "normal" year. A "normal" year refers to a year in which typical climatic conditions occur resulting in "normal" water usage. Another agreed-upon parameter involves the 1-in-10 year drought, versus the 5-in-10 (average annual) rainfall year. A 1-in-10 drought is defined as "an event that results in an increase in water demand of a magnitude that would have a 10 percent probability of occurring during any given year." Demand projections represent the estimated *total quantity* of water needed; no attempt was made in the projections to account for alternative sources that could potentially be developed to meet future demand, or water conservation that could potentially be achieved to reduce future demand. Alternative sources and conservation are addressed in the sources chapter of this plan. For planning purposes, water use within the District has been separated into four basic categories: agriculture, public supply, commercial/industrial & mining/dewatering, and recreation/aesthetic. The separation of uses into these categories provides for the projection of demand for similar water uses under similar assumptions, methods and reporting conditions. An additional water-use category, environmental restoration, comprises the quantities of water that may need to be developed to offset potential reductions in withdrawals from ground- and/or surface-water sources. The reductions may be necessary to achieve MFLs that will be established in the future. It is not possible to project demand for this category because MFLs and potential accompanying recovery strategies have not yet been determined for all water resources within the planning region.

Input from various use sectors and stakeholders on the demand projections developed for the RWSP was highly varied. Some suggested that demand was too high for certain categories, others agreed with the projections, and still others suggested it was too low for certain categories. In developing the projections, staff decided to take a conservative approach and use higher demand projections. District staff is currently working to develop improved methodologies for projecting demands for the next version of the RWSP. Table ES-1 summarizes demand projections for the SWUCA and NTB area portions of the planning region and the planning region as a whole from 1995 to 2020.

From the table it is apparent that the total 2020 5-in-10 (average annual) demand for all use sectors in the SWUCA, NTB area, and the planning region as a whole is 257.0 mgd, 107.1 mgd, and 364.1 mgd respectively. In the SWUCA portion of the planning region, the agricultural use sector will continue to be the largest water user by the year 2020 at 633.5 mgd with a 20 percent increase in use from 1995 to 2020. The public supply use sector will continue to be the second largest water user by the year 2020 at 309.1 mgd, with a 55 percent increase from 1995 to 2020. Public supply accounts for the greatest increase in demand from 1995 to 2020; 110.3 mgd versus a 103.4 mgd for agriculture. The agricultural and public supply use sectors account for 83 percent of the total increase in demand through 2020.

In the NTB area portion of the planning region, the public supply use sector will continue to be the largest water user by the year 2020 at 331.1 mgd with a 27 percent increase in use from 1995 to 2020. The agricultural use sector will continue to be the second largest water user by the year 2020 at 77.2 mgd, with a 34 percent increase in use from 1995 to 2020. Public supply accounts for the greatest increase in demand from 1995 to 2020; 70.5 mgd versus 19.5 mgd for agriculture. The agricultural and public supply use sectors account for 84 percent of the total increase in demand through 2020.

In the planning region as a whole, the agricultural use sector will continue to be the largest water user by the year 2020 at 710.7 mgd with a 21 percent increase in use from 1995 to 2020. The public supply use sector will continue to be the second largest water user by the year 2020 at 640.2 mgd, with a 39 percent increase in use from 1995 to 2020. Public supply accounts for the greatest increase in demand from 1995 to 2020; 180.8 mgd versus 122.9 mgd for agriculture. The agricultural and public supply use sectors account for 83 percent of the total increase in demand through 2020.

Again, it is stressed that additional water demand may result from potential reductions in ground- and/or surface-water withdrawals necessary to achieve further water resource and ecological recovery as MFLs continue to be adopted in the planning region.

Table ES-1. Demand Projection Summary for the SWUCA and NTB Area Portions of the Planning Region and the Planning Region as a Whole (1995 - 2020 (mgd)). [1]

Category	1995	2000		2005		2010		2015		2020		Additional		% change
		Avg.	1-in-10	Avg.	1-in-10	Avg.	1-in-10	Avg.	1-in-10	Avg.	1-in-10	Avg.	1-in-10	Avg.
SOUTHERN WATER USE CAUTION AREA (SWUCA)														
Agriculture	530.1	546.7	791.5	569.6	823.6	592.5	855.7	613.1	884.7	633.5	913.8	103.4	373.7	20
Public Supply	198.8	223.9	237.3	243.9	245.0	266.1	282.1	287.3	304.5	309.1	327.7	110.3	128.8	55
Commercial/ Mining/Power	95.1	98.0	98.0	100.9	100.9	104.0	104.0	107.1	107.1	110.3	110.3	15.2	15.2	16
Recreation	35.0	39.9	51.5	45.7	59.0	51.6	66.5	57.2	73.8	63.1	81.5	28.1	46.5	80
TOTAL	**859.0**	**908.5**	**1,178.3**	**960.1**	**1,228.5**	**1,014.2**	**1,308.3**	**1,064.7**	**1,370.1**	**1,116.0**	**1,433.3**	**257.0**	**574.2**	**30**
NORTHERN TAMPA BAY (NTB) AREA														
Agriculture	57.7	62.9	86.5	66.5	90.8	69.8	95.2	73.5	99.9	77.2	104.5	19.5	46.8	34
Public Supply	260.6	278.5	295.2	292.1	323.2	306.6	325.0	320.3	339.5	331.1	350.9	70.5	90.4	27
Commercial/ Mining/Power	28.4	29.3	29.3	30.3	30.3	31.1	31.1	32.0	32.0	33.0	33.0	4.6	4.6	16
Recreation	24.6	27.4	35.2	29.8	38.4	32.2	41.6	34.7	44.7	37.1	47.8	12.5	23.3	51
TOTAL	**371.3**	**398.1**	**446.2**	**418.7**	**482.7**	**439.7**	**492.9**	**460.5**	**516.1**	**478.4**	**536.2**	**107.1**	**165.1**	**29**
PLANNING REGION (SWUCA and NTB Quantities Totaled)														
Agriculture	587.8	609.6	878.0	636.1	914.4	662.3	950.9	686.6	984.6	710.7	1018.3	122.9	430.5	21
Public Supply	459.4	502.4	532.5	536.0	568.2	572.8	607.1	607.5	644.0	640.2	678.6	180.8	219.2	39
Commercial/ Mining/Power	123.5	127.3	127.3	131.2	131.2	135.1	135.1	139.1	139.1	143.3	143.3	19.8	19.8	16
Recreation	59.6	67.3	86.7	75.5	97.4	83.8	108.1	91.9	118.6	100.2	129.3	40.6	69.7	68
TOTAL	**1230.3**	**1306.6**	**1624.5**	**1378.8**	**1711.2**	**1454.0**	**1801.2**	**1525.2**	**1886.3**	**1594.4**	**1969.5**	**364.1**[2]	**739.2**	**30**

[1] The Northern Tampa Bay area encompasses all areas of the planning region that are not in the SWUCA, including the very northern portion of Polk County (see Figure I-4).
[2] Does not include the 68 mgd of cutbacks in Northern Tampa Bay ground-water withdrawals which would adjust the total 2020 demand to 432 mgd.

Chapter IV. Sub Chapter B. Determination of Water Supply Deficits and Traditional and Alternative Supply Sources

In accordance with the RWSP objectives, the District identified potential sources of water capable of meeting projected demand, and options for developing those sources. Sources include (1) surface water and storm water, (2) reclaimed water, (3) agricultural water conservation, (4) non-agricultural water conservation, (5) brackish ground water and (6) seawater desalination. Fresh ground water was not included as a potential source for new supplies due to known resource impacts throughout much of the planning region caused by existing ground-water withdrawals. In fact, it was this lack of additional fresh ground water in significant quantities within the planning region, coupled with growing water demands, that led to the preparation of this RWSP. For puposes of this RWSP, the District's goal was therefore to identify sufficient quantities of water other than fresh ground water to meet projected water demands.

Based on evaluation of potential sources of water supply that can be developed, it was determined that up to 678.1 mgd is potentially available. As stated previously, the projected increase in demand by the year 2020 will be 364.1 mgd. Including 68 mgd that must be developed to replace wellfield cutbacks in the NTB area, total additional water demand in the planning region through 2020 will be approximately 432 mgd. ***It is therefore concluded that sufficient sources of water are available within the planning region to meet projected demand through 2020***. Table ES-2 summarizes the potential quantity of water available from each source in the SWUCA and NTB area portions of the planning region as well as the planning region as a whole.

Sources

The following is a discussion of the existing and potentially available sources of water listed in Table ES-2.

Surface Water/Storm Water

Prior to determining the availability of water from rivers for water supply, general criteria were developed to ensure, at a planning level, that existing uses and the water supply needs of natural systems would be protected. Since many of the rivers in the region do not yet have established minimum flows, it was necessary to assume a minimum flow criteria before estimating water availability. For the RWSP, the minimum flow was assumed to be the flow that is equaled or exceeded 85 percent of the time (P85). Diversions for water supply were zero when flows were below the assumed minimum flow. Therefore, 15 percent of the time there were no calculated withdrawals from the rivers. This ensured that during periods of low flow, sufficient water would be available to sustain natural systems. The second criteria for determining surface water availability was to limit withdrawals to 10 percent of the total daily flow of the river when the flow exceeded the P85. Once the available amount of water was determined, 53 surface-water and 12 storm-water options were identified and are included in Chapter IV, Sub Chapter D, as the long list of surface-water/storm-water options. Using a variety of screening criteria, this list was reduced to a short list of 16 options which were representative samples of the options on the long list. The short list is also included in Chapter IV, Sub Chapter D. For the surface-water options, water diversions would occur during periods of high flow with the majority of the diversions occurring for

Table ES-2. Potential Quantities of Water Available in the SWUCA and NTB Area Portions of the Planning Region and the Planning Region as a Whole (mgd).[1]

	Conservation		Desalination		Reclaimed Water	Surface Water/ Storm Water	Total
	Agricultural	Non-Agricultural	Seawater	Brackish Ground Water			
SOUTHERN WATER USE CAUTION AREA (SWUCA)							
Total	**36.8**	**42.6**	**50**	**14.2**	**58.8**	**146.1**	**348.5**
NORTHERN TAMPA BAY (NTB) AREA							
Total	**4.5**	**52.8**	**50**	**15.3**	**109.3**	**97.7**	**329.6**
PLANNING REGION (SWUCA and NTB Quantities Totaled)							
Total	**41.3**	**95.4**	**100**	**29.5**	**168.1**	**243.8**	**678.1**

[1]The Northern Tampa Bay area encompasses all areas of the planning region that are not in the SWUCA, including the very northern portion of Polk County (see Figure I-4).

relatively short periods. Therefore, suitable storage mechanisms such as off-stream surface-water reservoirs and aquifer storage and recovery (ASR) systems were identified to hold water during wet times of the year for later use in the dry season.

Reclaimed Water

Reclaimed water is defined as water that is beneficially reused after being treated to at least secondary wastewater treatment standards. The use of reclaimed water decreases the reliance on potable water supplies, as well as reduces the discharge of wastewater treatment plant (WWTP) effluent to surface waters. Over the past decade, the District has provided more than $120 million in grant funding to assist in developing over 125 reuse projects, including construction and expansion of reuse transmission lines, pump stations and storage facilities to deliver reclaimed water to residential communities, golf courses, recreational fields, commercial entities, community green spaces and industrial users. These projects have been conservatively estimated to offset potable water use by approximately 92 mgd.

Despite successes to date in implementing reuse within the District, tremendous opportunities exist to improve both the utilization rate and efficiency of use of reclaimed water. One hundred and eighty reclaimed water options were conceptualized and included in Chapter IV, Sub Chapter D, as the long list of reclaimed water options. Using a variety of screening criteria, the long list was reduced to a short list of 25 options which were representative samples of the different types of options included on the long list. The short list is also included in Chapter IV, Sub Chapter D. The amount of reclaimed water that could be produced by these projects through 2020 was estimated to be 168 mgd.

Water Conservation

Water conservation is considered by the District to be an alternative water source, and is defined as the beneficial reduction of water use resulting in (1) modification of water use practices, (2) reduction of unaccounted-for losses, or (3) installation and maintenance of low volume water use systems, processes, fixtures or devices. Conservation options have been evaluated within two categories, including non-agricultural and agricultural. Each is described below.

Non-agricultural Conservation - Conservation options appropriate for implementation by public supply, domestic self-supply, recreation/aesthetic and commercial/industrial (C/I) and mining/dewatering (M/D) users were determined. The list included only those projects which cost less than $2.00/1000 gallons of water saved and those that can be implemented similarly across the region. Some measures that are known to be effective, such as water efficient rate structures, ordinances, and education, were not included in the list of options because they must be evaluated and quantified on a case-by-case basis. Conservation measures identified as having the best potential for water savings include: 1) plumbing retrofit kit give-aways, 2) ultra low volume (ULV) toilet rebates, 3) residential water use surveys, 4) water-efficient landscape and irrigation system rebates, 5) industrial, commercial and institutional (ICI) water use surveys, 6) large landscape water use surveys, 7) rain sensor shut-off device rebates, and 8) water budgeting. Through the implementation of all options it is anticipated that between 75 and 95 mgd of water could be saved each day, at a cost of less than $2.00 per thousand gallons saved. This range represents the volume of water that could be saved by implementing voluntary measures (75 mgd), versus the implementation of both voluntary and mandatory measures (95 mgd).

Agricultural Conservation - Agricultural conservation options include: 1) conversion to more water-conserving irrigation systems, 2) on-farm decision support systems (irrigation scheduling programs), 3) tensiometers, 4) shallow water table observation control wells, 5) automatic pump controls, 6) variable rate pumping, 7) water flow meters, 8) laser leveling, 9) seepage interception/horizontal wells, and 10) tailwater recovery/rainwater harvesting.

To estimate the costs that might be incurred by a ‘typical’ agricultural operation to implement one or more conservation options, 20 ‘model’ farms that are typical of a variety of different agricultural operations in the planning region were developed. The estimated water savings derived from the model farm case study analyses under average annual (5-in-10) conditions were determined. If no irrigation system conversions occurred but all applicable Best Management Practices (BMPs) were implemented, an estimated 34 mgd could be saved. If all possible conversions to the most water-conserving irrigation system technologies were accomplished and all applicable BMPs were implemented, an estimated 41 mgd could be saved.

Potential for Water Conservation and Reuse to Meet Future Demands

Water conservation has tremendous potential to help meet future water demands. In Table ES-1, 364.1 mgd of projected increase in demand from 1995 through 2020 is identified. Adding in the currently identified demand for environmental restoration of 68 mgd (the reduction in ground-water withdrawals required as part of the recovery plan associated with the adoption of minimum flows and levels in the northern Tampa Bay area) results in a total demand of 432.1 mgd. The discussion that begins on page ES-15, Overview of Funding Mechanisms, explains that 215.5 mgd of the 432.1 mgd demand has been accounted for by projects that are either completed, under development, or planned with secured or pledged funding. This leaves 216.6 mgd that is not yet under development or planned.

Figure ES-1 shows that if all of the non-agricultural water conservation options (95 mgd) and all agricultural water conservation options (41 mgd) are implemented and combined with the 168 mgd that can potentially be obtained from reclaimed water, the resulting 304 mgd could play a major role in meeting future demand.

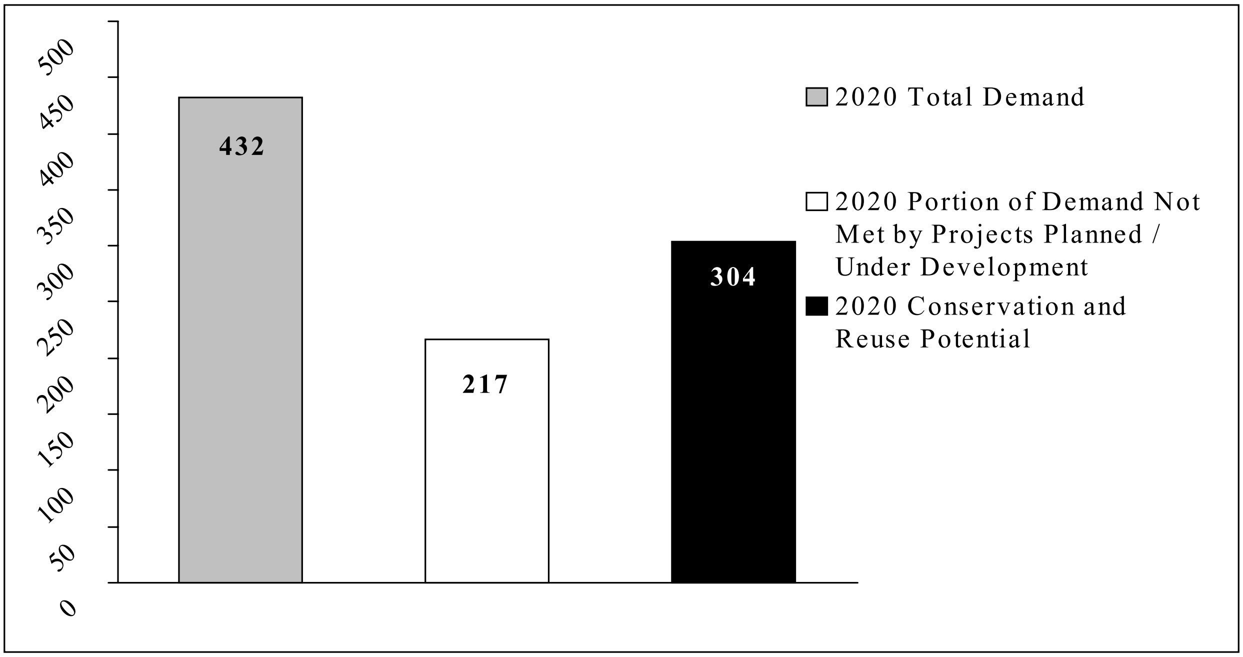


Figure ES-1. Total Demand (mgd) in the Planning Region through 2020 versus the Quantity of Water (mgd) that Could Potentially be Saved or Developed through Conservation and Reclaimed Water Options.

The potential for water conservation to meet demands is particularly evident in the public supply and agricultural water use sectors. Figure ES-2 shows that the additional regional demand for public supply is projected to be 181 mgd (Table ES-1) by 2020 and that the portion of this demand that is not accounted for by projects that are completed, under development or planned with secured or pledged funding is about 100 mgd. The Figure also shows that water conservation options have the potential to meet about 95 mgd of these demands, if all options are implemented.

Figure ES-3 shows that additional agricultural demands are projected to be 122 mgd (Table ES-1) by 2020 and that the portion of this demand that is not accounted for by projects that are completed, under development, or planned with secured or pledged funding is approximately 78 mgd. The Figure also shows that water conservation has the potential to meet 41 mgd of this demand.

Although the potential for water conservation and reclaimed water options alone to meet the 216.6 mgd 2020 demand does exist, there are a number of reasons why such a scenario may not be feasible. First, the District does not have the authority to prescribe the sources of water to users that they will develop to meet their demands. Second, the development of a variety of sources provides greater assurance that regional demands can be met. Developing only water conservation and reclaimed water options will

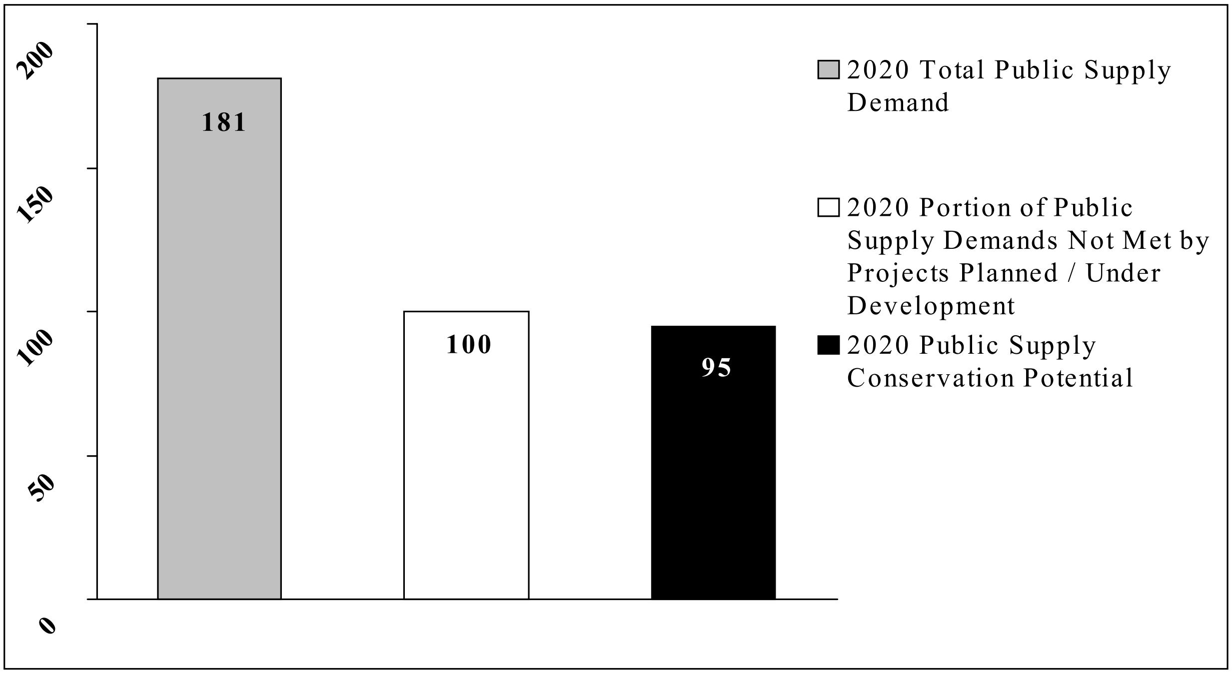


Figure ES-2. Public Supply Demand (mgd) in the Planning Region through 2020 versus the Quantity of Water (mgd) that Could Potentially be Saved through Public Supply Water Conservation Options (does not include the 168 mgd reuse potential).

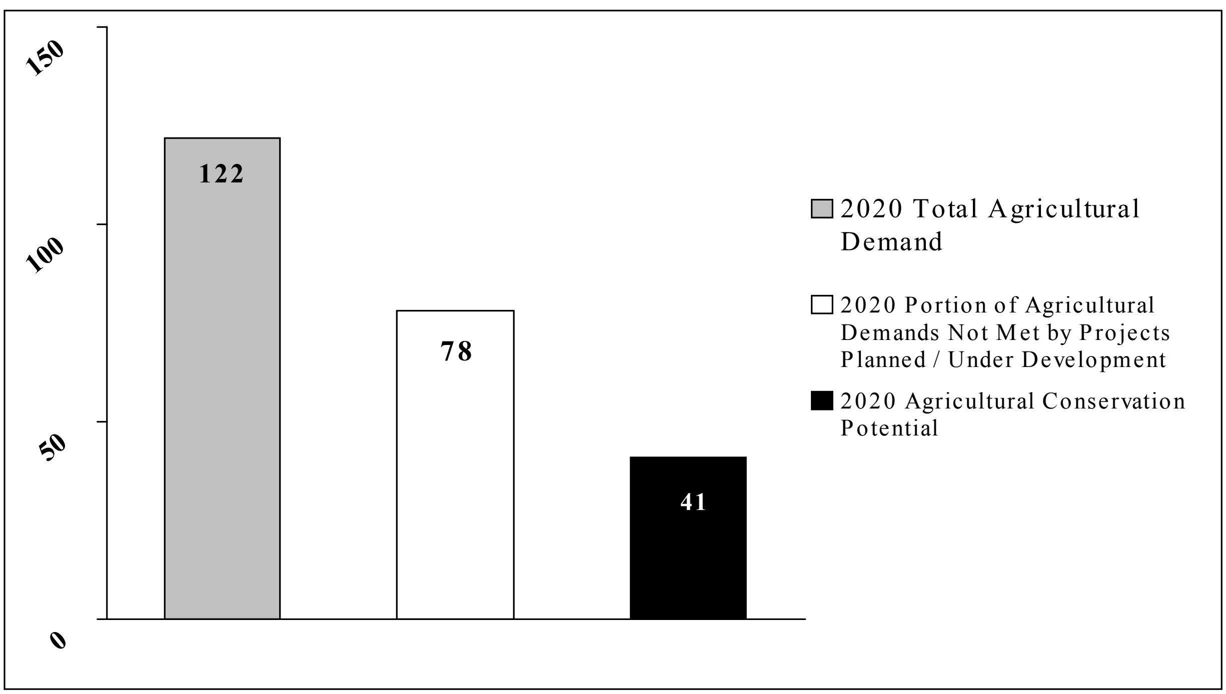


Figure ES-3. Agricultural Demand (mgd) in the Planning Region through 2020 versus the Quantity of Water (mgd) that Could Potentially be Saved through Agricultural Water Conservation Options (does not include the 168 mgd reuse potential).

likely render the region less able to address issues related to system variables such as demand peaking and seasonal stress.

Third, the success of water conservation projects in particular, and reclaimed water projects to a lesser degree, is dependent upon the decisions of the end-user. The development of a variety of sources reduces the uncertainty associated with this dependency. Finally, in some areas of the District, great success has been achieved with the use of reclaimed water and water conservation, while success in other areas has been limited. The distribution and magnitude of conservation and reuse efforts must be heightened before these sources can begin to be considered sufficient to meet demands throughout the planning region.

While it may not be feasible for reclaimed water and water conservation projects to reliably meet all of the demands of the region over the next 20 years, it is the goal of the District to enhance these efforts to the greatest extent practicable. Ongoing efforts to include conservation and reuse in water supply planning will be continued. The significant role that conservation and reuse can play in water supply development in the region is emphasized in many of the District's existing programs. Planning documents such as the RWSP, the District Water Management Plan, Basin Plans and Comprehensive Watershed Management Plans identify water conservation and reclaimed water as key factors in addressing water supply issues. Regulatory efforts, such as permitting rules that require conservation plans in the water use caution areas and water restrictions, address demand management. In addition, substantial incentive programs such as the Cooperative Funding Program offer financial assistance toward the development of water conservation and reclaimed water projects.

The District has enhanced its outreach efforts to attempt to mobilize the community. Through efforts like the Water Conservation Task Force, formed in 2000, the benefits of and the awareness of the need for water conservation and the efficient use of reclaimed water are emphasized. Such efforts are planned to continue and even increase throughout the planning horizon.

Brackish Ground Water

Brackish ground water has impurity concentrations greater than drinking water standards (TDS concentration greater than 500 mg/l) but less than seawater (TDS equal to or greater than 35,000 mg/l). Brackish ground water is found principally in the coastal portions of the Floridan and intermediate aquifers. Though brackish ground water is a viable source of water, it is important that future withdrawals of brackish ground water are planned and operated so as not to exacerbate regional movement of the saltwater interface. Historically, brackish ground-water desalination has been a more expensive source of water than traditional fresh ground-water or surface-water sources. However, improvements in technology involving low pressure reverse osmosis (RO) and ultra-filtration membranes have substantially reduced operating costs for newer systems. The RO process results in fresh product water and a highly mineralized waste concentrate. The waste concentrate must be disposed of through methods that include surface-water discharge, deep well injection, or dilution at a WWTP.

Within the District there are currently 12 active brackish ground-water desalination facilities that are permitted for a total of approximately 38 mgd. These plants are principally located in the coastal areas of Charlotte, Pinellas, and Sarasota counties. The projected amount of additional water supply from brackish ground water includes approximately 14.5 mgd from within the existing water supply infrastructure and about 15 mgd from facilities that are in the planning phase as well as a potential water supply option described in the RWSP, for a total amount of 29.5 mgd.

Seawater Desalination

Although there are currently no seawater desalination plants in the planning region, Tampa Bay Water is developing a facility that will be co-located with Tampa Electric Company's Big Bend Power Plant on Tampa Bay near Apollo Beach. The District is providing $85 million toward the capital cost of the plant. The facility will have a capacity of 25 mgd, expandable to 35 mgd and it is expected that the price for delivery of this water to the consumer will average $2.08 per 1,000 gallons over a 30-year period. This price sets a new standard for seawater desalination which historically has experienced costs ranging from approximately $4.00 to $8.00 per thousand gallons. Two major problems associated with desalination have discouraged its development in the past. The first problem, excessive cost, has been minimized by recent technological improvements in the RO process. The second problem is the disposal of the waste concentrate. Tampa Bay Water's planned desalination facility will use an innovative design to dilute the waste concentrate in the same discharge pipe and discharge canal that returns the cooling water from the power plant to the Bay. The end result will be a discharge water that is diluted to within approximately 1.5 percent of the ambient Bay water quality.

Much of the near-shore area in the planning region has been designated as either Outstanding Florida Waters (OFW) or aquatic preserves. For this reason, it was important and preferable to find potential sites that did not have either of these designations. Other criteria for identifying potential locations were access to existing public supply infrastructure and the existence of nearby water demand. Four potential sites for large scale (at least 20 mgd) seawater desalination plants in the planning region have been identified as part of the RWSP process. It is estimated that a total of 75 mgd of water supply can be provided by facilities located at these sites. When the 25 mgd planned for the Big Bend site is included, a total of 100 mgd of water supply could be produced in the planning region from seawater desalination

Chapter IV. Sub Chapter C. Water Supply Projects Under Development

The District contributes substantial funds toward the development of sustainable water supplies on an annual basis. These funds come primarily from four sources, including:

- The Cooperative Funding Program of the Basin Boards;
- The New Water Sources Initiative (NWSI) funded by the Governing Board and Basin Boards;
- The Water Supply and Resource Development Funds funded by the Governing Board and Basin Boards; and
- The Partnership Agreement (funded through the NWSI).

Determining whether these funds and associated projects should be categorized as "water resource development" or "water supply development," pursuant to the statutory definitions is very problematic. To give a comprehensive understanding of the substantial assistance provided by the District for overall water development, a general description of these programs and the water resource and supply development projects funded by them is provided below. Combined, District funding for water resource and water supply development in Fiscal Year 2000 totals $55,379,773, representing 28 percent of the District's total budget.

This "Sub Chapter" provides an overview of the District's ongoing programs and activities related to the implementation of water resource and water supply development projects. Included are overviews of the District's Cooperative Funding and New Water Sources Initiatives programs, as well as the water supply projects funded through the Partnership Agreement with Tampa Bay Water.

Chapter IV. Sub Chapter D. Water Supply Options

A list of water supply options for the individual sources was developed based on input from the District's NTB Input Group, SWUCA Working Group, Advisory Committees, and other members of the community. A "long list" of projects was identified for each source and reduced to a manageable "short list" of projects. The short list contains options that are representative samples of the different types of options included on the long list. Options on the short list were submitted to more detailed planning-level technical and financial feasibility analysis to more fully develop the concepts and refine the estimates of costs. The short list does not represent a prioritization or list of the District's preferred options, but provides reasonable concepts that water users in the region may pursue in their water supply planning. It is anticipated that users will choose an option or combine elements of different options that best fit their needs. Following a decision to pursue an option identified in the RWSP, it will be necessary for the interested party(ies) to conduct more detailed engineering, hydrologic and biologic assessments to demonstrate that the conditions for issuance of all applicable permits can be met.

Additional Source Considerations

In the future, water demands will likely be met with the sources listed above. However, management techniques and technologies such as improved water treatment methods, aquifer storage and recovery, and aquifer recharge and conveyance systems will be required to meet the projected demands.

Aquifer Storage and Recovery (ASR)

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. 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. To date, the majority of ASR projects have been limited to storage and recovery of potable water. However, several projects are in progress to determine the feasibility of utilizing non-potable water such as reclaimed water or storm water. Another type of non-potable ASR involves withdrawing, treating and storing excess flows from a river. The river water would be treated to an appropriate level then pumped into an aquifer through wells for storage. When the water is needed, the same wells would be used to withdraw the water from the aquifer.

Aquifer Recharge and Conveyance

A major component of some of the proposed surface-water and reclaimed water options includes aquifer recharge and conveyance. This involves capturing excess water from rivers during periods of high flows and recharging it at various points in the Floridan aquifer. This would increase the amount of available ground water and minimize the cost of conveyance since the aquifer would be the instrument used to convey water to users who could then capture it through traditional ground-water wells.

CHAPTER V. WATER RESOURCE DEVELOPMENT COMPONENT

This chapter of the RWSP addresses the legislatively required water resource development projects identified through the planning process. It is very difficult to categorize the numerous projects receiving District funding assistance as water supply development or water resource development projects. For the RWSP, the majority of projects funded through the Basin Boards' Cooperative Funding Program, the New Water Sources Initiative, and the Partnership Agreement have been categorized as water supply development projects. The intent for water resource development projects is to enhance the amount of water available for water supply development and the District is primarily responsible for water resource development projects. Water resource development is defined as "*the formulation and implementation of regional water resource management strategies, including the collection and evaluation of surface water and ground-water 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 ground-water recharge augmentation; and related technical assistance to local governments and to government-owned and privately owned water utilities*" (s. 373.019(19), F.S.).

Projects the District believes constitute water resource development and for which the District will take the lead in implementing include: 1) hydrologic data collection, 2) Regional Observation Monitoring Program (ROMP) (well construction and testing), 3) Quality of Water Improvement Program (QWIP) (plugging of abandoned artesian wells), 4) flood control and associated storage projects, 5) hydrogeologic investigations, and 6) establishment of MFLs. Over the next five years, the District will allocate approximately $68.5 million for these types of water resource development projects that will support water supply development by local governments, utilities, RWSAs, and others.

CHAPTER VI. OVERVIEW OF FUNDING MECHANISMS

An analysis was undertaken to compare potentially available funding sources to the total estimated cost needed to develop the water supply or demand management components of the RWSP. As previously mentioned, water demands in the planning region are anticipated to increase by 364.1 mgd between 1995 and 2020. An additional 68 mgd will also be necessary in conjunction with reductions in ground-water withdrawals from Tampa Bay Water's regional wellfield system as a part of the recovery strategy for the NTB area. Combined, a total of 432.1 mgd in new water supplies will be needed through this time frame. In addition, there is potential for additional water supply and demand management initiatives to achieve further water resource and ecological recovery as MFLs continue to be adopted in the planning region. However, some of this new water supply has already been completed (1995 to date), is under development, or is planned with secured or pledged funding. It is estimated that of the total 432.1 mgd, approximately 215.5 mgd is in this category, leaving approximately 216.6 mgd remaining to be funded and developed.

The historical funding sources and amounts have been determined for the development of the 215.5 mgd. The total amount of these sources is $1.025 billion and is detailed in Table ES-3. Based on the District's experience and knowledge of the costs associated with developing the 215.5 mgd, as well as making a series of assumptions about future costs and funding participation by various user groups, a cost of $6 million per mgd in new water supply infrastructure was used to project future costs. This resulted in a total funding need of approximately $1.3 billion (216.6 mgd x $6 million per mgd).

Table ES-3. Secured or Pledged Sources of Funding for Completed, Ongoing, or Planned Projects that have or will Produce 215 mgd of the 432 mgd Demand Needed between 1995 and 2020.

Funding Sources	
District NWSI funding @ $20 million per year from fiscal year 1994 through 2007, minus $26 million of these funds that were not pledged at the completion of the fiscal year 2001 budget development.	$244 million
Matching funds from NWSI Partners of funds described above. These funds were provided primarily by local governments and regional water supply authorities.	$244 million
Reimbursed or pledged Basin Board Cooperative Funding Program funds for water supply projects for fiscal years 1994 through 2007 as of completion of fiscal year 2001 budget development.	$129 million
Matching funds from Cooperative Funding Program Partners of funds described above, primarily local governments, for water supply projects.	$129 million
Reimbursed or pledged funds from the District's Water Supply and Resource Development Fund. The only funds pledged from this fund to date were from fiscal year 2000, the year the fund was originally established.	$2 million
Matching funds from the District's Water Supply and Resource Development Fund partners as described above.	$2 million
Preservation 2000 funds used to acquire land for water supply development.	$13 million
Unmatched funds provided by Tampa Bay Water to develop their water supply projects.	$217 million
Federal grant funds that have been obtained for major water supply and reclaimed water projects in the planning region as of completion of fiscal year 2001 budget development.	$45 million
Total	**$1.025 billion**

Potential funding sources have also been identified to help meet these future water supply development costs. If the Governing Board and Basin Boards maintain their current NWSI funding commitment of $20 million per year through 2020, $286 million could be produced (excludes current NWSI funding pledges of $94 million through 2007). Secondly, if the District's Basin Boards maintain their recent commitments to water supply development and demand management under the Cooperative Funding Program, which is also about $20 million per year collectively, this could yield $361 million (excludes $19 million in existing Cooperative Funding Program pledges through 2003). Together, these two funding sources could yield $647 million of the required $1.3 billion or roughly 50 percent, before any matching funds are contributed.

Historically, both the NWSI and Cooperative Funding Programs have required cost share on an equal basis (50/50 cost share for eligible costs). Therefore, if a similar match was required in the future, adequate funding could be available. However, many of the future projects may require a higher percentage funding from the District. For example, if it is determined that a seawater intrusion barrier needs to be established in the SWUCA, it may be funded entirely by the District. In recognition of this, this analysis has assumed that 50 percent of the future NWSI and Cooperative Funding Program budgets would be set aside for projects to be funded completely by the District. The remaining 50 percent would be matched on an equal cost basis, which would yield an additional $324 million.

Another potential source of funding is the continuation of the District's recently implemented Water Supply and Resource Development Fund. If the Governing Board were to set aside $3 million for this fund annually, and the Basin Boards were to collectively match this amount, $114 million could be set aside from 2002 through 2020. As with NWSI and the Cooperative Funding Program, if half of these funds were matched on an equal cost share basis, an additional $57 million could be leveraged. Another potential source of funding is the state's Florida Forever Program. The Governing Board could request an estimated $117 million from this fund for implementation of the RWSP over the next ten years. The last potential funding source is federal grants for water supply and resource development projects. Although it is always difficult to gauge the likelihood of receiving future federal grants, the District will continue to be an active partner in obtaining such funds.

Table ES-4 compares the dollars needed to implement the water supply development and demand management components of the RWSP that have yet to secure funding, to the various potential funding sources described above. As illustrated in this Table, the potential funding sources described above have the potential to yield the magnitude of funds that will be required. ***However, if additional water supply development and demand management is needed to address water resource or ecological restoration due to future establishment of MFLs, the deficit of fiscal resources may be greater than that identified based on the potential funding sources and associated assumptions described above.***

CHAPTER VII. RECOMMENDATIONS

The District has developed strategies for implementation of the RWSP that include: 1) MFLs, 2) water supply development, 3) water resource development, 4) water supply planning, 5) coordination with other agencies and affected parties, and 6) funding for water resource development.

Minimum Flows And Levels

- Continue to identify priority water bodies for establishment of MFLs on an annual basis.

Table ES-4. Remaining 216.6 mgd Water Use Demand that does not yet have Secured or Pledged Funding and Potential Sources of Funding.

Funding Needs	
Estimated cost of developing 216.6 mgd of new water supplies @ $6 million per mgd.	$1.3 billion
Funding Sources	
District NWSI funding @ $20 million per year through 2020 (excludes existing NWSI pledges through 2007).	$286 million
Funding provided assuming one half of the $286 million of District NWSI funds are used for projects that would be matched by a partner on an equal cost share basis.	$143 million
Basin Board Cooperative Funding Program @ $20 million per year through 2020 (excludes 19 million in existing Cooperative Funding Program pledges through 2003).	$361 million
Funding provided assuming one half of the $361 million of District Cooperative Program funds are used for projects that would be matched by a partner on an equal cost share basis.	$180.5 million
District Water Supply and Resource Development Fund.	$114 million
Funding provided assuming one half of the $114 million of District's Water Supply and Resource Development Fund are used for projects that would be matched by a partner on an equal cost share basis.	$57 million
State of Florida, Florida Forever Program	$117 million
Federal Funds	TBD
Total potential funding sources through 2020	**$1.26 billion**
Less estimated cost of developing 217 mgd of new water supplies @ $6 million per mgd	**$1.3 billion**
Balance	**$40 million (deficit)**

- Continue to adopt MFLs in accordance with the annually updated priority schedule.
- Continue monitoring to determine the effectiveness of adopted MFLs and recovery and prevention strategies.
- Continue to evaluate, update, and expand methodologies used in the establishment of MFLs.
- Continue to evaluate recovery tools such as modifications to surface water control structures, reductions in ground-water withdrawals, and augmentation of water bodies.

Water Supply Development

- Aggressively pursue the expansion of demand management measures whenever possible.
- Increase the use of reclaimed water through the District's water use permitting program.
- Require increased efficiencies and utilization of reclaimed water for District funded projects.

- Work with FDEP to require more efficient and beneficial use of reclaimed water.
- Continue to fund research on advanced water supply technologies.
- Develop strategies with water suppliers and other affected parties that promote the development and coordination of regional water supplies.
- Investigate options to optimize development of surface-water sources while protecting existing legal uses and environmental systems. This may include assigning responsibility for the development of individual surface-water sources to a single entity, such as the District or water supply authority.
- Ensure that self-supplied users have reasonable access to future water supplies.
- Work with local governments to ensure that the availability of water supplies is a key component in the process of approving new development.

Water Resource Development

- Continue to collect hydrologic and biologic data to support investigations of water resource availability.
- Continue to conduct hydrologic and biologic investigations and develop models to determine water resource availability and developing methodologies for establishment of MFLs.
- Conjunctively develop flood protection and water supply projects to achieve multiple benefits.
- Continue to collect aerial photography for water resource and flood investigations.
- Continue to develop analytical tools for assessing advanced water supply technologies.
- Investigate development of large scale aquifer recharge projects to manage saltwater intrusion and lake level declines and enhance water supply opportunities in the region.
- Implement a program to locate and study offshore springs to provide definitive data on the issue of the existence of offshore springs, their magnitude of discharge and water quality, and potential for water supply development.

Water Supply Planning

- In the NTB region, provide an interim evaluation of the adopted Recovery Plan by 2005 to project the need for additional recovery and water supplies beyond the 2010 time frame.
- Conduct a reassessment of water supply demands by 2003.
- Update the RWSP in 2005 and expand it to address the water supply planning needs of the northern portion of the District.
- Continue to work with user groups in the region to monitor changes in demand and to refine methodologies for projecting future demand.

Coordination

- Continue to coordinate with adjacent WMDs to ensure consistency in determining water supply constraints and evaluation of impacts of withdrawals.
- Work with adjacent WMDs to ensure that a coordinated approach to the development of water supplies in boundary regions occurs.
- Coordinate the review of WUPs in the boundary regions of adjacent WMDs with the WMDs to address and resolve concerns about interdistrict impacts.

- Provide incentives to encourage local governments and water suppliers to coordinate water supply projects to facilitate a regional approach to water supply development.
- Enhance outreach programs to educate citizens on water supply issues.
- Continue to seek input from affected parties in the development and implementation of RWSPs.

Funding for Water Supply and Water Resource Development

- Continue the District's incentive-based funding programs such as the Cooperative Funding and NWSI programs and the Water Supply and Resource Development Reserve.
- Continue to seek federal funding for water supply and resource development projects.
- Continue to provide adequate funding to maintain expertise for conducting hydrologic and biologic assessments and developing methodologies for establishing MFLs.
- Continue to provide adequate funding for data collection programs in support of water resource assessments and establishment of MFLs.
- Continue to provide adequate funding for advanced technological support for water resource assessments and establishment of MFLs.
- Continue to provide adequate funding for implementation of the water use permitting program as one of the essential District tools in managing water supply issues.
- Integrate the RWSP process into the Comprehensive Watershed Management (CWM) decision support system.

Chapter I. Introduction

Part A. Background

This Regional Water Supply Plan (RWSP) is an assessment of projected water demands and potential sources of water to meet these demands for the period from 1995 to 2020. The RWSP is developed for a ten-county area that extends from Pasco County in the north to Charlotte County in the south. The purpose for preparing the RWSP is to provide the framework for future water management decisions in areas of the Southwest Florida Water Management District (SWFWMD or District) where the hydrologic system is stressed due to ground-water withdrawals. The RWSP shows that sufficient water sources exist in the planning region to meet future demands and replace some of the current withdrawals causing hydrologic stress. Because sources within the planning region are sufficient from a technical and economic perspective to meet these demands, sources outside the planning region have not been investigated. The RWSP also identifies potential options and associated costs for developing these sources. Options identified in this report are not intended to represent the District's most "preferable" options for water supply development. They are, however, provided as reasonable concepts that water users in the region can pursue in their water supply planning. Water users can select a water supply option as presented in the plan or combine elements of different options that better suit their water supply needs. Additionally, the plan provides information to assist water users in developing funding strategies to construct water supply development projects.

The requirement for regional water supply planning originated from legislation passed in 1997 that significantly amended Chapter 373, Florida Statutes (F.S.). New regional water supply planning requirements were codified in s. 373.0361, F.S., and this RWSP has been prepared pursuant to these provisions. Key components of this legislation included:

- Designation of one or more water supply planning regions within the District
- Preparation of a Districtwide Water Supply Assessment (WSA), and
- 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 WSA.

The District's WSA was completed and accepted by the Governing Board in June 1998. Four water supply planning regions (northern, west-central, east-central and southern) were identified for purposes of preparing the WSA. Three of the four planning regions generally correspond to the jurisdictional areas of regional water supply authorities (RWSA), (Withlacoochee RWSA for the Northern region, Tampa Bay Water [previously West Coast RWSA] for the west-central region and Peace River/Manasota RWSA (PR/MRWSA) for the southern region). The fourth planning region includes portions of Polk, Highlands and Hardee counties, where the District recently co-funded a feasibility study for the establishment of a new RWSA.

For each water supply planning region, existing and reasonably anticipated sources of water were evaluated to determine the adequacy of these sources to meet projected demands. In the WSA, the District concluded that regional water supply planning should be initiated for the west-central, east-central and southern planning regions because *"sources of water are not adequate for the planning period to supply water for all reasonable-beneficial uses and to sustain the water resources and related* *natural systems"* (373.0361(1), F.S.). Based upon this conclusion, this RWSP has been prepared for the area encompassed by the west-central, east-central, and southern water supply planning regions.

Subsequent to completing the WSA, the District concluded that it would be beneficial to redefine these three regions into one water supply planning region. Information contained in the RWSP (e.g., demand projections and potential sources of water) has been prepared at the county level and can be aggregated for the three originally-designated planning regions, as well as for each of the water use caution areas encompassed by the planning region (see below for a description of water use caution areas). Figure I-1 depicts the planning region, which is a combination of the originally-designated three regions.

Part B. Organization of the Regional Water Supply Plan

A *Format and Guidelines for Regional Water Supply Planning* document was developed by a group representing the five water management districts and the Florida Department of Environmental Protection (FDEP) to ensure a common understanding of, and approach to meeting, the legislative requirements for regional water supply planning. This RWSP has been prepared consistent with this document.

The remainder of the RWSP is organized as follows: Chapter II describes the approach of the District in developing the RWSP. Chapter III addresses minimum flows and levels (MFLs) within the planning region. Chapter IV contains the water supply development component of the RWSP. Water supply development is defined as "*the planning, design, construction, operation, and maintenance of public or private facilities for water collection, production, treatment, transmission, or distribution for sale, resale, or end use*" (s. 373.019(21), F.S.). Chapter IV is divided into four Sub Chapters. Sub Chapter A includes a quantification of the water supply needs for all existing and reasonably projected future uses through the year 2020. These water supply needs have been developed for both average conditions and a 1-in-10-year drought event. Sub Chapter B contains a discussion of water supply sources and deficits. Sub Chapter C contains a discussion of water supply projects that are currently under development for which the District is providing financial assistance. Finally, Sub Chapter D contains a list of water supply development options from which various users may choose. For each option, the estimated amount of water available for use and the estimated cost of developing the option have been included. The total quantity of water potentially available from these source options on a cumulative basis exceeds the projected needs under the 1-in-10 drought event. Sub Chapter D also includes a list of water supply development projects that meet the criteria in s. 373.0831(4). Chapter V contains the water resource development component of the RWSP. Water resource development is defined as *"the formulation and implementation of regional water resource management strategies, including the collection and evaluation of surface-water and ground-water 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 ground-water recharge augmentation; and related technical assistance to local governments and to government-owned and privately-owned water utilities*" (s. 373.019(19), F.S.). Chapter VI contains an overview of funding mechanisms for water resource and water supply development and Chapter VII contains the District's recommendations for the implementation of RWSP components and for the development of subsequent RWSP versions.

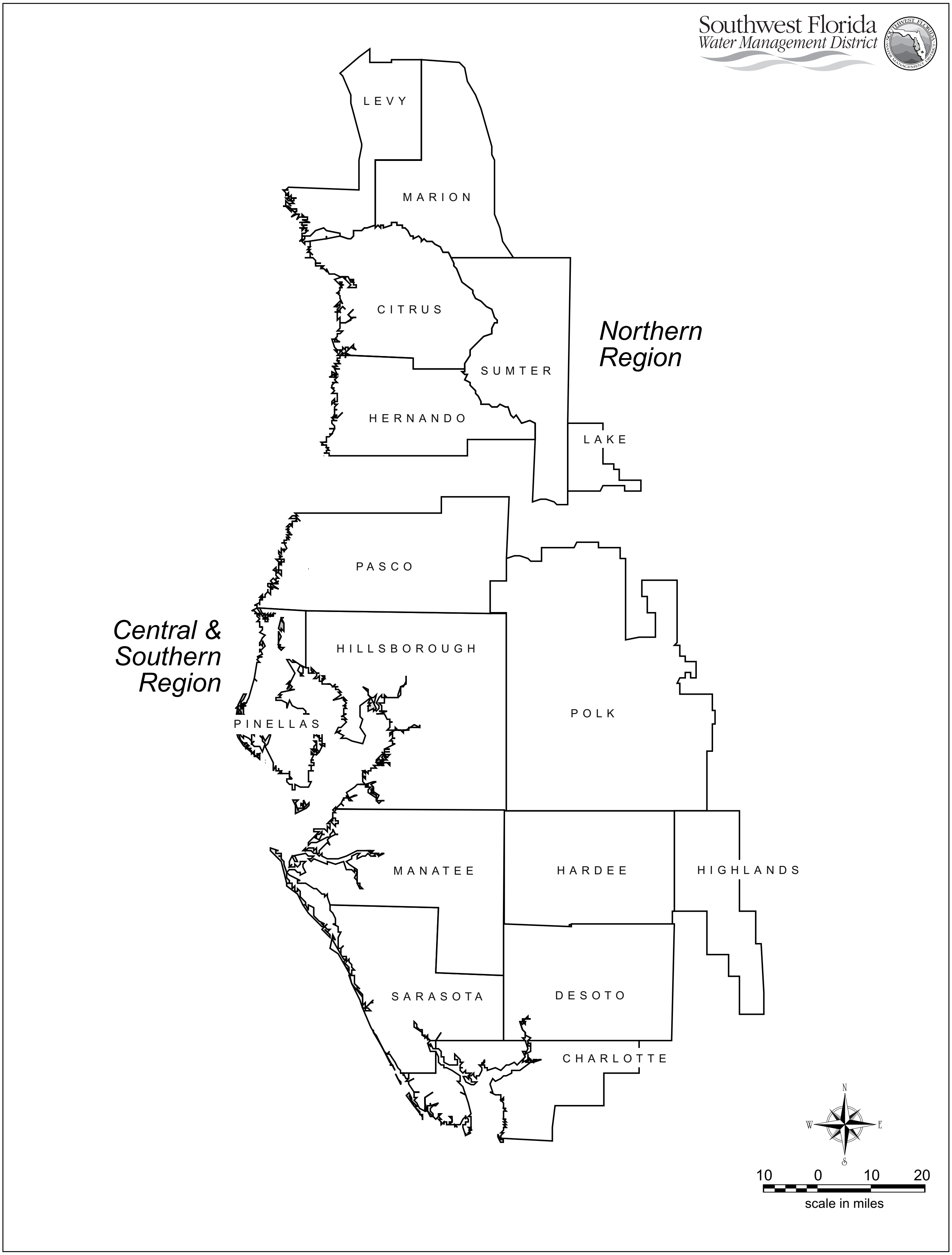


Figure I-1. Central and Southern Region (Planning Region)

Part C. Description of the Southwest Florida Water Management District

The Southwest Florida Water Management District is one of five regional districts in Florida charged with the management, protection and enhancement of water and water-related natural resources (Figure I-2). Established by Chapter 373, F.S., the Water Resources Act, the District is governed by an eleven-member board. Board members are appointed by the Governor and confirmed by the Senate. The Governing Board is responsible for all District initiatives, including all regulatory programs. The District is further divided into nine basins (Figure I-3), eight of which have separate Basin Boards (activities within the Green Swamp Basin are overseen by the Governing Board). Members of the Basin Boards are also appointed by the Governor and confirmed by the Senate. These Boards identify water management issues specific to their basins and fund a variety of programs to address these issues. The District and basin boundaries generally are based upon surface-water hydrologic features.

Section 1. Mission Statement

The Governing Board of the District has adopted the following mission statement:

> "The mission of the Southwest Florida Water Management District is to manage water and related natural resources to ensure their continued availability while maximizing environmental, economic and recreational benefits. Central to the mission is maintaining the balance between the water needs of current and future users while protecting and maintaining water and related natural resources which provide the District with its existing and future water supply."
>
> "The Governing Board of the District assumes its responsibilities as authorized in Chapter 373 and other chapters of the Florida Statutes by directing a wide-range of programs, initiatives and actions. These include, but are not limited to, flood protection, water use, well construction and environmental resource permitting, water conservation, education, land acquisition, water resource and supply development and supportive data collection and analysis efforts."

The District's various responsibilities can be divided into four areas including: water supply, flood protection, water quality and natural systems. This RWSP is an important new component of the District's water supply area of responsibility and it is incorporated by reference into the District Water Management Plan; the comprehensive plan that addresses all areas of the District's responsibilities.

Part D. Technical Investigations and Planning Efforts

The RWSP builds upon previous technical investigations and planning efforts at the District, including the 1992 Needs and Sources Report, water resource assessment projects, management plans developed for the Northern Tampa Bay (NTB), Eastern Tampa Bay (ETB), Highlands Ridge (HR) and Southern Water Use Caution Areas (SWUCA), as well as the Districtwide WSA referenced above.

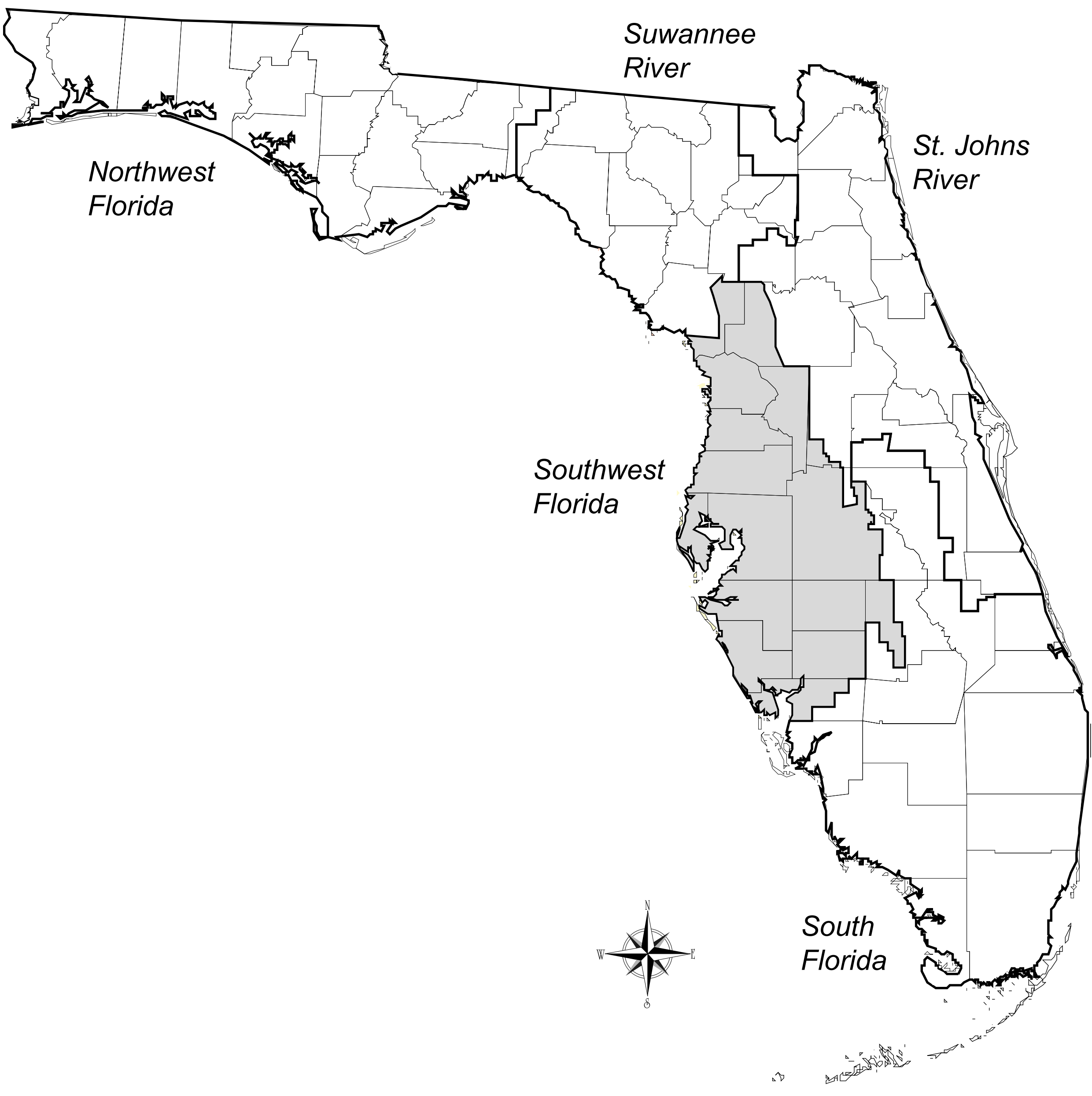


Figure I-2. Five Water Management Districts of Florida.

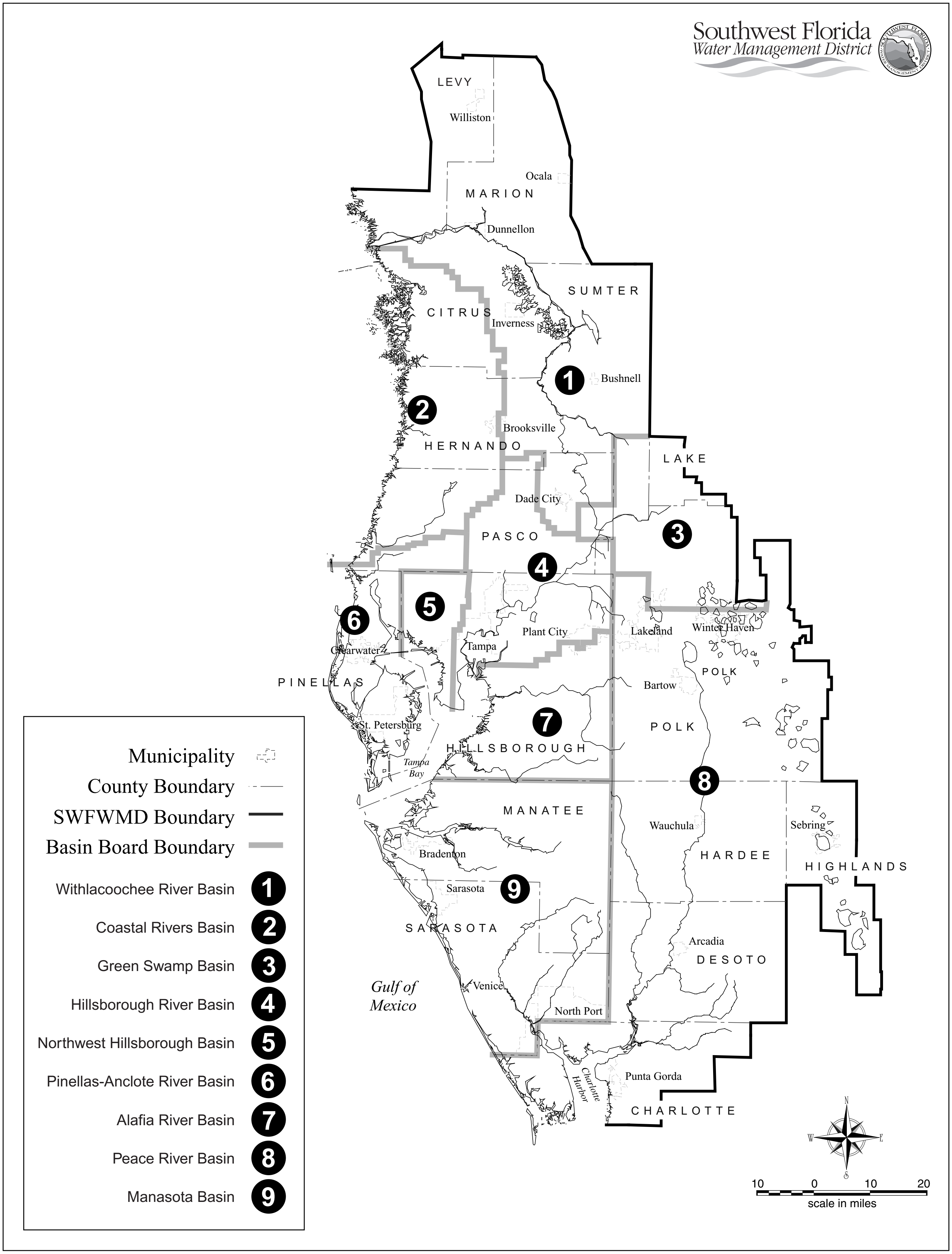


Figure I-3. District Basin Board Boundaries.

Section 1. Water Resource Assessment Projects

In the late 1980s, the District initiated a program to conduct Water Resource Assessment Projects (WRAPs) to assess water availability in several regions. These projects are detailed assessments of the water resources and include intensive data collection, monitoring and ground-water modeling to characterize hydrologic conditions and determine the effects of water withdrawals. There are five areas in the District for which WRAPs have been initiated. The first three WRAPs were initiated in the late 1980s and early 1990s for the NTB, ETB, and HR areas.

In the NTB area, resource impacts included lowered water levels in lakes and wetlands, impacts to existing legal users and limited saltwater intrusion caused primarily by ground-water withdrawals from 11 regional, public supply wellfields in the area. In the HR area, resource impacts included lowered lake levels and impacts to existing legal users, caused primarily by agricultural ground-water withdrawals in the area. In the ETB area, resource impacts included saltwater intrusion into the confined Upper Floridan aquifer caused by ground-water withdrawals for agriculture, industry and public supply. In the mid-1990s, a fourth WRAP was initiated which covered the southern portion of the District and encompassed both the ETB WRAP and HR WRAP areas. The purpose of this WRAP is to assess the cumulative effects of all water withdrawals in the region. A fifth WRAP is being conducted for the northern portion of the District, primarily focusing on areas north of Pasco County and outside the planning region. The ETB WRAP was completed in 1993 and the NTB WRAP was completed in 1996. These studies have helped to define the availability of ground-water resources in the planning region. The Southern District WRAP and Northern District WRAP are scheduled to be complete by 2005 and 2007, respectively. In addition, the District in 1999 initiated the NTB Phase II Investigation as a follow up to the NTB WRAP and MFLs. It is anticipated that this effort will be completed by 2010. As the ongoing WRAPs are completed, the results of these studies will be incorporated into future updates of the RWSP.

Section 2. Water Use Caution Areas

In the late 1980s the District realized that certain interim resource management initiatives could be implemented to help prevent existing problems in the WRAP areas from getting worse prior to the completion of each WRAP. As a result, in 1989, the District established the NTB, ETB, and HR Water Use Caution Areas (WUCAs), or Water Resource Caution Areas as they are referred to in Chapter 62-40, Florida Administrative Code (F.A.C.) (Figure I-4).

For each of the initial three WUCAs, a three-phased approach to water resources management was implemented, including: (1) short-term actions that could be put in place immediately, (2) mid-term or intermediate 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. Short-term actions for each WUCA included the establishment of a Work Group comprised of representatives from all types of water users within each WUCA (e.g., public supply, agriculture, industry), local governments, environmental representatives, and other interested parties. These Work Groups were convened to assist the District in the development of management plans for each WUCA. The main goal of the management plans was to stabilize and restore the water resource in each area through a combination of regulatory and non -

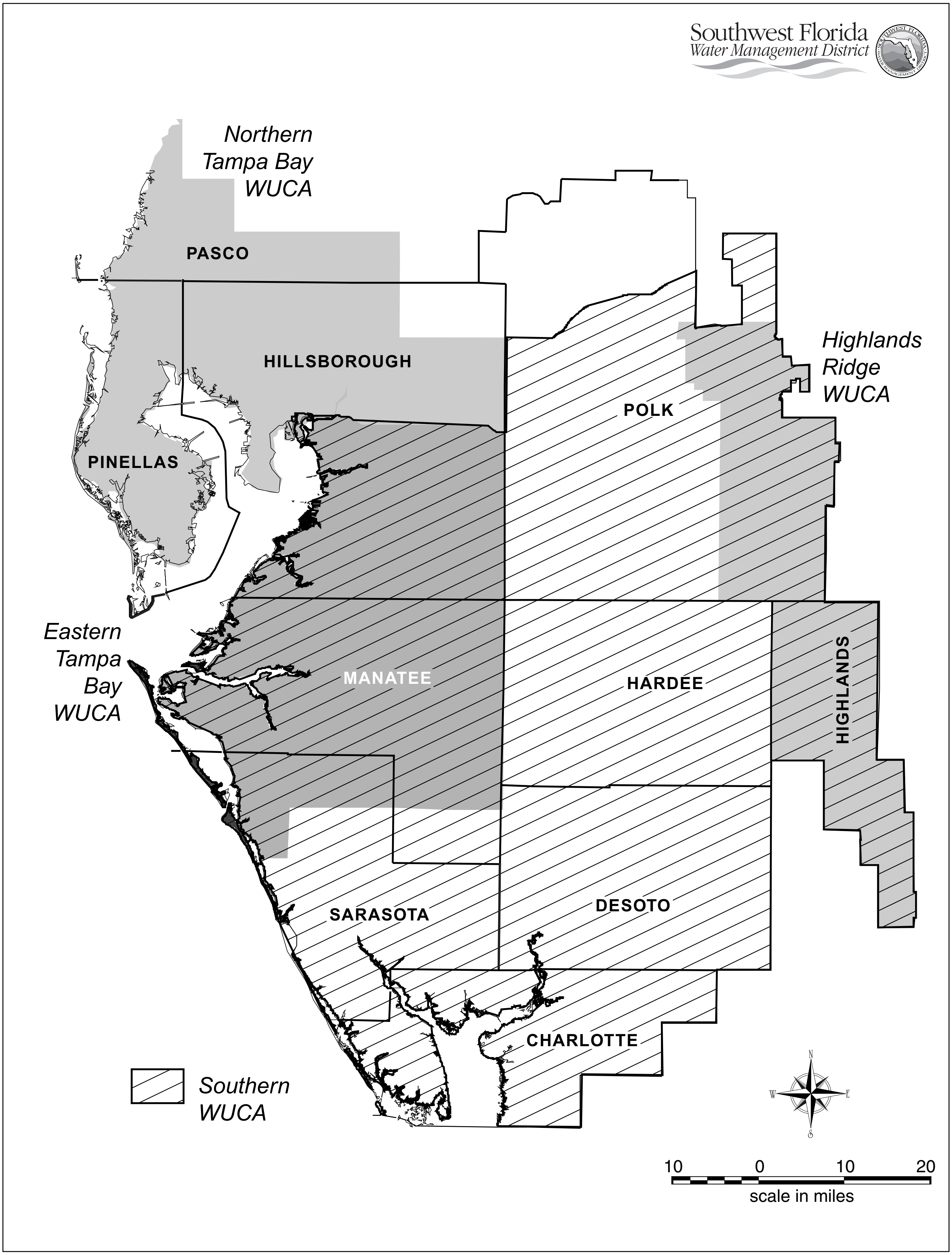


Figure I-4. District Water Use Caution Areas (WUCAs).

regulatory efforts. The plans were adopted in 1990 and 1991. Additional short term measures included development of conservation plans, permitting using cumulative impact analysis, and requiring withdrawals from stressed lakes to cease within three (3) years.

One of the primary means of implementing the WUCA management plans was through modifications to the District's Water Use Permitting rules for each specific WUCA. These modifications primarily addressed additional conservation requirements and investigation of alternative water sources for water use permittees. One significant change was the designation of the Most Impacted Area (MIA) within the ETB WUCA, within which no net increase in permitted water use from the Upper Floridan aquifer was allowed. This would be accomplished by significantly limiting the issuance of new permitted quantities.

Realizing that the Southern Ground-Water Basin should be managed in a comprehensive fashion, the entire southern part of the District encompassing this basin was declared the Southern Water Use Caution Area (SWUCA) in October of 1992. The SWUCA encompassed the previously established ETB and HR WUCAs. As with the previous WUCAs, the District convened a Work Group to assist in drafting a management plan for the area. The Work Group concluded a year-long series of meetings in late 1993. The District completed the management plan for the SWUCA in mid-1994, which included both regulatory and non-regulatory recommendations. To implement the regulatory component, the District subsequently initiated rulemaking.

The 1994 SWUCA rule had three main objectives, including: (1) significantly halt saltwater intrusion into the confined Upper Floridan aquifer along the coast, (2) stabilize lake levels in Polk and Highlands counties, and (3) limit regulatory impacts on the region's economy and existing legal users. The principal concept of the rules was to establish a minimum aquifer level and, because existing levels were below this minimum, to allow renewal of existing permits while gradually reducing existing quantities. The rule also had a mechanism, referred to as reallocation, to allow the voluntary redistribution of existing permitted quantities to new uses and locations within the SWUCA. A number of parties filed objections to parts of the rule and an administrative hearing was conducted. In March 1997, the District received the administrative law judge's Final Order upholding the minimum Floridan aquifer level (and the science used to establish it) and the phasing in of conservation. However, the ruling on provisions for reallocation and preferential treatment of existing users was determined invalid. The scientific work conducted previously for the SWUCA and its implications for limited additional ground-water availability has been incorporated into this RWSP.

In 1998, the District initiated a reevaluation of the SWUCA management strategy in recognition that the reallocation and preference to existing legal users provisions of the previously proposed rule were found invalid and the District elected not to appeal these provisions of the Final Order. This reevaluation was also promoted by a recognition of improved resource conditions in the SWUCA (e.g., permitted and actual water use had declined and ground-water levels had improved), new legislative direction provided in 1997 (e.g., water resource planning and development, provisions for a recovery and prevention strategy, among others), and recognition of the long-term nature of the resource constraints. This process is ongoing, with a current focus on maximizing water resource and supply development opportunities through development of this RWSP. For purposes of this RWSP, because permitted quantities in the SWUCA (approximately 1.3 billion gallons per day) exceed the quantities available under the previously proposed minimum aquifer level (650-750 million gallons per day (mgd)) and based on previous Governing Board direction, it has been assumed that there is little, if any, additional fresh ground water available in the area to meet future demands.

Section 3. Tampa Bay Partnership Agreement

While much of the southern portion of the planning region is encompassed by the SWUCA, much of the remaining area is encompassed by the NTB WUCA. Significant progress has been made in water resource and supply development planning in this area prior to the preparation of this RWSP.

In an effort to help resolve the resource impacts in the NTB WUCA, the District entered into an agreement with Tampa Bay Water and its member governments (Tampa, St. Petersburg, New Port Richey and Hillsborough, Pasco and Pinellas counties). An overall strategy to reduce reliance on ground water, implement alternative sources and allow recovery of natural systems was put in place in May 1998 with the approval of the NTB New Water Supply and Ground-Water Withdrawal Reduction Agreement (Partnership Agreement). The key objectives identified in the Agreement are the development of new water supply from sources other than ground water, the phased reduction of pumpage from the existing 11 wellfields in NTB, the ending of litigation, and financial assistance from the District for new water supply development and conservation (see Chapter IVB, Part B, Section 1 and Chapter IVC, Part A, Section 2 for additional detail).

Part E. Characteristics of the Planning Region

Section 1. Physical Characteristics

The planning region can be grouped into two distinct provinces with the division occurring roughly along Interstate 4. The northern District region is comprised of Pinellas, Hillsborough, and Pasco counties, and the SWUCA is located to the south. Each region is distinct in its hydrogeologic setting. In the NTB region, much of the topography is largely a result of limestone dissolution and sediment deposition. Numerous closed depressions and sinkholes throughout the area reflect active solution of the underlying limestone. This type of terrain is termed karst topography. In the SWUCA area, surficial deposits composed of sand, gravel, and clay form a thick sequence of sediments that overlie the carbonate aquifers. This thick sequence of sediments and limited ground-water circulation have subdued development of karst features in the western, central, and southern portions of the SWUCA (SWFWMD, 1988).

Land surface altitude from the Gulf Coast gradually increases from sea level to a high of about 150 feet National Geodetic Vertical Datum (NGVD) in eastern Pasco, northeastern Manatee, southeastern Hillsborough counties and interior Polk County. Land surface elevation continues to rise to the east where a series of north-northwesterly trending sand ridges interrupt the landscape in eastern Polk and Highlands counties (White, 1970). Elevation exceeds 300 feet NGVD at various points in the Lake Wales Ridge, the highest land elevation on the Florida peninsula.

Section 2. Hydrology

1.0 Rivers

The planning region contains ten major watersheds (Figure I-5). In the NTB area, they are the Anclote River, Hillsborough River, and the Tampa Bypass Canal (TBC) (the former Six Mile Creek/Palm River watershed that was extensively altered by the construction of the TBC). Further south are the Alafia, Little Manatee, Braden, Manatee, Myakka, and Peace Rivers along with Myakkahatchee and Shell Creeks. There are many smaller tributaries to these larger systems as well as several coastal watersheds drained by many small tidally-influenced or intermittent streams.

2.0 Lakes

There are over 150 named lakes located in the NTB area with extensive water-level data. Lakes greater than 20 acres in size are included in Figure I-5. Many lakes were formed by sinkhole activity and retain a hydraulic connection to the Upper Floridan aquifer. Others are surface depressions perched on relatively impermeable materials and reflect water table levels. Many of the lake systems are internally drained, while others are connected to river systems through natural streams or man-made canals. Many lakes have been altered by drainage and development with water-level control structures commonly present. About 50 lakes have been or are currently augmented with ground water from the Upper Floridan aquifer. In the eastern part of the SWUCA, almost 200 lakes and ponds are located along the ridges and flanks of the Lake Wales Ridge. The lakes are most likely the result of ancient sinkholes formed by the dissolution of the underlying limestone. The lakes range in size from a few tens of acres to more than 5,500 acres at Crooked Lake in southern Polk County. Flood control structures have been constructed on many of the lakes. However, several of the lakes, especially in the uplands portion of the central ridge, have not discharged water for the past 25 years due to low water levels (SWFWMD, 1990).

3.0 Springs

Several springs of first magnitude (discharge exceeds 100 cubic feet per second (cfs)) and second magnitude (discharge is between 10 and 100 cfs) are located within the planning region. These include Crystal Spring in Pasco County, Wall, Crystal Beach, and Tarpon Springs in Pinellas County, Sulphur, Lithia, and Buckhorn Springs in Hillsborough County and Warm Mineral Spring in Sarasota County (Figure I-5).

Crystal Spring is located in Pasco County near Zephyrhills and is one of the principle sources of the Hillsborough River's headwaters. Measured flow has averaged 57.6 cfs (37.4 mgd) for the period of record (1934 to present), though declines in flows have been noted over the past 40 years. Sulphur Springs is located on the Hillsborough River several miles north of downtown Tampa. During the dry season when the entire flow of the Hillsborough River is captured for water supply at the City of Tampa's Dam, Sulphur Springs is the only input of water to the lower Hillsborough River. The average flow of Sulphur Springs during the past five years is approximately 31 cfs (personal communication, Sid Flannery, SWFWMD).

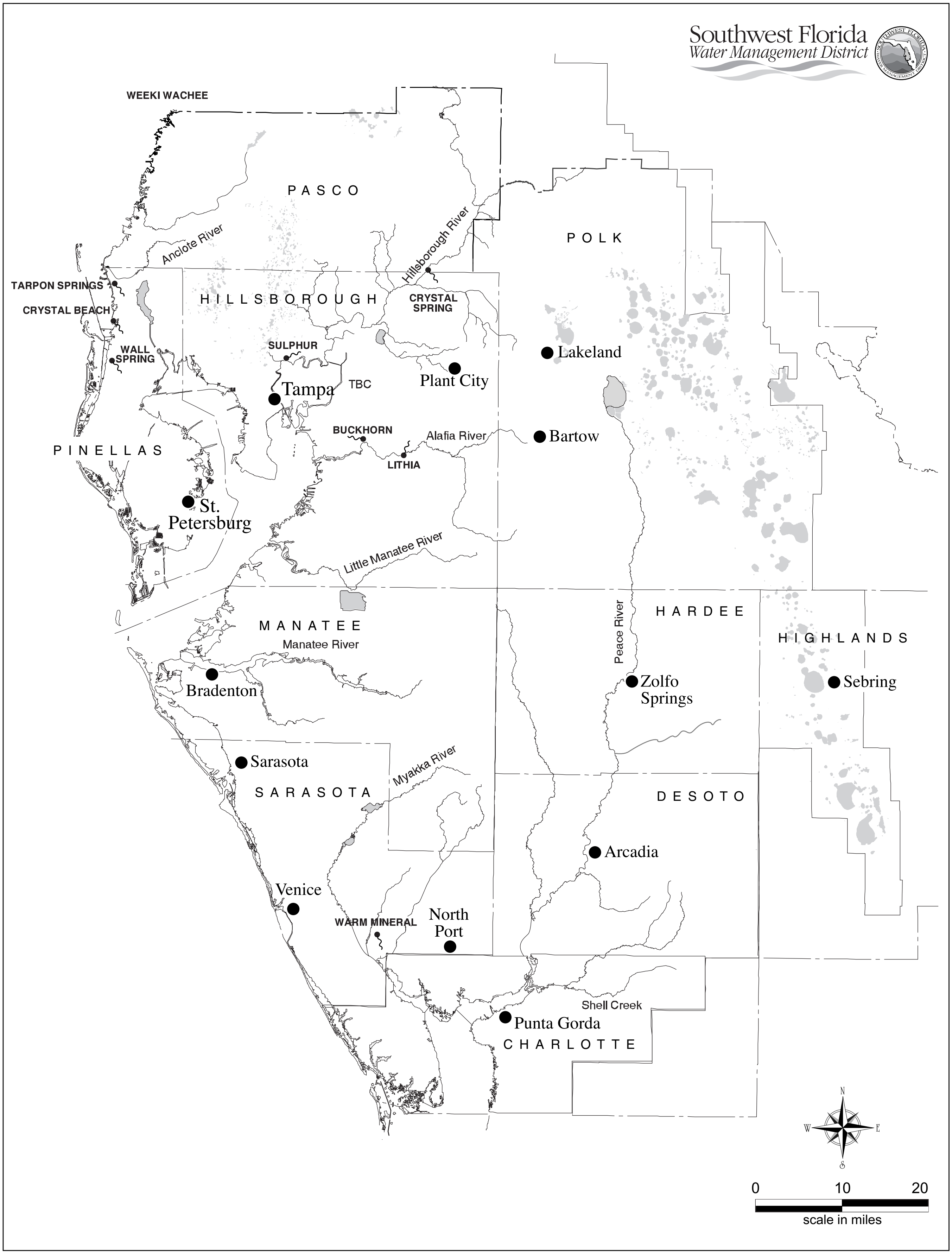


Figure I-5. Major Hydrologic Features in the Planning Region.

Wall, Crystal Beach, and Tarpon Springs are all located on the Gulf Coast in northern Pinellas County. Wall Springs was formerly a private recreation area that was purchased by Pinellas County as part of a county park. Although no flow data are available, the vigorous boil on the surface indicates it is possibly a second magnitude spring. Crystal Beach Spring is a submarine spring located about 1000 feet southwest of the shoreline. Although no flow data are available, the vigorous boil on the surface indicates that it is possibly a second magnitude spring. Tarpon Springs is located in the City of Tarpon Springs. The spring is tidally influenced and can reverse flow. Maximum recorded discharge is 1000 cfs (Roseneau and others, 1973).

Lithia and Buckhorn Springs are located on the Alafia River, south of Brandon in southeastern Hillsborough County. Lithia Springs is composed of two vents; Lithia Major and Lithia Minor. Periodic measurements of Lithia Springs since the early 1930s indicate an average discharge of between 30 and 40 cfs. Buckhorn Springs, composed of a number of vents spread over several acres, is located several miles down river of Lithia Springs. Periodic measurements made by District staff and the West Coast Regional Water Supply Authority (now Tampa Bay Water) in the early 1990s, indicated that the combined average flow from four significant vents was approximately 17.6 cfs. This includes the water diverted from the spring for industrial purposes (Jones and others, 1994). An industrial operation diverts a total annual average of approximately 4.3 mgd from Lithia and Buckhorn Springs. The majority of this diversion is pumped from Lithia Major.

Warm Mineral Spring is located about 13 miles southeast of the City of Venice in Sarasota County. Periodic measurements indicate that average discharge is approximately 10 cfs (Roseneau and others, 1973). The warm temperature of the spring water indicates that the source of the water is probably much deeper in the aquifer than springs further to the north, which tend to have shallow flow systems.

The District is periodically questioned about freshwater springs in the Gulf of Mexico and the possibility of utilizing them for water supply. Although the existence of a number of offshore springs has been documented, there is no evidence that the quality of water is suitable for the development of an economically feasible water supply. Because the saltwater/freshwater interface, the boundary between fresh ground water and saline ground water in the Floridan aquifer, is located onshore in most of the planning region, it is highly unlikely that fresh ground water could be discharging offshore through springs. This statement is supported by water quality investigations of a number of springs located directly on the coastline or a short distance offshore (Jones and others, 1997; Jones and others, 1998). The quality of the water discharging from these coastal springs is brackish at best. The District is beginning a reconnaissance program to locate and study offshore springs. It is hoped that this study will provide definitive data on the issue of both the existence of offshore springs and their magnitude of discharge and water quality.

4.0 Wetlands

Prior to significant development, approximately 54 percent of Florida was wetlands. However, due to drainage and development, only about 30 percent of the State is currently 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. Tampa Bay and Charlotte

Harbor are two large estuaries along the west-central Florida coast. Saltgrasses and mangroves are common estuarine plants.

Freshwater wetlands are common in inland areas of Florida. Hardwood-cypress swamps and marshes are two major freshwater wetland systems. Both systems are found either bordering lakes and rivers or standing alone as isolated wetlands. The hardwood-cypress swamps are forested systems with water at or above ground for a considerable portion of the year. Marshes are typically shallower systems vegetated by herbaceous plants rather than trees.

Section 3. Geology/Hydrogeology

Figure I-6 is a generalized cross section of the hydrogeology of the entire SWFWMD. As seen in this figure, the Central West-Central Florida Ground-Water Basin (CWCFGWB), where the NTB area is located, constitutes a hydrogeologic transition zone between the southern and northern parts of the District. In the southern portion of the District where the Southern West-Central Florida Ground-Water Basin (SWCFGWB) exists, a regionally extensive intermediate confined aquifer divides the surficial and Upper Floridan aquifers. The intermediate aquifer system and its associated clay confining units thin to the north and eventually become a single confining unit in the Tampa Bay area. Further north, in the central and northern portions of the CWCFGWB, this single confining unit becomes discontinuous and eventually disappears entirely in the northern part of the District. In this area, the Upper Floridan aquifer is unconfined.

1.0 NTB Area

In the NTB area, the surficial aquifer is comprised primarily of unconsolidated deposits of fine-grained sand, silt, and clayey sands with an average thickness of 30 feet. The surficial aquifer is found extensively throughout most of the NTB area except in northwestern Pasco County and most of Hernando County west of the Brooksville Ridge. Water table depth ranges from near land surface in wetlands and marshes to as much 15 feet along sand ridges. The unconsolidated materials that comprise the surficial aquifer are generally low in permeability and neither yield nor transmit significant quantities of water.

Below the surficial aquifer is a semi-confining unit comprised chiefly of clay, silt, and sandy clay that retards the movement of water between the overlying surficial aquifer and the underlying Upper Floridan aquifer. Regionally, the thickness of the semi-confining unit varies from essentially zero to more than 60 feet. The clay thickness generally follows the regional trend of being thicker in the southern portions and thin or absent in the northern portions of the NTB area. However, the karst geology of the area has created a semi-confining unit that is highly variable locally. The Upper Floridan aquifer consists of a continuous series of carbonate units that include portions of the Tampa Member of the Arcadia Formation, Suwannee Limestone, Ocala Limestone, and Avon Park Formation. Except in the extreme northern portions of the planning region, ground water within the Upper Floridan aquifer is pressurized or under confined conditions. The middle confining unit of the Floridan aquifer lies near the base of the Avon Park Formation. It is composed of gypsiferous dolomite and dolomitic limestone and has a very low permeability. The middle confining unit is generally considered to be the base of the freshwater production zone of the Upper Floridan aquifer.

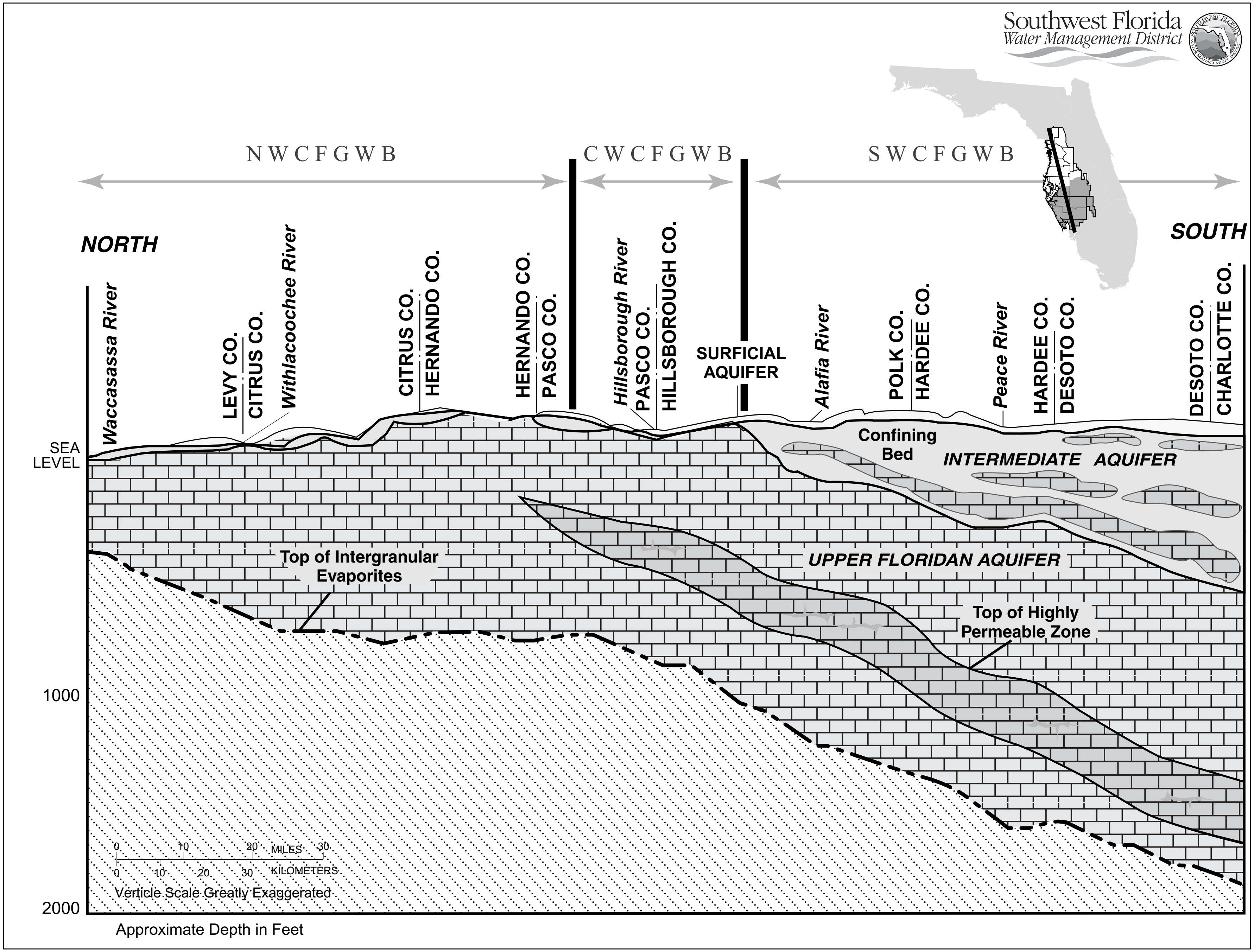


Figure I-6. Generalized North/South Geologic Cross Section through the SWFWMD.

In the Green Swamp, recharge to the Upper Floridan aquifer is generally low. Although the confining unit is thin or absent in this area, the transmissivity of the Upper Floridan aquifer is low and the vertical head difference between the surficial and Upper Floridan aquifers is small, so recharge is low. The Green Swamp is the source of the Hillsborough, Withlacoochee, Peace, and Oklawaha Rivers.

2.0 SWUCA

The surficial aquifer produces relatively small quantities of water in the western and central portions of the SWUCA and is generally used for lawn irrigation or domestic water supply. The aquifer consists of fine sand, clayey sand, silt, shell, shelly marl, and some phosphorite. In this area, surficial deposits range in thickness from 10 feet in coastal areas to greater than 50 feet (SWFWMD, 1993). In the eastern portion of the SWUCA, the surficial aquifer extends from 10 to more than 300 feet in depth (Yobbi, 1996). The thickness of the surficial aquifer varies widely along the length of the Lake Wales Ridge from about 50 feet in Polk County to 300 feet in southern Highlands County (Yobbi, 1996). East and west of the Lake Wales Ridge, aquifer thickness is generally less than 100 feet. Recharge to the surficial aquifer is through infiltration of rainfall and irrigation water.

Underlying the surficial aquifer is the confined intermediate aquifer system. This aquifer consists predominately of discontinuous sand, gravel, shell, limestone, and dolomite beds. The intermediate aquifer system usually contains at least two distinct water-bearing zones (Wolansky, 1983). The water-bearing zones are separated by low-permeability sandy clays, clays, and marls. The aquifer system also includes major confining units that are comprised of sandy clay, clay, and marl. These confining beds restrict vertical movement of ground water between individual water bearing zones and between the overlying surficial and the underlying Upper Floridan aquifers.

In general, the thickness of the intermediate aquifer system increases from north to south across the SWUCA (Figure I-6). Thickness of the intermediate aquifer system varies from less than 50 feet in central Hillsborough County to over 600 feet in Charlotte County (Duerr and others, 1988). Recharge to the intermediate aquifer varies from low to moderate depending upon seasonal ground-water use in the area.

The confined Upper Floridan aquifer is composed of a thick, stratified sequence of limestone and dolomite units. The Upper Floridan aquifer can be separated into an upper and lower flow zone. The Tampa Member and Suwannee Formation together form the upper flow zone. The lower zone is termed the highly transmissive zone of the Avon Park Formation. The two zones are separated by the lower permeability Ocala Limestone which acts as a semi-confining layer. The two flow zones are locally connected, through the Ocala, by vertical solution openings along fractures or other zones of preferential flow (Menke and others, 1961). There is generally no recharge to the Upper Floridan aquifer along the coast. Further inland, natural recharge to the Upper Floridan aquifer increases from zero to one inch per year (Aucott, 1988). This low recharge rate is due to the thick sequence of multiple clay confining layers that overlie the Upper Floridan aquifer system. These clay layers severely restrict the vertical exchange of water from the surficial aquifer to the deeper Upper Floridan aquifer. One exception is the ground-water system underlying the eastern portion of the SWUCA. In this area, principally along the Lake Wales Ridge, leakage between the surficial and Floridan aquifers is greatest due to karst features.

Estimated recharge rates in the Lake Wales Ridge area, based upon numeric modeling, range from about 6 to 15 in/yr (SWFWMD, 1993).

Section 4. Cultural Resources

The planning region is characterized by a diversity of land use types (Table I-1 and Figure I-7), ranging from urban built-up areas such as most of Pinellas County (Pinellas County is the most densely populated county in the State) to predominantly agricultural land uses in DeSoto and Hardee counties. As is the case with Florida as a whole, much of the urban development within the region is concentrated along the coast. Significant phosphate mining activities, primarily in Hillsborough, Manatee and Polk counties, also occur in the planning region; however, future mining operations are anticipated to move southward into Hardee and DeSoto counties as phosphate reserves at existing mines are depleted. The population of the planning region is projected to grow from an estimated 3.5 million persons in 1995 to nearly 4.8 million in 2020. This represents approximately 1.3 million new residents, a 27 percent increase over the planning horizon. The majority of this population growth will be due to net migration.

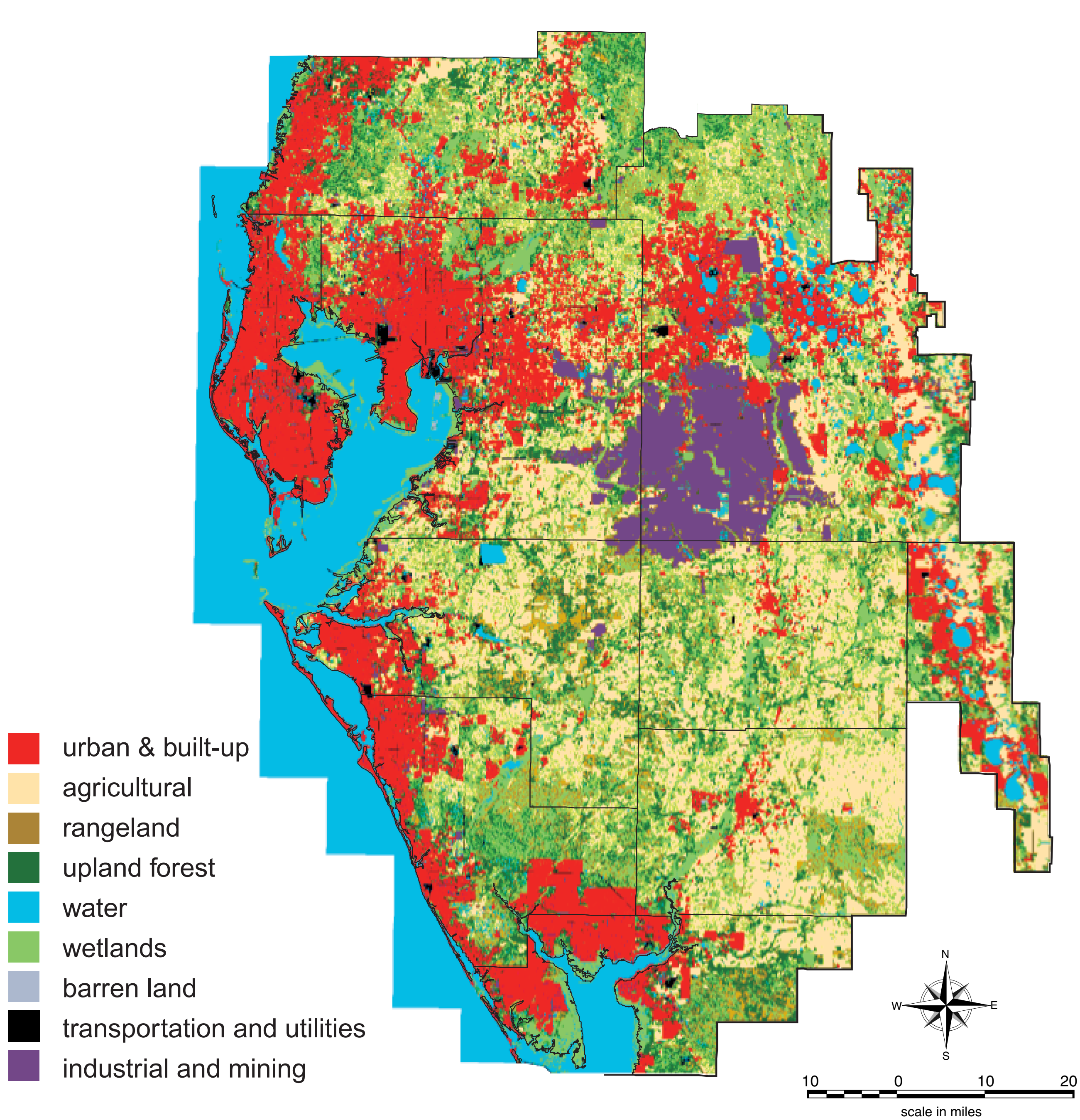
Table I-1. Land Use/Land Cover in the Planning Region.

Land Use/Land Cover Types (1995)	Acres	Percent
Urban & Built-up	879,755.47	19.4
Agriculture	1,512,843.10	33.3
Rangeland	351,683.55	7.7
Upland Forest	523,150.39	11.5
Water	158,933.03	3.5
Wetlands	805,475.32	17.7
Barren Land	6,281.87	0.1
Transportation, Communication & Utilities	59,501.03	1.3
Industrial and Mining	247,359.01	5.5
TOTAL	**4,544,982.77**	**100.0**

Source: FLUCCS & SWFWMD (GIS Department), 1995.

Total water use in the planning region is projected to increase by 364 mgd through 2020, from an estimated 1.23 billion gallons per day (bgd) in 1995 to 1.59 bgd in 2020. Agricultural water use is anticipated to remain the largest water use type in the planning region, at approximately 47 percent (588 mgd) of total water use in 1995 and 44 percent (711 mgd) in 2020. Public supply is the second largest water use type in the planning region, estimated at 37 percent (459 mgd) in 1995 and projected to increase to 39 percent (640 mgd) in 2020. The projected water demand and descriptions of the methodologies used for projections are described in Chapter IVA.

Southwest Florida
Water Management District



Source: SWFWMD, Modified from Florida
Land Use, Cover and Forms Classification System, 1995

Figure I-7. Land Use in the Planning Region.

Chapter II. Methods

Part A. Background

The RWSP was developed in an open public process, in coordination and cooperation with local governments and utilities, the agricultural community, business and industry representatives, environmental organizations and other affected and interested parties. The District's objective has been to actively involve all stakeholders in the RWSP planning process. The District has accomplished this by involving the SWUCA Working Group and by establishing the NTB Input Group for the remainder of the planning region outside the SWUCA. These groups have a diverse membership that represents local governments, water supply utilities, agriculture, the electric power industry, phosphate mining, the construction industry and environmentalists. The District has also involved its standing advisory committees (public supply, agricultural, industrial, green industry and environmental) in the process. Affected parties have also been involved in the development of the RWSP by working with District staff to develop methods for projecting water demand, and assisting with the identification of potential options for water resource and water supply development. Finally, staff have regularly provided status reports to the District Basin Boards and Governing Board during their scheduled public meetings.

The District has also coordinated closely with the St. Johns River and the South Florida Water Management Districts in the preparation of the RWSP. Both of these water management districts have concurrently prepared RWSPs for areas adjacent to the District's planning region. This inter-district coordination was intended to ensure:

- A consistent understanding of existing and projected water demands, particularly for areas split by the district boundaries.
- That each district developed an understanding of how existing and future withdrawals in one district may contribute toward resource constraints in an adjacent district.
- That the water resource and supply development options or recommendations contained in each district's respective RWSP would be compatible with those contained in the other district's plans.

Finally, the District coordinated closely with the FDEP to ensure the State's expectations for the RWSP are met. Consistent with this effort, the RWSP reflects:

- An emphasis on conservation: Conservation is treated as a potential supply of water for all major use types (e.g., agriculture, public supply, industrial, etc.).
- An emphasis on reclaimed water: Reclaimed water is a major source type which has been investigated to meet future demands. This includes evaluation of new reclaimed water projects and an investigation into how existing reclaimed water projects can be made more efficient.
- The role of constraints and minimum flows and levels: Potential water supply options included in this RWSP have been identified and screened utilizing a number of criteria, with perhaps the most critical being their ability to avoid and minimize potential environmental impacts. Prior to implementation of these or any other future water supply options, it will be necessary for projects to meet the conditions for issuance of a water use permit from the District.

- Avoiding the need for mitigation of new withdrawal impacts: All the water supply development options contained in the RWSP are designed to minimize the need for future mitigation. A number of the projects are intended to help offset impacts of existing projects. In addition, several projects propose such innovative techniques as "saltwater barriers" that would maximize the quantities of water available from ground-water sources.
- Realistic demand projections: The District used the best available information in the development of estimated future water demands within the planning region. This has included significant input from all major use sectors and other experts in the field.
- Existing state policy on "Local Sources First": The District has sought to maximize local sources in the preparation of the RWSP, consistent with existing State policies and District rules. Sources from within the planning region have been determined to be sufficient to meet all projected reasonable and beneficial demands through the planning period. Therefore, sources outside the planning region were not investigated.

Coordination and stakeholder involvement will continue to be critical during implementation of the RWSP.

Part B. Demand Projections

For the development of water demand projections through the year 2020, District staff was governed by the *Development and Reporting of Water Demand Projections in Florida's Water Supply Planning Process,* Final Report (Demand Subcommittee, 1998). This document was produced by the Water Demand Projection Subcommittee of the Water Planning Coordination Group. The subcommittee was comprised of representatives from the FDEP and the five water management districts and was assembled to reach consensus among the agencies regarding the parameters and methodologies to be used in developing the RWSPs.

Among the agreed-upon parameters, a base year from which demand is projected was established. The year 1995 was selected as the base year, as it was considered to be a "normal" year. A "normal" year refers to a year in which typical climatic conditions occur resulting in "normal" water usage. In addition, minimum thresholds of water use within each water use category in the planning region were agreed upon.

Another agreed-upon parameter for reporting involves the average rainfall year, versus the 1-in-10 year drought. A 1-in-10 drought is defined as "an event that results in an increase in water demand of a magnitude that would have a 10 percent probability of occurring during any given year" (Drought Subcommittee, 1998) Specific parameters were prescribed for at least a portion of the demand related to all water supply categories except that of Commercial/Industrial and Mining/Dewatering. These categories are described in the following section, and in more detail in Chapter IVA. Demand projections represent the estimated *total quantity* of water needed; no attempt was made to account for alternative sources that could potentially be developed to meet future demand, or water conservation that could potentially be achieved to reduce future demand.

Section 1. Categories of Water Use

For planning purposes, the water use within the District has been separated into four basic categories: agriculture, public supply, commercial/industrial & mining/dewatering, and recreation/aesthetic. The separation of uses into these categories provides for the projection of demand for similar water uses under similar assumptions, methods and reporting conditions. An additional water-use category, environmental restoration, comprises the quantities of water that may need to be developed to offset potential reductions in withdrawals from ground- and/or surface-water sources. The reductions may be necessary to achieve MFLs that will be established in the future. It is not possible to project demand for this category because the MFLs and accompanying recovery strategies have not yet been determined.

1.0 Agriculture

Water use for agricultural irrigation is reported for the following crops:

Citrus	Vegetables, Melons, and Berries
Field Crops	Greenhouse/Nursery
Sod	Pasture

Water use for non-irrigated agricultural operations (e.g., aquaculture, dairy, poultry, and swine) is reported in the aggregate.

2.0 Industrial/Commercial and Mining/Dewatering

Industrial/commercial (I/C) uses within the District include chemical manufacturing, food processing, thermoelectric power generation, and miscellaneous I/C uses. While diversified, much of the water used in food processing can be attributed to citrus and other agricultural crops. For the most part, chemical manufacturing is closely associated with phosphate mining and consists mainly of phosphate processing. For the RWSP, thermoelectric power generation (PG) has been separated out as an individual use category. Mining/Dewatering (M/D) water use is associated with a number of different products which are mined in the planning region, including phosphate, limestone, sand, and shell.

3.0 Public Supply

The public supply category includes water use associated with customers of public water supply systems and private utilities, and domestic self-supply, in accordance with the parameters set forth in the final report produced by the Water Demand Projection Subcommittee. Also factored into the projections for public water supply are estimates of use associated with utility customers using irrigation wells for outdoor purposes which do not require a District water use permit (WUP) due to small size and low volume.

4.0 Recreation/Aesthetic

The recreation/aesthetic category includes the self-supplied freshwater use associated with the irrigation of golf courses, cemeteries, parks, and other large-scale landscapes. Water use for golf course irrigation comprises the majority of demand associated with this category.

Section 2. Demand Development Process

As described above, the RWSP was developed in coordination and cooperation with local governments and utilities, the agricultural community, business and industry representatives, environmental organizations and other affected and interested parties. As part of the development of water demand projections, technical memoranda were produced detailing the methods and assumptions for determining future demand based upon the 1995 base year, and anticipated future conditions. One technical memorandum was produced for each of the four water use categories described above, and distributed for review and comment to the appropriate stakeholders and interested parties. The memorandum for the public supply category is incorporated into the detailed demand discussion within the plan, the others are provided in Appendix II-1. Presentations were made to advisory committees, working groups and input groups with the objective of soliciting input from affected parties. The demand projections contained in this document are the result of extensive research and collaboration, months of review, and subsequent revisions based on comments.

Part C. Potential Sources and Options

In accordance with the RWSP objectives, the District identified potential sources capable of meeting projected demand, and options for developing those sources. Sources identified which are potentially available to meet projected demands include: 1) surface water and storm water, 2) reclaimed water, 3) agricultural water conservation, 4) non-agricultural water conservation, 5) brackish ground water and 6) seawater desalination. It is recognized that quantities of additional fresh ground water may be available to meet future demands in certain areas of the planning region. However, quantities are limited and it is anticipated that the development of fresh ground-water sources would occur on a case-by-case basis through the District's water use permitting process.

Planning level analyses were conducted on individual sources of water to quantify available water supplies, identify development options, and estimate costs associated with water supply development. Lists of water supply options associated with the individual sources were developed based on input from the District's NTB Input Group, SWUCA Working Group, Advisory Committees, and other members of the community. A "long list" of projects was identified for each source, reduced to a manageable "short list" of projects. The short list contains options that are representative samples of the different types of options included on the long list. Options on the short list were submitted to more detailed analysis to more fully explore and develop the concepts and refine estimates of costs to develop the options. The short list does not represent a prioritization of or a list of the District's preferred options.

Section 1. Surface Water/Storm Water

The availability of surface water and storm water in the region was critical to assessing available sources of water to meet future demands. The goal of this effort was to quantify the amount of surface water and storm water that was potentially available to meet projected water demands. Prior to estimating the amount of available surface water, it was necessary to establish criteria for determining how water diversions would be allowed so that water supply goals could be achieved and water supply needs of the natural systems were protected. This task was accomplished by assuming a minimum flow in rivers for which there was no adopted minimum flow. A second assumption that preserved water for the natural systems was to limit the maximum amount of water that could be diverted from the rivers at any one time. A complete explanation of these assumptions is contained in Chapter IVB, Part D, Section 2. Following establishment of the criteria for water withdrawals, potential water supply options were identified.

Section 2. Reclaimed Water

Reclaimed water refers to highly treated water from a wastewater treatment plant (WWTP) that may be beneficially used. The predominant use of reclaimed water in the planning region is for irrigation. For the purpose of identifying reclaimed water options to meet projected future demand, current reclaimed water use and availability was determined, and potential future reclaimed water availability was estimated.

Options for various types of reclaimed water projects were identified and investigated. Some of the variables that affect reclaimed water availability are utilization rate (the actual percent of treated WWTP flows that is sent to customers for beneficial use), seasonal storage, and offset (the amount of traditional water resources that have been saved by the use of reclaimed water). Many of the potential reclaimed water projects identified address these variables in order to maximize the availability of the resource.

Section 3. Agricultural Water Conservation

Agricultural water conservation refers to the water savings achieved when growers convert to more water-conserving irrigation systems, and/or implement best management practices (BMPs) that reduce water use. Through a joint effort by staff and project consultants, measures to reduce agricultural water use have been investigated and identified. Growers who have not already installed low-volume irrigation systems may be able to convert to more water-conserving irrigation system technologies. Even more growers may be able to implement management practices that result in water savings without sacrificing product quality or quantity. Parameters such as soils, crop type, existing primary irrigation system, climatic conditions, and typical farm size were considered during the identification of conservation options and the estimation of water savings.

Section 4. Non-Agricultural Water Conservation

Non-agricultural water conservation refers to water savings that can be achieved through improved water-efficiency by water users in the public supply, domestic self-supply, recreation/aesthetic and commercial/industrial and mining/dewatering categories. Options for programs that save water on interior and exterior water use through voluntary and mandatory measures were investigated. Some of the variables that affect non-agricultural water conservation include participation rate of customers/water users in conservation programs, existing plumbing, amount of landscape irrigation, existing codes and ordinances, and the number of persons using plumbing fixtures. Such variables were accounted for in the process of identifying specific projects that can be implemented over the next 20 years to assist in meeting projected water demand.

Section 5. Brackish Ground Water

The evaluation of brackish ground water as a future water supply source was based largely on examination of currently permitted and planned brackish desalination facilities. Though it is a viable source of water supply in the planning region, withdrawals must be carefully planned to ensure a sustainable supply of water. Rates of withdrawals should be controlled so that the effects do not exacerbate regional saltwater intrusion. Similar to fresh ground water, the availability of brackish ground water will be determined largely on a case-by-case basis. Withdrawals of brackish ground water must be consistent with the District's water use permitting rules and any adopted recovery and prevention strategies.

Section 6. Seawater Desalination

Currently there are no existing seawater desalination plants in the planning region. However in 1999, Tampa Bay Water contracted a developer to design, build, own and operate a 25 mgd seawater desalination facility on Tampa Bay. Seawater in the planning region is viewed as being virtually unlimited, drought proof, and may be developed in an environmentally sustainable manner. Advances in membrane technology have made seawater desalination economically competitive with traditional water-supply sources. Investigation of the potential for seawater desalination as a future water supply source focused on locating suitable sites, including the potential for co-location with industries with permitted discharges. Recent work prepared for the Tampa Bay Water effort was used to determine the availability of sites in the NTB region. In the SWUCA, potential sites were located and designed according to knowledge gained from the Tampa Bay Water efforts.

Chapter III. Establishment of Minimum Flows and Levels (MFLs)

Part A. Background

Since the early 1970s, the District has been engaged in an effort to develop MFLs for water bodies. Beginning with the 1996 legislative changes to the MFL statute, the District has enhanced its program for development of MFLs. A MFL is that level or flow below which significant harm occurs to the water resources or ecology of the area. MFLs provide a tool to assist in sound water management decisions.

There are numerous District initiatives associated with setting MFLs. These include:

- Developing Districtwide lake and stream classification systems and databases
- Identifying priority water bodies for setting MFLs
- Performing applied research to support the development of MFLs
- Setting minimum levels for priority wetlands, lakes and aquifers, and minimum flows for priority springs, streams, and rivers
- Monitoring waters levels, hydrology, soils, and biological communities to verify that established MFLs are at appropriate levels

The District implements established MFLs primarily through its Water Supply Planning, Water Use Permitting and Environmental Resource Permitting programs, and funding of water resource and water supply development projects that are part of a recovery or prevention strategy.

Section 1. Statutory and Regulatory Framework

The Florida Water Resources Act (Chapter 373, F.S.) and the Water Resource Implementation Rule (Chapter 62-40, F.A.C., formerly the State Water Policy) provide the basis for establishing MFLs and explicitly include provisions for setting such flows and levels.

1.0 Florida Water Resources Act

Chapter 373, F.S., requires the water management districts (WMDs) to establish minimum levels for both ground and surface waters and minimum flows for surface-watercourses below which significant harm to the area’s water resources or ecology would result. In addition, Chapter 373:

- Mandated the District submit by July 1, 1996, a priority list and schedule for the establishment of minimum flows and levels for surface-watercourses, aquifers, and surface waters in the counties of Hillsborough, Pasco, and Pinellas, Section 373.042(2).
- Mandated the District and the other WMDs submit by November 15, 1997, and annually thereafter, a priority list and schedule for the establishment of MFLs for surface-watercourses, aquifers, and surface waters throughout the districts, Subsection 373.042(2).
- Mandated the District establish MFLs for priority waters in the counties of Hillsborough, Pasco, and Pinellas by October 1, 1997, Section 373.042(3).

- Specifies that the WMDs must provide information concerning MFLs to local governments for development and revision of comprehensive plans, Subsection 373.0391(2).

2.0 Water Resource Implementation Rule

Chapter 62-40, F.A.C., highlights the State's approach to water management (Rule 62-40.110, F.A.C.). WMD programs are required by section 373.103(1), F.S., to be consistent with Chapter 62-40, F.A.C. Rule 62-40.310(4)(a), F.A.C., provides guidance for the establishment of MFLs to protect water resources and the environmental values associated with marine, estuarine, freshwater, and wetlands ecology.

Part B. The District's MFLs Program

The District's MFLs program addresses all the requirements expressed in the previously referenced sections of the Florida Water Resources Act and the Water Resource Implementation Rule.

The District intends to continue to:

- Identify, prioritize, and schedule water bodies for setting MFLs
- Perform data collection and research to support establishing scientifically sound MFLs
- Perform more detailed investigations to establish MFLs for priority water bodies
- Perform ongoing monitoring and periodic re-evaluation of MFLs
- Develop and refine ground- and surface-water models, including developing an interface between ground- and surface-water models where appropriate, to predict if water withdrawals will cause levels and flows to fall below established MFLs
- Provide information about MFLs to local governments and others for comprehensive planning
- Undertake voluntary ". . . independent scientific peer review . . ." on the data and methodologies used to establish MFLs

Section 1. Priority-Setting Process

In accordance with the requirements of Section 373.042, F.S., the District has established a list of priority ground and surface waters for which MFLs will be set. This priority list is based upon the importance of waters to the state or region and the existence of or potential for significant harm to the water resources or ecology of the region. As part of determining the priority list, the following factors are considered:

- Whether the demand for water in the area is sufficient to significantly affect flows and/or levels of the surface water or ground water.
- Whether the system includes regionally significant environmental resources.
- Whether the area is experiencing stress resulting from chronic low ground- or surface-water levels or low surface-water flows.
- Whether historic hydrologic records (flows and/or levels) are available to allow statistical analysis and calibration of computer models when selecting particular water bodies in areas with many water bodies.

- The proximity of MFLs already established for nearby water bodies.

As required by Chapter 373.042(2), F.S., the District must update the priority list and schedule annually, and submit the schedule for approval to the FDEP. The priority list and schedule is published annually in Florida Administrative Weekly.

Section 2. Technical Approach to the Establishment of MFLs

The District's MFLs approach is designed to be applied to lakes, rivers, wetland systems, and aquifers. The approach assumes that alternative hydrologic regimes exist that are different from historic conditions, but that will protect the structure and functions of aquatic and wetland resources from significant harm. For example, a historic condition could consist of an unaltered river or lake system with no withdrawal from local ground- or surface-water sources. A new hydrologic regime is associated with each increase in water use, from very small withdrawals that have no measurable effect on the historic regime to very large withdrawals that could markedly lower the long-term hydrologic regime. A threshold hydrologic regime may exist that is lower than historic, but which protects the water resources and ecology of the system from significant harm. Conceptually, the threshold regime, resulting primarily from water withdrawals, will have less frequent highs and more frequent lows.

The purpose of MFLs is to define this threshold hydrologic regime that would allow for water withdrawals while protecting the water resources and ecology from significant harm. Thus, MFLs represent minimum acceptable rather than historic or optimal hydrologic conditions.

1.0 Development of Wetland Minimum Levels

Due to available data constraints, the District has developed a minimum levels methodology for palustrine (isolated) cypress wetlands only. Data collection and analysis will continue for the development of minimum levels for other wetland types.

The establishment of minimum levels for palustrine cypress wetlands was based on a statistical assessment of the relationship between hydrology and certain ecologic parameters in a number of wetlands. The goal was to identify a hydrologic threshold, expressed as a water level, beyond which it would be reasonable to expect that "significant harm" will occur in a wetland. A complete description of the methodology can be found in SWFWMD (1999a).

1.1 Method

After review of data from 655 wetland sites, 36 wetlands were chosen that meet the following criteria:

- Wetlands were classified as palustrine cypress swamps.
- Wetlands had adequate water level data, collected at least monthly, for the period of water years 1989 to 1995.
- Wetlands had no obvious significant drainage alterations that would account for altered hydroperiods.

- Wetland sites were accessible to collect/verify ecological assessment information and perform surveys.
- Wetland size was greater than 0.5 acres.

Each wetland was assessed for a variety of ecological parameters, with each parameter assigned a categorical rating. A Spearman rank correlation was performed between the categorical ratings and the median value of the stage frequency curve of water levels in the corresponding wetland. The four most sensitive ecological parameters, succession, weedy species, soil subsidence, and shrubs, were chosen for the final analysis. Based on these parameters, each wetland was assigned an overall score as either showing “no significant change,” “significant change,” or “severe change.” Wetland normal pool was chosen as a datum for the analysis. Normal pool has been commonly used for many years in the design of wetland stormwater systems, and is identified in cypress swamps based on similar vertical locations of several indicators of inundation. Indicators include the root crown of *Lyonia lucida*, the lower limit of epiphytic bryophytes on cypress trees, the inflection point on the buttress of cypress trees, and others. Through the use of statistical techniques in which wetland hydrology was tested against wetland ranking, a determination was made that a palustrine cypress swamp is predicted to show signs of significant change if the median stage (based on a six-year stage record) is lowered to a level between 1.8 and 1.9 feet below the unaltered normal pool elevation. As a policy decision, the Governing Board determined that wetlands identified as significantly changed have been “significantly harmed,” and adopted a value of 1.8 feet below the elevation of normal pool to be the minimum level of palustrine cypress wetlands.

1.2 Implementation of Wetland Minimum Levels

Minimum levels for palustrine cypress wetlands are determined by surveying a normal pool, and calculating an elevation 1.8 feet below the normal pool. Such wetlands are determined to be below their minimum levels if the median stage (based on a long-term stage record) is below the adopted minimum level.

2.0 Development of Lake Minimum Levels

The District has developed a minimum levels methodology for lakes that are fringed with cypress wetlands. Because the fringing cypress wetlands were determined to be a critical component of these lakes to maintain health, the assumption was made that if significant harm to the fringing cypress wetlands is avoided, then the health of the lake in general will be maintained. An assumption was also made that since fringing cypress wetlands share most of the attributes of isolated cypress wetlands, and no other data exist to suggest otherwise, then the minimum level of 1.8 feet below wetland normal pool could be reasonably applied to lakes with fringing cypress wetlands. An exception to this assumption was the case of lakes with structural alterations. Due to the popularity of lakes for residential purposes, structural alterations are commonly used to control lake levels. In some cases, the installation of structures does not allow the median stage of the lake to reach the 1.8 feet below normal pool standard, even in the absence of water withdrawals. Therefore, as is required in Chapter 373.0421(1)(a), F.S., the effect of the structure must be considered in the methodology. A complete description of the methodology can be found in SWFWMD (1999a).

2.1 Method

For purposes of determining minimum levels in lakes, lakes were divided into three categories, as explained below.

2.1.1 Category 1 Lakes

A Category 1 lake is a cypress wetland-fringed lake that either has no man-made control structure, or has a control structure that does not prevent the median lake stage from reaching 1.8 feet below the normal pool established in the fringing cypress wetlands. For such lakes, the minimum level is calculated similarly to the palustrine cypress wetland method. As with the isolated wetlands, the Governing Board determined that lakes with fringing cypress wetlands identified as significantly changed have been "significantly harmed," and adopted a value of 1.8 feet below the elevation of normal pool to be the minimum level for Category 1 lakes.

To assure that lake water levels reach higher levels on a periodic basis, the District established a second minimum level for lakes, known as the high minimum level. The high minimum level is a level required to be exceeded 10 percent of the time on a long-term basis. Using the same procedure that determined the minimum level for palustrine cypress wetlands based upon median values (or P50 values), the analysis for P10 values determined the high minimum level to be 0.4 feet below normal pool.

2.1.2 Category 2 Lakes

A Category 2 lake is a cypress-wetland fringed lake where man-made structural alterations prevent the median lake stage from reaching 1.8 feet below the normal pool established in the fringing cypress wetlands.

For such lakes, the minimum level is set at the median stage that would occur in the absence of withdrawals but with the existing control structure. The Governing Board determined that lakes with median levels below this level have been "significantly harmed," and adopted this level to be the minimum level of Category 2 lakes.

To assure that lake water levels reach higher levels on a periodic basis, the District established a high minimum Level for Category 2 lakes. The high minimum level is a level required to be exceeded 10 percent of the time on a long-term basis. For Category 2 lakes, the high minimum level is equal to the P10 that would occur in the absence of withdrawals but with the existing control structure.

2.1.3 Category 3 Lakes

As presently defined, a Category 3 lake could include any lake that does not have a fringing cypress wetland greater than 0.5 acres in size. A Category 3 lake could be fringed with a forested hardwood wetland or a herbaceous wetland with emergent and floating leaved vegetation. District staff has developed a methodology that would address establishment of MFLs for lakes with herbaceous wetlands.

This methodology, per the recommendation of the Peer Review Committee (Bedient et al., 1999), considers changes associated with lake area, volume, etc., as a function of water level elevation. Staff presented a methodology for this subset (i.e., lakes with herbaceous wetlands) of lakes to the Governing Board in April of 2001.

2.2 Implementation of Lake Minimum Levels

Minimum levels for cypress-wetland fringed lakes are determined by surveying a normal pool and control point, and applying the appropriate methodology for Category 1 or 2 lakes. Category 1 and 2 lakes are determined to be below their minimum levels if the median stage (based on a long-term stage record) is below the adopted minimum level.

3.0 Development of Saltwater Intrusion Minimum Levels in NTB

The development of minimum levels for the Upper Floridan aquifer for the prevention of water quality degradation through saltwater intrusion was developed for the NTB area. Due to differing hydrogeologic conditions in the NTB area as compared to other areas of the District, minimum aquifer levels in other portions of the District may be determined through differing methodologies.

The development of minimum aquifer levels in the NTB area was a three-step process. The first step was to assess the current status and anticipated future advancement of saltwater intrusion in the NTB area. Secondly, a proposed goal of the saltwater intrusion minimum levels in this area was determined. Finally, a network of monitor wells and corresponding water levels was selected to accomplish this goal. A complete description of the methodology can be found in SWFWMD (1999a).

3.1 Method

An assessment of several saltwater intrusion studies that has been performed within the NTB area concluded that although some regional saltwater intrusion appears to have occurred, most appears to be limited to more localized areas. Unlike the SWUCA, Upper Floridan aquifer drawdowns in the NTB area are limited by a leaky confining unit, which in turn greatly decreases the potential for regional saltwater intrusion.

The Governing Board made the policy decision that the goal of minimum aquifer levels in the NTB area should be to prevent further significant advancement of regional saltwater intrusion. After an assessment of available Upper Floridan aquifer monitor well data, the decision was made to set minimum aquifer levels in seven wells positioned in two transects. The first transect consists of four wells extending westward from the Eldridge-Wilde Wellfield, while the second transect consists of three wells extending southward from the Northwest Hillsborough Regional Wellfield. The two transects were chosen as priority areas because it was felt that the high quality monitor wells associated with these two large wellfields located relatively near the coast, were capable of providing the earliest sign of any advancement of regional saltwater intrusion for the area. Further advancement of saltwater intrusion beyond that caused by current long-term drawdowns should be averted if the existing potentiometric surface gradients are maintained along these transects.

3.2 Implementation of Aquifer Minimum Levels

Minimum aquifer levels were determined in each well by calculating the average water level over a period representing current ground-water withdrawal rates, which consisted of periods ranging from six to 10 years. These wells are determined to be below their minimum levels if the median stage (based on a long-term stage record) is below the adopted minimum level.

4.0 Development of a Minimum Flow in the Lower Hillsborough River

The Lower Hillsborough River was identified as the priority surface-watercourse in the NTB area for which to develop minimum flows. The determination of minimum flows for the Hillsborough River accounted for the fact that the system has experienced extensive changes and structural alterations. The Hillsborough River near the city of Tampa has been impounded in one form or another since the late 1800s. The present impoundment was built in the 1940s at the site of a previous hydroelectirc dam. The Hillsborough River below the dam is a highly modified system which has experienced considerable shoreline hardening, filling of wetlands, sediment deposition, and impacts to water quality from stormwater runoff. The alterations of the Lower Hillsborough River have been so extensive that some hydrologic functions associated with floodplain and estuarine wetlands have essentially been lost. A complete description of the methodology can be found in SWFWMD (1999b).

4.1 Method

While accounting for the extensive changes and structural alterations to the Lower Hillsborough River, the District evaluated the beneficial effects of various rates of flow of fresh and near-freshwater on the downstream ecosystem. The existing flow regime of the Lower Hillsborough River is characterized by prolonged periods when there is no discharge at the reservoir spillway other than from dam leakage. The District's analysis concentrated on minimum flows that might be released during periods when there would otherwise be no discharge at the reservoir spillway. The evaluation of potential hydrologic and ecologic benefits below the dam emphasized the relationships of flows with salinity distributions.

4.2 Implementation of Minimum Flow in the Hillsborough River

Based on results of the above evaluations, the Governing Board adopted a minimum flow for the Lower Hillsborough River of 10 cfs at the base of the Hillsborough River Reservoir dam as measured at the Rowlett Park Bridge Station. The minimum flow will be phased in through 2010 and adjustments may be made as a result of ongoing studies.

5.0 Scientific Peer Review

Chapter 373.042(4), F.S., permits affected parties to request Scientific Peer Review of the scientific and technical data and methodologies used to determine flows and levels. Such a review was requested by a number of parties for each of the above MFL methodologies. This process was completed in August 1999 for lakes, isolated cypress wetlands, and aquifers in the NTB area, and October 1999 for the Hillsborough River, and the results were published and presented to the Governing Board. The Governing Board found the results mostly supportive, although the Peer Review panel did offer many ideas for future analysis and potential improvement. As part of the adopted MFLs rules, the District has committed to pursuing independent scientific peer review as part of future efforts.

6.0 MFLs Reassessment and Future Development

MFLs are established based on data available at the time. The District plans to conduct periodic reassessment of the adopted MFLs based on consideration of the significance of particular MFLs in water supply planning and the relevance of new data that may become available. Scientific analyses and data collection programs are outlined in the NTB Phase II Scope of Work.

Section 3. District MFLs Determined to Date

To date, the District has adopted MFLs for priority water bodies only in the NTB area. A complete list of established MFLs is provided in Appendix III-1. MFLs currently adopted by rule include:

- Forty-one palustrine cypress wetlands
- Fifteen Category 1 and 2 lakes
- Seven Floridan aquifer wells for saltwater intrusion protection
- The lower Hillsborough River below Fletcher Avenue

Figure III-1 depicts locations of these adopted MFLs sites.

Section 4. Recovery and Prevention Strategy

1.0 Strategy/Goals

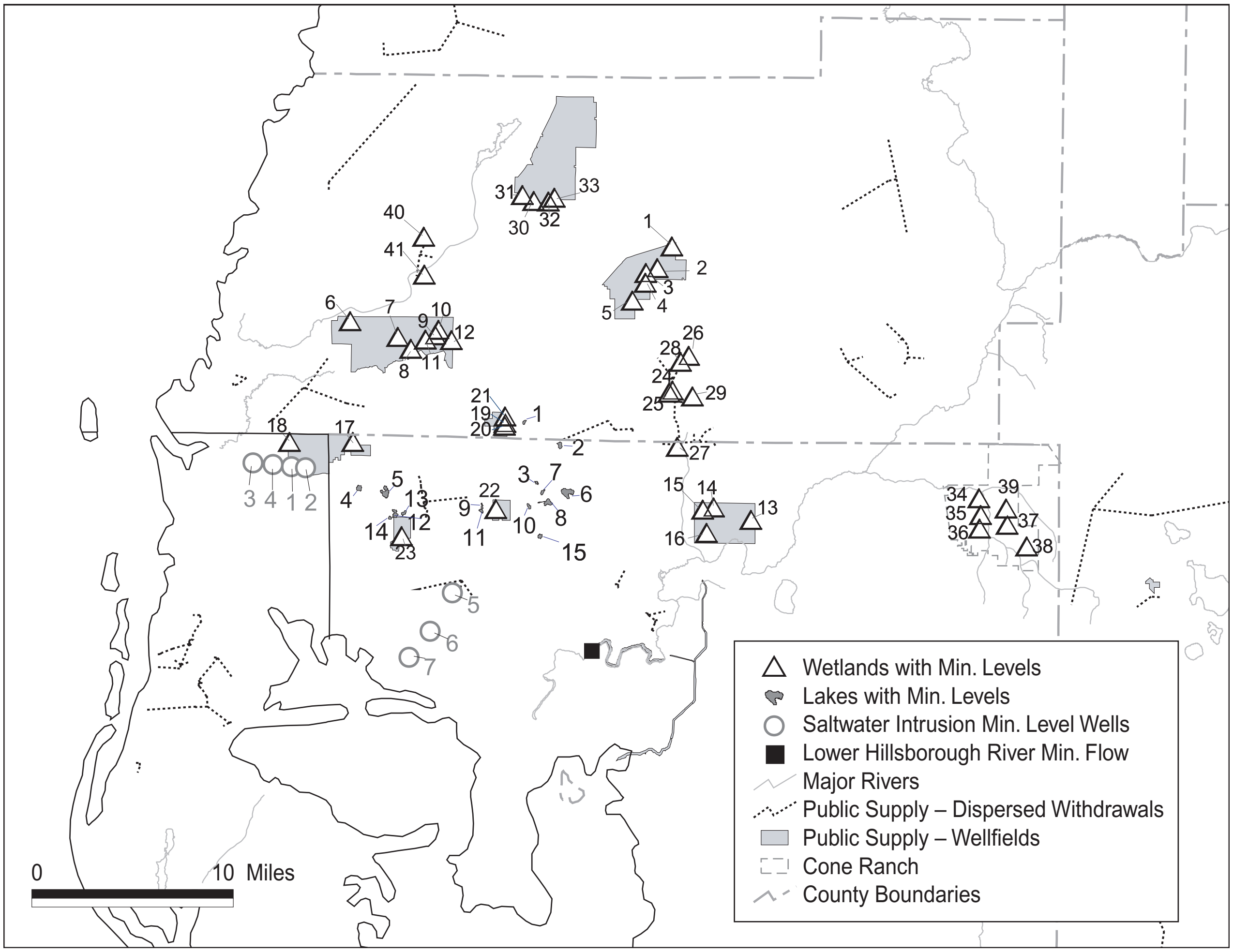
Section 373.0421(2), F.S., requires that a recovery or prevention strategy be developed if the existing flow or level in a water body is below, or within 20 years is projected to fall below, established MFLs. The District established recovery or prevention strategies by rule in Chapter 40D-80, F.A.C.,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

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

Concurrent with the District's efforts to establish MFLs in the NTB area, Tampa Bay Water and its member governments entered into an agreement with the District to reduce ground-water withdrawals from its regional wellfields in the NTB area, and to work towards recovery in areas where water resources are currently harmed. This agreement (Partnership Agreement) establishes that regional public supply ground-water withdrawals will be reduced from the current permitted withdrawal rate of 158 mgd to 90 mgd by the end of the year 2007. The Partnership Agreement constitutes that portion of the District's recovery strategy that is specifically applicable to Tampa Bay Water's central system regional wellfield facilities.

As part of the Partnership Agreement, the District combined all 11 of Tampa Bay Water's central system regional wellfield permits into one permit. Known as the Consolidated Permit, the new permit requires an extensive water resource monitoring network around the individual wellfields, along with many other data reporting and planning requirements. It is anticipated that Tampa Bay Water's monitoring network will address most of the data collection needs in and around major withdrawal centers, while the District's efforts will focus on the areas between and beyond Tampa Bay Water's withdrawal centers. In areas where existing flows or levels are below adopted MFLs, new quantities of water will not be approved if they impact such waterbodies or watercourses, unless they contribute to the attainment of MFLs. Existing legal withdrawals in areas where existing flows or levels are below adopted MFLs will not be subject to the MFL until 2010, when the recovery and prevention strategy will be reevaluated.

Southwest Florida Water Management District



Lake Name

1 Camp
2 Deer
3 Sapphire
4 Sunset
5 Alice
6 Stemper
7 Crystal
8 Brant
9 Dosson
10 Merrywater
11 Sunshine
12 Rainbow
13 Juanita
14 Little Moon
15 Bird

1 CCW-41
2 CCW-11
3 CCW-12
4 CCW-17
5 CC Site G
6 STWF D
7 STWF Central Recorder
8 STWF Z
9 STWF Eastern Recorder
10 STWF S-75
11 STWF M
12 STWF N
13 MBWF Entry Dome
14 MBWF X-4
15 MBWF Clay Gulley Cypress
16 MBWF Unnamed
17 EWWF NW-44
18 EWWF Sails Property Wetland 10S/10D
19 SPWF NW-49
20 SPWF South Cypress
21 SPWF NW-50 South PAsco
22 S21 WF NW-53 East
23 Cosme WF Wetland
24 CBRWF #16
25 CBRWF A
26 CBRWF #25
27 CBRWF #32
28 CBRWF #4

Figure III-1. Locations of Sites with Adopted Minimum Flows and Levels as of January 2000.

Chapter IV. Water Supply Development Component

The Water Supply Development Component of the RWSP is composed of four Sub Chapters. Sub Chapter A details the anticipated future water supply needs through 2020 in each county within the planning region as well as the methods and assumptions used in projecting future demand. Sub Chapter B is a discussion of the sources of water anticipated to be available to meet current and future demands. This chapter includes a description of existing sources and the ability of each to assist in meeting current demands, as well as a discussion of the amount of water potentially available from each source to meet demands through 2020. In addition, the projected demands (above what is currently being used) are compared to available ground-water sources in order to identify deficits that would be met by alternative sources. Sub Chapter C contains a discussion of water supply projects currently under development that the District is co-funding. Finally, Sub Chapter D contains a list of water supply options that could potentially be developed by RWSAs, public utilities, local governments, public/private water users, etc. It is demonstrated in Sub Chapter D that collectively these options could produce sufficient water to meet demands through 2020.

Sub Chapter A. Quantification of Water Supply Needs

Part A. Background

Future water supply needs have been quantified for each of the ten counties within the planning region, and for each of the following four categories:

- Agriculture
- Commercial/industrial and mining/dewatering
- Public supply
- Recreation/aesthetic

An additional water use category, environmental restoration, comprises the quantities of water that may need to be developed to offset potential reductions in withdrawals from ground- and/or surface-water sources. The reductions may be necessary to achieve MFLs that will be established in the future. It is not possible to project demand for this category because MFLs and potential accompanying recovery strategies have not yet been determined for all water resources within the planning region.

The demand projections represent those reasonable and beneficial uses of water that are anticipated to occur through the year 2020. Future 5-in-10 (average annual) and 1-in-10-drought-year demands have been determined for each five-year increment from 1995 to 2020, for each category. The demand projections for counties which are partially located in other water management districts reflect only the anticipated demands in those portions located within the Southwest Florida Water Management District boundaries.

Demand projections were developed using a variety of resources. These include District documents; models and records; permit-holder responses to survey questions; and feedback from stakeholders.

Section 1. Description of Water Use

General reporting conventions followed herein were guided by the document *Final Report: Development and Reporting of Water Demand Projections in Florida's Water Supply Planning Process*. This document was produced by the Water Demand Projection Subcommittee of the Water Planning Coordination Group.

Among the agreed upon parameters, a base year from which demand is projected was established. The year 1995 was selected as the base year, as it was considered to be a "normal" year. A "normal" year in the water supply planning process refers to a year in which typical climatic conditions occur resulting in "normal" water usage. In addition, minimum thresholds of water use within each water use category in the planning region were agreed upon for consideration in the RWSP.

Another agreed upon parameter for reporting involves the 5-in-10 (average annual) rainfall year, versus the 1-in-10 year drought. The 1-in-10 Year Drought Subcommittee of the Water Planning Coordinating Group defines the 1-in-10 drought as "an event that results in an increase in water demand of a magnitude that would have a 10 percent probability of occurring during any given year" (Water Planning Coordination Group, 1998). Specific parameters were prescribed for at least a portion of the demand related to all water supply categories except that of Commercial/Industrial and Mining/Dewatering.

For planning purposes, the projected demand is "raw" demand, and does not include demand management measures, such as water conservation or reclaimed water. Such measures will be accounted for as existing or future water sources available to meet projected demand. As such, it is important to note that the demand projections described in this chapter are not "targets" aimed for by the District; they are realistic projections based on 1995 conditions. In practice, the District intends to continue to encourage, and require where appropriate, a high degree of water efficiency.

Section 2. Categories of Water Use

For planning purposes, water use within the District has been separated into four basic categories: agriculture, public supply, commercial/industrial & mining/dewatering, and recreation/aesthetic. The separation of uses into these categories provides for the projection of demand for similar water uses under similar assumptions, methods and reporting conditions.

1.0 Agriculture

Agricultural irrigation use is reported for irrigated acreage by crop category as shown below:

- Citrus
- Vegetables, Melons, and Berries (reported as six individual sub-categories)
- Field Crops
- Greenhouse/Nursery
- Sod
- Pasture

Within the 'Vegetables, Melons, and Berries' category, the District has reported projected water use for the following sub-categories:

- Cucumbers
- Melons
- Potatoes
- Strawberries
- Tomatoes
- Other Vegetables and Row Crops

Projected water uses associated with 'Miscellaneous' (*i.e.*, non-irrigated) agricultural operations such as aquaculture, dairy, poultry, swine, etc., are reported in the aggregate.

Projected water use is presented under two water use scenarios which are consistent with applicable statutes, Water Demand Projection Subcommittee guidelines, and the District's 1998 WSA reporting format. These scenarios are:

- A 5-in-10 (average annual) effective rainfall scenario
- A 1-in-10 drought year scenario (an increase in water demand having a 10 percent probability of occurring during any given year)

2.0 Commercial/Industrial and Mining/Dewatering

Industrial/commercial (I/C) uses within the District include chemical manufacturing, food processing, thermoelectric power generation, and miscellaneous I/C uses. While diversified, much of the water used in food processing can be attributed to citrus and other agricultural crops. For the most part, chemical manufacturing is closely associated with phosphate mining and consists mainly of phosphate processing. For the purposes of the RWSP, thermoelectric power generation (PG) has been separated out as an individual use category.

Mining/dewatering (M/D) water use is associated with a number of products mined within the planning region, including phosphate, limestone, sand, and shell.

For planning purposes, the Water Demand Projection Subcommittee identified 0.1 mgd as the reporting threshold for the I/C and M/D subcategories. In the PG subcategory, the Subcommittee agreed that all permitted or reported uses should be included as the reporting threshold. These parameters were held-to by the District, and are reflected in the demand projections.

3.0 Public Supply

The public supply category includes water use associated with customers of public and private utilities and domestic self-supply. In accordance with the parameters set forth in the final report produced by the Water Demand Projections Subcommittee, the demand for those utilities which are permitted for over 0.5 mgd was calculated individually as "large utilities," while the use associated with those utilities that are permitted for between 0.1 mgd and 0.5 mgd was calculated collectively under a "small utility" subcategory. Also factored into projections of public supply water use are estimates of use by customers of utilities who have private irrigation wells for outdoor irrigation. These wells do not require a District WUP due to their small size and limited volume of use. An estimate of the use associated with these wells was determined because of concerns that the utilization of these wells may cause per capita water use to be under estimated.

Domestic self-supply estimates are associated with the freshwater consumption from individual wells and water supply systems which are too small to be required to have a District WUP. A WUP is required for all wells with a six-inch inside diameter or which produce in excess of 100,000 gpd, or with a single use of one mgd or greater.

4.0 Recreation/Aesthetic

The recreation/aesthetic category includes the self-supplied freshwater use associated with the irrigation of golf courses, cemeteries, parks, and other large-scale landscapes. Water use for golf course irrigation comprises the significant majority of demand associated with this category. The Water Demand Projection Subcommittee identified 0.5 mgd as the reporting threshold for this category. However, a significant collective use would not be captured using this threshold. Therefore, the threshold used by the District for the RWSP for the recreation/aesthetic category includes all permitted or reported users.

Part B. Summary of Water Demand

Projected water demands were developed through identification and analysis of parameters that affect water use, and associated trends, within each category. Data collected from publications, the District's regulatory database, consultant research, and permittee responses to surveys were used to project future demand in the planning region. This section summarizes the data sources, methods, assumptions and parameters considered in developing estimates of projected water needs. The projections are described according to water use category, and are further detailed according to the needs of each county.

Section 1. Agriculture

Agricultural water use represents the largest category of water use in the region. The methods and assumptions for determining agricultural water demand, the base year and projected water use under both 5-in-10 (average annual) and 1-in-10 conditions, are described in the following sub-sections.

1.0 Assumptions and Methodologies for Projecting Demand

Estimation of agricultural water use is accomplished by formulating estimates of acreage and associated irrigation requirements for specific commodities. Acreage for each commodity is multiplied by the irrigation requirement to get estimated annual water use. Estimated average daily water use is calculated by dividing the estimated annual water use by 365 days.

To be consistent with the 1998 WSA, the RWSP presents agricultural water use estimates for the 1995 base year as the aggregated products of planted acreage and estimated irrigation allocations. This construct is essential to provide a consistent basis of comparison through the year 2020. As such, there will be differences between the estimates of agricultural water use in 1995 in the RWSP, and those in the District's *1995 Estimated Water Use* report, since the estimation methods are different in the two documents.

Discussions of more specific assumptions and methodologies pertinent to particular elements of the RWSP agricultural water use estimates are presented in the following sections.

1.1 Commodity Acreage Estimates and Projections

The District retained the services of HSW Engineering, Inc., to assist in the preparation of the portion of the RWSP dealing with the agricultural water use sector. HSW functioned as the primary researcher for the development of agricultural water use projections. To assist with the completion of this task, District staff provided HSW with data regarding permitted acreage for each RWSP crop reporting category. Current and projected acreage for some of the crops and for some of the counties within the District were provided by the University of Florida Institute of Food and Agricultural Sciences (IFAS) (Taylor and Reynolds, 1999). Acreage and water use projections also were drawn from the WSA (SWFWMD, 1998a) and Needs and Sources Update (1997a). Other information sources included the Florida Department of Agriculture and Consumer Services (Bureau of Plant Inspections, Nurseries), and the Florida Agricultural Statistics Service (citrus, vegetables, melons, potatoes, strawberries and tomatoes).

This information and professional judgement were used to prepare draft acreage projections that were submitted to the agricultural community for comment. Substantial constructive input was received from the following sources:

- District's Agricultural Advisory Committee
- Commodity group representatives
- County Cooperative Extension Service Agents
- Individual growers
- NTB Input Group
- SWUCA Working Group

Public input was an integral part of this process. For example, precise acreage projections for many crops are not available on an individual county basis. For confidentiality reasons, such information is supplied to state agencies only under the condition that the county in which it is grown is not identified. The acreage projections included in this report were compiled based on the information accumulated from all of the sources noted above; they could not have been developed without significant input from the agricultural community.

Acreage projections through the year 2020 were formulated based on a cumulative review of the information provided by the sources identified above. For those counties that are not located wholly within the District (*i.e.*, Charlotte, Highlands, and Polk), only the portion of the crop acreage located within the District was considered.

1.2 Crop Irrigation Requirements and Projected Water Use

Crop irrigation requirements were derived using the District's agricultural water use allocation program (AGMOD). AGMOD (SWFWMD, 1992) is based on a modified Blaney-Criddle procedure that utilizes historical temperature, effective rainfall, and solar radiation data to calculate the estimated irrigation requirements necessary to produce optimum crop yield under specified rainfall scenarios. For the RWSP, AGMOD input parameters were designed to produce estimated crop irrigation requirements for average and 1-in-10 scenarios.

For each county in the planning region, irrigation allocations were developed for each reporting category by using AGMOD and incorporating typical site conditions for each crop, including location, climatology, soil type, irrigation system, and growing season(s). Irrigation allocations include quantities for miscellaneous associated water use including, but not limited to, fumigation, maintenance, and flushing. The estimated crop irrigation requirements determined using parameter values for a typical operation are assumed to be reasonable for regional planning purposes; however, they may differ somewhat from quantities allocated via District WUPs, as actual permitted irrigation allocations are determined on a site-specific basis.

In accordance with the Water Demand Projection Subcommittee guidelines, water use projections for irrigated crop reporting categories were determined by multiplying projected irrigated crop acreage by crop irrigation requirements. Planning level water use projections were developed through the year 2020 for average and 1-in-10 scenarios.

1.3 Special Assumptions Applicable to 'Vegetables, Melons, and Berries'

The following assumptions were made with regard to crops included in the 'Vegetables, Melons, and Berries' category:

- All crops in the 'Vegetables, Melons, and Berries' category except for potatoes were assumed to be grown on plastic mulch. Although it is recognized that this is not entirely true for all operations in the planning region (*e.g.*, some melon acreage), the impact of this assumption on the overall water use projections is not believed to be significant.
- Irrigation allocations for all crops grown on plastic mulch were calculated assuming zero effective rainfall. The result of this assumption is that projected water use needs for mulched crops are the same under both average and 1-in-10 scenarios.
- Irrigation allocations for all crops grown on plastic mulch include quantities for crop establishment.

These assumptions are believed to be reasonable in the context of mulched crop operations and were made out of an abundance of caution from a water user's perspective. Furthermore, the assumptions are consistent with the District's reporting methodology in the 1998 WSA.

1.4 'Miscellaneous' Agricultural Enterprises

The Water Demand Projection Subcommittee established the 'Miscellaneous' reporting category to include operations such as aquaculture, dairy, poultry, swine, and others whose water use is not irrigation-related. These projections were formulated by staff primarily based on District data and are reported in the aggregate. Since water use for these operations is not driven by irrigation, their projected water use is not associated with acreage projections. Projected water use for this reporting category is the same for average and 1-in-10 scenarios.

1.5 Selection of Base Year for Projections Comparison

The Water Demand Projection Subcommittee established 1995 as the base year for the RWSP planning horizon. To provide a consistent basis of comparison across the planning horizon to the year 2020, water use for 1995 was constructed by multiplying irrigated crop acreage by crop irrigation requirements. AGMOD was used incorporating input parameters for typical operations to estimate water use for average conditions. In keeping with the methodology utilized in the WSA, a 1-in-10 scenario was not modeled for the year 1995.

2.0 Projected Demand

2.1 General Comparison to 1995 Base Year

General base year and planning horizon projections are presented in Table IVA-1. For average conditions, overall agricultural water use for irrigated commodities in the planning region is projected to reach 701.7 mgd by 2020; an estimated increase of 122.9 mgd from the 1995 base year.

Projected demand at year 2020 for a 1-in-10 scenario is estimated to be 1009.3 mgd for irrigated commodities. Agricultural water use is projected to increase in nine of the ten counties in the planning region. Only Pinellas County is expected to experience a decrease. However, agricultural water use in Pinellas County is not significant (< 0.2 %) relative to the total for the planning region.

2.2 Projected Demand for Non-Irrigated Commodities

Table IVA-2 summarizes total water use projections by county through 2020 for agricultural industries whose water use is not irrigation related. The estimated water use for non-irrigated agricultural operations is not anticipated to change significantly over the planning horizon.

2.3 Projected Demand for Irrigated Commodities by County (average and 1-in-10)

Appendix IVA-1, Tables 2.1 through 2.10 summarize projected acreage and water use through the year 2020 by county for each irrigated crop reporting category. For average conditions, the two counties with the largest projected demand in 2020 are Polk and Manatee (approximately 135.0 mgd and 128.0 mgd, respectively). Manatee County (Table 2.6) projections reflect a presence of all reported commodities, the largest of which is tomatoes (37.0 mgd, or 28.9 percent of the county total). In Polk County (Table 2.9), citrus is the predominant commodity (122 mgd or 90.4 percent of the county total).

Table IVA-1. Five-in-10 (Average Annual) and 1-in-10 Agricultural Irrigation Demand Projections (mgd).

COUNTY	1995	2000		2005		2010		2015		2020		Additional		% Change
	Base Year[1]	Avg	1/10	Avg	A/10	Avg	1/10	Avg	1/10	Avg	1/10	Avg	1/10	
Charlotte	24.8	25.2	35.2	26.9	37.6	28.6	39.9	29.6	41.2	30.5	42.5	5.7	17.7	23
DeSoto	83.8	88.8	148.1	94.4	156.6	100.0	165.2	105.6	173.8	111.2	182.3	27.4	98.5	33
Hardee	60.1	61.8	102.1	63.4	104.8	64.9	107.5	66.6	110.3	68.1	113.0	8.0	52.9	13
Highlands	64.7	67.5	95.5	69.7	98.7	71.9	101.9	74.2	105.0	76.4	108.2	11.7	43.5	18
Hillsborough	81.3	84.9	112.6	90.2	118.7	95.2	124.6	99.6	129.8	104.0	134.9	22.7	53.6	28
Manatee	110.9	112.3	128.7	116.8	134.0	121.4	139.3	124.6	143.0	127.8	146.8	16.9	35.9	15
Pasco	20.3	22.1	31.8	23.6	33.7	25.0	35.6	27.0	38.2	29.0	40.7	8.7	20.4	43
Pinellas	1.2	1.1	1.3	1.0	1.2	1.0	1.2	0.9	1.1	0.9	1.1	-0.3	-0.1	-25
Polk	117.6	121.1	194.5	124.6	200.1	128.1	205.8	131.5	211.3	134.9	216.8	17.3	99.2	15
Sarasota	14.1	15.8	19.2	16.5	20.0	17.2	20.9	18.0	21.9	18.9	23.0	4.8	8.9	34
Totals	**578.8**	**600.6**	**869.0**	**627.1**	**905.4**	**653.3**	**941.9**	**677.6**	**975.6**	**701.7**	**1009.3**	**122.9**	**430.5**	**21**

[1] A 1-in-10 scenario was not constructed for the base year of this, or any other, categories of water use.

Table IVA-2. Non-Irrigated Agricultural Water Users Demand Projections (mgd). [1,2]

COUNTY	1995	2000	2005	2010	2015	2020	Additional Demand	
							mgd	%
Charlotte	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
DeSoto	0.8	0.8	0.8	0.8	0.8	0.8	0.0	0.0
Manatee	0.8	0.8	0.8	0.8	0.8	0.8	0.0	0.0
Sarasota	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
Hardee	0.7	0.7	0.7	0.7	0.7	0.7	0.0	0.0
Highlands	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.0
Polk	1.5	1.5	1.5	1.5	1.5	1.5	0.0	0.0
Hillsborough	4.6	4.6	4.6	4.6	4.6	4.6	0.0	0.0
Pasco	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.0
Pinellas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commodity Totals	**9.0**	**9.0**	**9.0**	**9.0**	**9.0**	**9.0**	**0.0**	**0.0**

[1] Includes agricultural operations not included in other categories (e.g., aquaculture, dairy, poultry, swine, etc.)
[2] Average annual and "1-in-10" use projections are the same for these enterprises

The county for which the largest increase in demand is projected over the next 20 years is DeSoto (27.4 mgd). This is due primarily to projected increases in the amount of irrigated citrus and sod acreage. With the exception of Pinellas County, Sarasota County has the smallest projected agricultural demand in 2020 (19.0 mgd). Irrigated sod acreage accounts for roughly half of the projected Sarasota County demand (9.5 mgd). As previously discussed, the irrigation allocations for all crops grown on plastic mulch were calculated assuming zero effective rainfall. The result of this assumption is that projected water use needs for mulched crops are the same for both the average and 1-in-10 scenarios. Thus counties where water use needs for mulched crops represent a significant portion of overall projected county demand will not exhibit as great a difference between average and 1-in-10 projected demand as counties where non-mulched crops predominate. For the RWSP, mulched crop reporting categories include cucumbers, melons, strawberries, tomatoes, and other vegetables and row crops. Non-mulched crop reporting categories include citrus, field (agronomic) crops, nurseries, pasture, potatoes, and sod.

Polk County (Appendix IVA-1, Table 2.9) is estimated to have the largest projected 1-in-10 demand in the planning region in 2020 (216.8 mgd). The large majority of this demand is associated with irrigation of citrus crops (201.8 mgd, or 93.1 percent of the county's estimated total 1-in-10 demand). In the planning region, Polk County also exhibits the largest difference between projected average and 1-in-10 demand in 2020 (81.9 mgd) in the planning region.

2.4 Projected Regional Demand for Irrigated Commodities (average and 1-in-10)

Appendix IVA-1, Table 2.14 shows acreage and water use projections by crop reporting category through 2020 for the planning region. For average conditions, the two commodities with the largest projected demand in 2020 are citrus and sod (398.9 mgd and 98.8 mgd, respectively). Together, these commodities represent approximately 71 percent of the estimated total 2020 agricultural demand.

Citrus and sod also exhibit the largest increases in projected demand over the next 20 years (45.6 mgd and 30.4 mgd, respectively). Smaller increases in demand are projected for cucumbers, nurseries, other vegetables/row crops, strawberries, and tomatoes. Estimated water use for field crops, melons, pasture, and potatoes is not projected to change significantly over the next 20 years.

The projected rate of growth in citrus acreage is reasonable in the context of recent historical growth trends during the period subsequent to the freeze events of the 1980s. As illustrated by Figure IVA-1, current acreage levels have rebounded from the freeze events and are commensurate with historical (pre-freeze) levels. The projected rate of growth represents only a 15 percent increase in total acreage over the next 20 years. This forecast is in line with expectations of the industry as a whole, which continues to experience increasing demand for juice and concentrate products for which the large majority of Florida citrus fruits are produced.

The District's past efforts to forecast changes in the amount of irrigated sod acreage have been complicated by the absence of published data for this commodity. Generally speaking, increases in sod acreage are linked to population growth, but the precise relationship is difficult to determine. During the development of RWSP demand projections, industry representatives assisted District staff and consultants in a reevaluation of previous forecasts. Results suggested that projections in the 1998 WSA may have been overstated. Although the amount of irrigated sod acreage is still predicted to increase significantly by year 2020 (Appendix IVA-1, Table 2.14), the currently projected rate of increase is approximately 20 percent less than that presented in the WSA.

Under 1-in-10 conditions, the two commodities with the largest projected demand in 2020 are citrus and sod (679.1 mgd and 118.8 mgd, respectively). Together, these two commodities represent approximately 79 percent of the estimated total 2020 agricultural demand for the 1-in-10 scenario. Citrus and sod also exhibit the largest differences between projected average and 1-in-10 demand in 2020 (280 mgd and 20 mgd, respectively).

2.5 Summary Discussion

Total water demand for agricultural purposes for average conditions in the planning region is projected to reach 710.7 mgd (Table IVA-1 plus Table IVA-2) by 2020. This represents an increase of 122.9 mgd from the 1995 base year. Nearly three-fourths of the incremental increase is due to projected increases in irrigated citrus and sod acreage. Smaller increases in demand are projected for cucumbers, nurseries, strawberries, tomatoes, and other vegetables/row crops. Projected demands for field crops, melons, pasture, potatoes, and non-irrigated enterprises are not expected to change significantly over the planning horizon. While the projected irrigated citrus and sod acreage at year 2020 is significant (393,485 acres and 36,345 acres, respectively), it is worthy of note that these projections are more

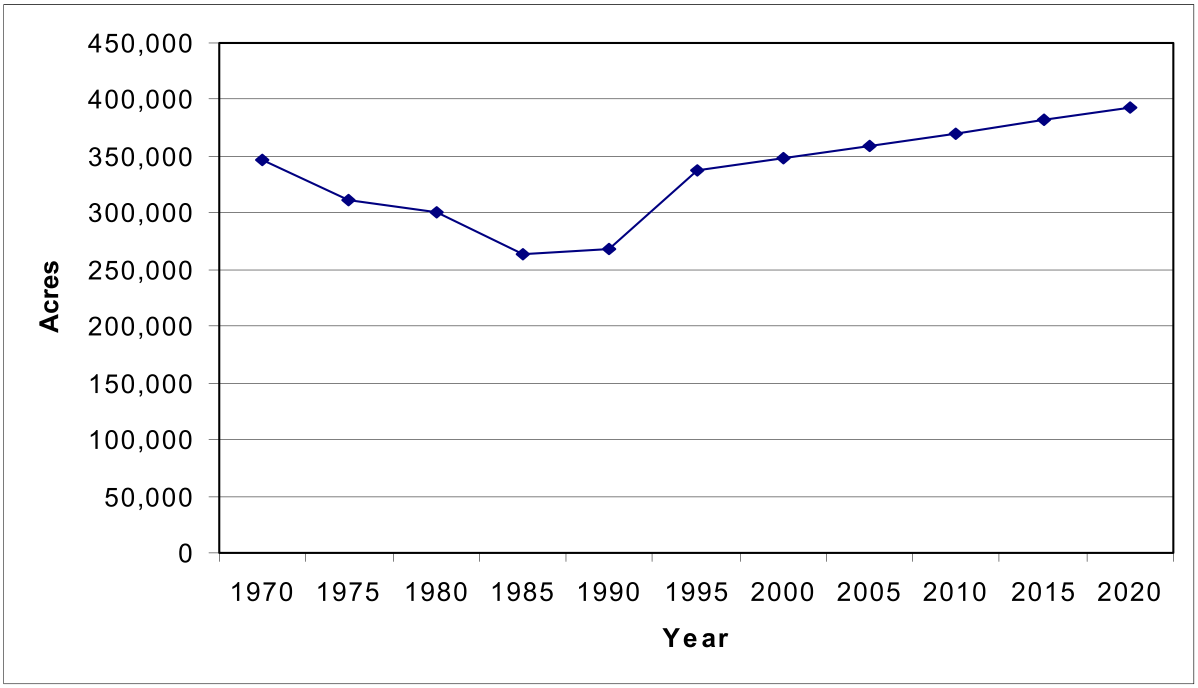


Figure IVA-1. Historical and Projected Trends in Citrus Acreage in the Planning Region, 1970 - 2020.
Source: *Citrus Summary, Florida Agricultural Statistics Service*. 1970 - 1998.

conservative than those presented for these two commodities in the WSA (416,922 acres and 45,445 acres, respectively). These revisions were made based on substantial input from the agricultural community and are believed to represent an improved projection over that which was based on data available at the time the WSA was prepared. The WSA projected a total increase in agricultural demand of 160 mgd over the planning horizon; thus, the 122.9 mgd projected for the RWSP reflects a reduction in estimated incremental demand of approximately 37 mgd (23 percent).

Although the current projections are more conservative than those presented in the WSA, the projected growth in agricultural water use is greater than the amount anticipated by some stakeholders. Two primary issues identified by stakeholders that could have an effect on incremental demand are: 1) projected rate of growth in citrus acreage; and 2) potential for land use conversions from agricultural to other uses in counties experiencing significant population growth.

District staff believe the projected rate of growth in citrus acreage to be reasonable in the context of recent historical growth trends during the period subsequent to the freeze events of the 1980s. As illustrated by Figure IVA-1, current acreage levels have rebounded from the freeze events and are consistent with historical (pre-freeze) levels. The projected rate of growth represents only a 15 percent increase in total acreage over the next 20 years. This forecast is consistent with industry trends which continue to indicate increasing demand for juice and concentrate products for which the large majority of Florida citrus fruits are produced.

It is a general perception that significant population growth tends to lead to the conversion of agricultural land to other (urban) land uses as development occurs. It is true that this type of land use change usually accompanies significant urbanization. However, based on investigations associated with developing projections for agricultural water use for the RWSP, in the urbanizing counties of Hillsborough, Manatee, and Sarasota, urban population growth is not anticipated to result in a significant overall net loss of agricultural land during the planning horizon. All three counties have large total land areas as well as large tracts of vacant or unimproved land. In addition, much of the population growth in these counties is in coastal zones or other areas which are not immediately proximate to core agricultural production areas.

Hillsborough County, for example, is expected to be the most populous county in the South Central Region by the end of the planning horizon. Although the projected agricultural irrigation water demand for the county is estimated to be approximately 104 mgd in 2020 (Table IVA-1), this estimate is reasonable due to several factors. While Hillsborough County's population has approximately doubled over the last 30 years, the amount of agricultural acreage and the dollar value of agricultural production also have increased significantly. The county's zoning policies include green belt acreage which sustains agricultural land use. As the county's population has grown, unimproved land and land used for unirrigated purposes (forage pasture, for example) has been converted to land uses that support higher dollar-per-acre irrigated crops such as strawberries and nurseries. An adopted landscape ordinance for new development has contributed to the growth of the nursery industry. The amount of irrigated strawberry acreage has increased by a factor of eight since 1970. Although urbanization is beginning to occur at the western fringe of the core strawberry production area, lost acreage is expected to be offset by industry expansion to the east and southeast.

Section 2. Industrial/Commercial and Mining/Dewatering Water Demand

This category includes various industries from beverage to electronics manufacturers, power plants, phosphate mines and chemical factories. The lack of a fundamental growth factor (such as acreage for agriculture, population for public supply, or number of golf course holes for recreation) against which water demand can be compared, has made demand prediction difficult. After rejecting other projection methods which were determined to be inaccurate, historic water usage data were relied upon, as described below, to project water demand for the next 20 years in this category. Detailed demand projections are included in a technical memorandum (Appendix II-1) describing the various methodologies which were attempted in order to project demand.

1.0 Methods and Assumptions for Projecting Demand

The Water Planning Coordination Group selected 1995 as the base year for developing and reporting water use projections. In 1995 there were a total of 170 existing WUPs in the I/C and M/D categories. Of these, 101 were categorized as I/C and 69 as M/D. In 1999, there were 119 existing I/C and M/D WUPs with permitted quantities greater than or equal to 0.1 mgd. Twenty-nine new WUPs have been issued since 1995, and 79 permits that existed in 1995 no longer existed in 1999. Only 91 permits existing in 1995 still existed in 1999. The reduction in the number of permits may be attributable to a number of factors including consolidation of multiple permits, closure of operations, and changes in industry classification.

Some permittees have indicated that some closed mines were subject to developments of regional impact (DRI) and are expected to eventually transition into residential communities or recreational facilities. Some manufacturing facilities had been purchased by larger corporations, and some were to be shut down due to low profitability. The volatility in the number of I/C and M/D WUPs in the region over a short period of time must be considered when comparing base year demand quantities with projected demand.

2.0 Projected Demand

The Water Demand Projection Subcommittee identified 0.1 mgd as the reporting threshold for the I/C and M/D categories for the RWSP. The threshold for PG is all permitted or reported users. Generally, only those collective water uses greater than 0.1 mgd are captured in the District's permitting process. District rules require a WUP for uses where the withdrawal during any single day is one million gallons, if the average annual daily withdrawal is equal to or greater than 100,000 gpd, or if the withdrawal is from a well having an inside diameter of 6" or more. Thus, the reporting threshold of 0.1 mgd for I/C and M/D is equivalent to the District's permitting threshold.

Since WUP information is contained in the District's Regulatory Data Base, it was used to identify all WUPs with permitted quantities (meeting the threshold criteria) associated with use codes indicating I/C or M/D operations in the planning region. A total of 119 I/C, M/D and PG permits were identified.

There may be small commercial operations with water uses which are less than the District's permitting threshold which were not captured for these demand projections. For example, every fast food restaurant is actually a commercial operation, using a daily quantity of water that falls below the District's permitting threshold. However, many of these small I/C operations are located in urban areas, obtain their water via the public supply system, and will be accounted for under the demand projections for public supply.

2.1 Methods and Assumptions

Future demand was calculated by multiplying the 1999 permitted quantity by the percentage of permitted quantity actually used in the I/C and M/D categories for that year. This projection methodology was adopted after it became apparent that other projection methods yielded seemingly inaccurate (overinflated) estimates of need. District staff worked with members of the Industrial Advisory Committee and other permittees, who generally accepted this method as reasonable. The average percentage of permitted quantity used was calculated by dividing total estimated use by the total permitted quantity in each category for several different time periods. During the five year period from 1994 through 1998, 56 percent of water permitted to the I/C and PG categories, and 36 percent of water permitted to the M/D category, was actually used. To check the reasonableness of the projections, these percentages were applied to 1999 permitted quantities to predict 2000 demand, and then compared to the 1998 water use. The resulting projection for the year 2000 was 127.3 mgd. The actual 1998 water use from the 1998 Estimated Water Use Report (SWFWMD, 1999 c) for WUPs still in existence in July of 2000 was 125.6 mgd, remarkably close to the 127.3 mgd projected using the 1994 through 1998 percentages.

The 1994, 1995, 1996, 1997, and 1998 editions of the District's Estimated Water Use Reports provided the source data for the portion of permitted quantity actually used. A conservative increase of three percent for each five year increment out to the year 2020 was assumed to be reasonable, based on the comparison to 1998 water use, as described above. In addition, the assumption and methods have been considered and accepted by the permittees and members of the Industrial Advisory Committee.

The 1995 Estimated Water Use Report indicates that I/C, M/D, and PG water use in the ten county area was 143.3 mgd (SWFWMD,1997a). It was decided that this number is somewhat misleading (as previously described) in that several WUPs have been consolidated since 1995, and many of the M/D permitted quantities have been revised to more accurately reflect consumptive use, so as not to include water pumped and stored on site. The number implies a reduction in use/need from 1995 to 2000, when in fact a change in reporting requirements is responsible for the decrease. As a result, the 1995 demand is calculated as a three percent decrease from the projected demand for 2000, from 127.3 mgd in 2000 to 123.4 mgd in 1995, in an attempt to account for the differences in permitting requirements between these years. Three percent is the same increment used to project increase in each five year period. The decrease is assumed to more accurately reflect baseline year 1995 usage under current SWFWMD permit reporting requirements, and allows for the comparison of year-to-year demands to be consistent across the planning horizon. Extreme care was taken to verify that the methods and assumptions used were reasonable and resulted in realistic projections. District regulatory staff members were asked to review all projections. Following regulatory review, the projections were presented to the District's Industrial Advisory Committee for consideration and concurrence with the projection methodologies.

2.4 Projected Regional Demand

Table IVA-3 summarizes the collective base year and projected water demands for the I/C, M/D and PG categories. The Water Demand Projection Subcommittee agreed that, since water use in this overall category is not significantly affected by drought conditions, a 1-in-10 demand calculation is not necessary.

It is anticipated that regional water demand for M/D will likely remain constant through 2020. It is expected that new mines will only be opened to replace others that have been mined out. This may be particularly true in the phosphate mining industry, where higher quality phosphate deposits found in the northern portion of the SWUCA are running out. In addition, the I/C quantities used for processing mined products such as phosphate will also remain stable. Water quantities used for that portion of I/C associated with food processing are likely to fluctuate depending upon prevailing market prices and also with crop yield, which is strongly affected by climatic conditions.

Table IVA-3. Combined I/C, M/D and PG Demand Projections (mgd)[1].

COUNTY	1995 (Adjusted)	2000	2005	2010	2015	2020	Additional Demand	
							mgd	%
Charlotte	1.54	1.59	1.64	1.68	1.73	1.79	0.25	16
DeSoto	0.78	0.80	0.83	0.85	0.88	0.90	0.12	16
Hardee	4.42	4.56	4.70	4.84	4.98	5.13	0.71	16
Highlands	0.11	0.12	0.12	0.12	0.13	0.13	0.02	16
Hillsborough	16.85	17.37	17.89	18.43	18.98	19.55	2.70	16
Manatee	8.04	8.29	8.54	8.80	9.06	9.33	1.29	16
Pasco	11.71	12.07	12.44	12.81	13.19	13.59	1.88	16
Pinellas	0.30	0.31	0.32	0.33	0.34	0.35	0.05	16
Polk	78.88	81.32	83.76	86.28	88.87	91.53	12.65	16
Sarasota	0.88	0.90	0.93	0.96	0.99	1.02	0.14	16
Regional Totals	**123.52**	**127.34**	**131.16**	**135.09**	**139.15**	**143.32**	**19.80**	**16**

[1] Average annual and "1-in-10" use projections are the same for these enterprises

It is essential to consider the fluctuation in the number of I/C, M/D, and PG water use permits, as discussed in Section 2.0, when attempting to project long-term demand. Approximately 19 mgd of 1995 water demand can be attributed to permits which no longer exist. The volatility in the number of WUPs creates a condition whereby simple extrapolation of historical data to project future demand would not be accurate. Therefore, projected demand is based on: 1) those permits that existed in 1995 and were still in existence at the time the projections were developed, 2) those which did not exist in 1995, but have since come into existence, and 3) permits that will likely be issued in the near future for pending or planned I/C, M/D, or PG operations. The considerations that must be made as a result of the fluctuation of the existing permits and the volatility of the industry in general have compounded the challenge associated with projecting demand in this category. However, considering the growth and development the region has experienced, and can continue to expect, the projected demands are believed to be the most realistic possible.

Florida's expanding population is expected to increase the demand for electricity and, consequently, to increase the demand for water needed in the power generation industry. Additionally, the population migration not only includes retirees from other parts of the country, but reflects an increasing number of working age people choosing to relocate in Florida, resulting in a large labor pool. The expansion of the labor pool is likely to attract new business and industry, resulting in greater I/C water demand throughout the planning horizon.

Section 3. Public Supply

The public supply sector, as described previously, includes three components of water use that are described in this section. The first is true *public supply*, representing those residential, commercial and industrial customers receiving water from large and small, public and private, utilities which serve domestic and secondary (irrigation, for example) water needs. For this component, both the population and associated water use are determined for the 1995 base year and projected future needs. The second is *domestic self-supply*, which includes the water use associated with those residential and commercial establishments using their own well(s) for domestic and secondary purposes. In determining future demand, the population and water use associated with domestic self-supply was calculated for the base year, and for each five-year increment through 2020. Since the methods and assumptions are similar, public supply and domestic self-supply are discussed concurrently. The third component is *irrigation wells*, which represents the water use associated with customers of public supply systems who use the water from the public supply system for primary (domestic) purposes and have a private well for irrigation purposes. The number of wells and the quantity of water used was estimated for the 1995 base year, as well as for future demand.

1.0 Base Year Populations

<u>Public Supply and Domestic Self-Supply</u>. The Water Demand Projection Subcommittee of the Water Planning Coordination Group determined that the base year for all projections would be 1995. The 1995 base year population for each county was derived from the Florida Population Studies, Bureau of Business and Economic Research (BEBR) (Smith and Nogle, 1996), and was adjusted for seasonal factors. Data related to seasonal population factors, such as commuters, tourists and seasonal residents, were gathered from various county planning documents. Using Sarasota County as an example, BEBR's estimate for Sarasota County's population (301,528) was adjusted using a seasonal multiplier of 0.26, and a seasonal adjustment of 0.333, which results in a total county population of 327,634 persons. Each county's 1995 baseline population was calculated in a similar manner, using county provided seasonal factors. Appendix IVA-2 contains seasonal factors and their sources.

Initially, population projections were planned to be based upon utility-provided service area population data. Population projections were requested from all utilities with an average daily permitted quantity greater than or equal to 0.5 mgd. Population projections supplied by the permittees within a county proved to be substantially higher than population projections from other sources, such as the BEBR and county comprehensive plans. After receiving guidance from the FDEP, the District developed a methodology resulting in more realistic estimates.

In order to project demands that reflected utility service area, the base year population for each county was categorized into three water use groups: large utility, small utility, and domestic self supply. These divisions were necessitated by the District's methods of estimating water use. Different methods are used for each category, based on available data.

The large utility category refers to those utilities with an average daily permitted withdrawal quantity of 0.5 mgd or greater. The individual 1995 population of each large utility was derived from the Estimated Water Use Report, Table A-1 (SWFWMD, 1997b). This report is produced using utility supplied information, among other sources, for those utilities permitted to withdraw over 100,000 gpd. Table A-1 of the 1995 Estimated Water Use Report contains the values used in the RWSP.

Small utility populations are those associated with utilities with a permitted average daily withdrawal of between 0.1 and 0.5 mgd. As an example, Charlotte County contains six such utilities. The small utility population of Charlotte County used for the RWSP is 8,551 persons. This is equal to the sum of the populations associated with the six small utilities in the county (7,408) plus the additional estimated population (1,143) from non-reporting utilities for public supply (Table 1, 1995 Estimated Water Use Report). All county small utility populations are calculated in a similar manner. Appendix IVA-3 contains detailed public supply estimates for the 1995 base year and projected population and demand.

Domestic self-supply is defined as that portion of each county's population not serviced by either a large or small utility. County domestic self-supply populations are calculated as the difference between the 1995 total county population and the combined 1995 large and small utility populations. For example, in Charlotte County, the domestic self-supply population is equal to the seasonally adjusted total 1995 population (139,696) minus the sum of the large and small utility populations (102,919), resulting in a population of 36,777 persons. All other county domestic self-supply populations are calculated in the same manner, and shown in Appendix IVA-3.

After populations were determined for the above categories, the percentage of total 1995 county population associated with each category of domestic self-supplied, small utility and each large utility was determined. For example, in Hillsborough County, small utility population was determined to be 31,363, or 3.45 percent of the total county population of 909,310. These percentage rates were used to calculate future populations associated with each category, and were assumed to remain constant for projection purposes.

For those counties not fully contained within the District boundaries, only that portion of the population within the District is included. The percentages used to calculate that portion of population in the District were validated by the other water management districts. The percentage of population accounted for is as follows: Highlands County: 90.1 percent, Polk County: 96.4 percent and Charlotte County: 99.5 percent. These percentages are assumed to remain constant over time.

Irrigation Wells. There has been some discussion surrounding the decision to include anticipated demand related to irrigation water use for small private wells in the public supply category. An argument has been made that this component of water use should be accounted for separately, or as part of the recreation/aesthetic category. This argument stems from the fact that public supply utilities have not traditionally been responsible for delivering or ensuring the availability of water of non-potable quality used for secondary purposes. The decision to include such demand under the public supply category was made primarily for accounting purposes. The additional water use from irrigation wells is associated with customers of utility systems; therefore, *public supply* is the water use category under which the demand occurs and should be accounted. In addition, if the irrigation wells were to be abandoned within the planning horizon, public utilities are likely to incur the increased demand from these existing customers.

The District's Well Construction Data Base was used to quantify the number of wells constructed within the planning region. The number of wells smaller than 6 inches with a use code for irrigation was determined for each county. In Highlands, Pasco, and Pinellas counties, the practice of "ganging" wells smaller than 3 inches created the need to adjust the total count of those wells in those counties. By adjusting the number of wells to reflect the actual number of withdrawal points, all withdrawals are treated equally. Detailed information is provided in Appendix IVA-3.

2.0 Base Year Water Use

Public Supply and Domestic Self-Supply. Per capita water use is equal to the total water use withdrawals plus imports, minus exports for a utility divided by its service area population. For the RWSP, per capita water use rates were assumed to remain constant, and are applied to projections of service area populations to project future water demand. All of the 1995 per capita rates were based on those reported in the 1995 Estimated Water Use Report.

Large utility per capita water use is calculated for each listed utility by dividing the 1995 water withdrawal, plus imports and minus exports, by the utility population. For example, in Highlands County, the City of Avon Park had a 1995 water use of 1.787 mgd, and a service population of 16,141. To compute the per capita rate, 1,787,000 was divided by 16,141, resulting in a per capita rate of 111 gpd.

In determining small utility per capita water use, the water use of all small utilities is first added to the water use of non-reporting utilities. This total is then divided by the associated populations of those utilities. The domestic self supply per capita for the 1995 base year is estimated by multiplying the population of the county not serviced by any utility, by the overall average residential per capita water use rate for that county.

The per capita rates shown on the tables throughout Appendix IVA-3 in some cases reflect rates which are higher than District WUP rules allow in Water Use Caution Areas. It cannot be overemphasized that these rates do not reflect targets, or even acceptable per capita water use rates within the planning region. The rates reflect a realistic per person water use from the point of withdrawal, including treatment losses. In addition, although per capita rates remain static as applied throughout the planning horizon, it is expected that in practice per capita rates will actually decrease over time as a result of increased demand management measures which will continue to be encouraged, or required where appropriate.

Treatment losses have been factored into the per capita rates of utilities to reflect the actual demand associated with each person in the projected population. High per capita rates may be a result of high treatment losses associated with alternative water supplies. If a utility is using brackish ground water for example, the amount of water pumped to meet demand may be much greater than the actual amount of finished water. An example of this is the City of Sarasota, where pumpage for 1995 was 9.8 mgd, and associated treatment losses were equal to 2.3 mgd, or 24 percent of the quantity pumped. This resulted in a per capita rate of 155, which is higher than the per capita use rate associated with finished water actually used by each person (121 gpcd, in this case).

Irrigation Wells - Associated Use. The amount of water withdrawn for outdoor irrigation from wells smaller than 6 inches was estimated and factored into the demand projections. Wells less than 6 inches in diameter do not require a WUP. Therefore, since data were not available to quantify the amount of water withdrawn from these wells, an estimate was calculated using a multi-step process that incorporated a number of assumptions, described in subsequent text.

The first step in the estimation was to assign a population to each withdrawal. Since the wells were associated with the "irrigation" use type code in the database, it was assumed that the wells were used for irrigation. Each withdrawal point was assigned the average number of people per household in 1995 according to BEBR (Floyd, 1996). To estimate the water use related to these withdrawals, the associated population was multiplied by 30 percent of the county per capita use for 1995. Thirty percent of the per capita rate was used based on a study conducted by the American Water Works Association's Research Foundation (Mayer, 1999), which quantified specific indoor and outdoor use for private residences in cities in North America, including Tampa. The study determined that Tampa residents used an estimated annual average of 30 percent of their total household use for outdoor purposes. Many assumptions have been made in attempting to account for irrigation well use associated with public supply systems. It is understood that water use patterns vary within the District, and the assumption of 30 percent of total use may not be applicable everywhere; however, public supply utilities in Sarasota and Manatee counties provided the District with some water use information associated with irrigation wells. Estimates for irrigation well use based on the 30 percent assumption were modified using the information provided by representatives of these two counties. In Manatee and Sarasota counties, irrigation well water use was calculated utilizing assumptions including: 1) a lot size of 0.25 acres associated with each well; 2) an irrigated area equivalent to 65 percent of total lot size; 3) 75 irrigation events per year, and 4) an irrigation application rate of 0.5 inches per irrigation event. This method resulted in an average of 406 gallons of water used per well, per day. On a regional basis, it was not possible to account for variables such as landscape material or soil characteristics as part of the assumptions.

The need to account for such water use (which is not metered or invoiced) highlights the need for data which allow for better estimates. A study has been completed in limited areas of Sarasota and Manatee counties which evaluated the impacts of withdrawals from the intermediate aquifer system associated with private wells. Included as part of the scope of the study was the development of an inventory of withdrawals, and an estimation of associated water use. It is anticipated that the results will provide the foundation for further investigation relating to the volume of water obtained from small, private wells.

3.0 Projected Demand

Public Supply and Domestic Self-Supply. Population was projected using the same subcategories as defined in the base year population calculations. For utilities, population projections were calculated by multiplying future county populations, extracted from various county planning documents by the percentage of county-wide 1995 base year population that each utility represented. The same method was used for domestic self-supply. Future county-wide population was multiplied by the percent of the 1995 county-wide base population associated with domestic self-supply. Water demand projections were calculated by multiplying the per capita water use rate for 1995 by the projected populations developed for each sub-category as described above, for each county. The planning documents used are summarized in Appendix IVA-2, and the projections are detailed on a county level in Appendix IVA-3. A regional summary of projected population is shown in Table IVA-4a, and the associated use in Table IVA-4b.

Table IVA-4a. Regional Population, Public Supply and Domestic Self-Supply (persons).

County	Population						Additional Population	
	1995	2000	2005	2010	2015	2020	Persons	%
Charlotte	139,696	161,329	181,109	203,358	223,974	246,810	107,114	76.7
DeSoto	29,594	33,520	35,933	38,520	40,948	43,510	13,916	47.0
Hardee	24,790	23,950	24,640	25,360	26,878	28,490	3,700	14.9
Highlands	76,575	87,415	97,845	109,517	114,024	118,734	42,159	55.1
Hillsborough	909,310	979,858	1,042,135	1,108,367	1,185,229	1,228,642	319,332	35.1
Manatee	256,495	284,280	307,610	333,010	355,050	378,430	121,935	47.5
Pasco	336,134	365,420	392,499	421,630	449,314	479,050	142,916	42.5
Pinellas	985,523	1,030,900	1,055,880	1,081,620	1,093,025	1,104,770	119,247	12.1
Polk	435,365	506,023	551,877	602,134	653,476	708,926	273,561	62.8
Sarasota	327,634	355,120	380,497	407,610	432,875	459,880	132,246	40.4
Total	**3,521,116**	**3,827,815**	**4,070,025**	**4,331,126**	**4,574,793**	**4,797,242**	**1,276,126**	**36.2%**

Irrigation Wells. Similar to the other components of the public supply category, the number of wells projected to exist in the future was calculated as a percentage of actual population in 1995. For example, in Polk County 0.7 percent of the total population utilized irrigation wells, (3,085 withdrawals divided by a population of 435,365 = 0.7 percent). The future increase in irrigation wells, and therefore associated demand, was calculated as a function of population growth. In the Polk County example, the number of wells in 2005 would then be 551,877 x 0.007 = 3,863. Table IVA-5 illustrates the projected number of wells, and the associated water use, in five-year increments from 1995 to 2020.

3.1 1-in-10 Drought Year Projections

Appendix IVA-3 reflects future water supply demand projections on a county-by-county basis. Both average 1-in-10 demands are reflected in these tables. According to the final report of the 1-in-10 Year Drought Subcommittee of the Water Coordination Planning Group, the 1-in-10 year drought event is "an event that results in an increase in water demand of a magnitude that would have a 10 percent probability of occurring during any given year" (Water Planning Coordination Group, 1998). The final report also determined that between a six and ten percent increase in demand will occur in such an event for public supply water use. In order to maintain consistency with the WSA, six percent was used as the factor by which public supply demand is expected to increase during a 1-in-10 drought. Therefore, the 1-in-10 water demand projections were calculated by multiplying by average-year demand by a

Table IVA-4b. Five-in-10 (Average Annual) Public Supply (PS) and Domestic Self-Supply (DSS) Demand Projections (mgd).

County	1995		2000		2005		2010		2015		2020		Additional (mgd)		Change (%)	
	PS	DSS	PS	DSS	PS	DSS	PS	DSS	PS	DSS	PS	DSS	PS	DSS	PS	DSS
Charlotte	12.3	3.4	14.2	4.0	15.9	4.4	17.9	5.0	19.7	5.5	21.7	6.0	9.4	2.6	77	77
DeSoto	1.4	1.8	1.6	2.0	1.7	2.1	1.8	2.3	1.9	2.4	2.0	2.6	0.7	0.8	50	47
Hardee	1.7	1.4	1.6	1.4	1.7	1.4	1.7	1.4	1.8	1.5	1.9	1.6	0.3	0.2	15	15
Highlands	8.8	1.2	10.9	1.5	12.2	1.7	13.6	1.9	14.2	1.9	14.8	2.0	6.0	0.8	57	69
Hillsborough	110.7	9.6	119.3	10.3	126.9	11.0	135.0	11.7	144.3	12.5	149.6	12.9	38.9	3.4	35	35
Manatee	31.7	0.8	35.2	0.8	38.1	0.9	41.2	1.0	43.9	1.1	46.8	1.1	15.1	0.4	48	48
Pasco	34.5	5.6	37.5	6.1	40.3	6.5	43.3	7.0	46.2	7.5	49.2	8.0	14.7	2.4	43	43
Pinellas	114.8	3.9	120.1	4.0	123.0	4.1	126.0	4.2	127.3	4.3	128.7	4.3	13.9	0.5	12	12
Polk	58.1	5.8	67.5	6.7	73.7	7.3	80.4	8.0	87.2	8.7	94.6	9.4	36.5	3.6	63	63
Sarasota	40.3	2.8	43.7	3.0	46.8	3.2	50.1	3.4	53.2	3.6	56.5	3.9	16.3	1.1	40	40
TOTAL	**414.3**	**36.1**	**451.6**	**39.7**	**480.2**	**42.6**	**511.0**	**45.8**	**539.8**	**48.9**	**565.9**	**51.8**	**151.7**	**15.8**	**37**	**44**

Table IVA-5. Number of Irrigation Wells and Associated Five-in-10 (Average Annual) Demand Projections.

County	Withdrawal Points (#)							Associated Water Use (mgd)						
	1995	2000	2005	2010	2015	2020	Additional	1995	2000	2005	2010	2015	2020	Additional
Charlotte	3,062	3,533	3,966	4,454	4,905	5,405	2,343	0.2	0.3	0.3	0.4	0.4	0.4	0.2
DeSoto	1,862	2,112	2,264	2,427	2,580	2,741	879	0.2	0.2	0.2	0.3	0.3	0.3	0.1
Hardee	1,185	1,150	1,183	1,217	1,290	1,368	183	0.2	0.2	0.2	0.2	0.2	0.2	0.0
Highlands	6,721	7,693	8,610	9,637	10,034	10,449	3,728	0.6	0.7	0.8	0.9	1.0	1.0	0.4
Hillsborough	4,845	4,899	5,211	5,542	5,926	6,143	1,298	0.5	0.5	0.5	0.6	0.6	0.6	0.1
Manatee	4,772	5,510	6,055	6,655	7,187	7,762	2,990	1.9	2.2	2.5	2.7	2.9	3.2	1.2
Pasco	9,041	9,866	10,597	11,384	12,131	12,934	3,893	0.7	0.8	0.8	0.9	1.0	1.0	0.3
Pinellas	8,820	10,309	10,559	10,816	10,930	11,048	2,228	0.7	0.8	0.8	0.9	0.9	0.9	0.2
Polk	3,085	3,542	3,863	4,215	4,574	4,962	1,877	0.4	0.4	0.4	0.5	0.5	0.6	0.2
Sarasota	8,954	12,284	16,265	21,537	27,520	35,165	26,211	3.6	5.0	6.6	8.7	11.2	14.3	10.6
TOTAL	**52,347**	**60,898**	**68,574**	**77,884**	**87,078**	**97,977**	**45,630**	**9.1**	**11.1**	**13.2**	**15.9**	**18.8**	**22.4**	**13.3**

factor of 1.06.

Table IVA-6 illustrates the overall average and 1-in-10 demand for the entire public supply water use category within the planning region, over the planning horizon.

The difference between water demand for public supply in 1995 and in 2020 is 167.4 mgd. This represents an additional estimated quantity of water which will need to be developed to meet the public supply water demand in 2020. However, if the utilities and the District can lower the per capita consumption rate, as expected, the amount of additional water needed can be reduced.

3.2 Summary of Public Supply Demand Projections

The anticipated growth in the public supply category is not surprising, considering the rate at which Florida's population continues to grow, particularly in the coastal counties. In developing the projections, best-available data were used. The base year per capita water use data, for example, are derived from data submitted by the permittees and the District Regulatory Data Base, and populations from permittees and BEBR.

The methodologies used to project demand, and the resulting values have been reviewed by the District's Public Supply and Environmental Advisory Committees, the SWUCA and NTB Work Groups, utilities for which projections are made, the FDEP, and other stakeholders. The demand projected for the RWSP was compared to previous District projections in the *Water Supply Needs and Sources* (SWFWMD, 1992) and the *Water Use Demand Estimates and Projections* (SWFWMD, 1997c). The comparison revealed that the current projections are consistent with the projections in these publications.

Water demand in the public supply category is a function of population. The populations utilized for each county are based on county comprehensive plans (see Appendix IVA-2), which are based on BEBR and other data sources. The majority of population growth is projected for the Tampa Bay area, and Sarasota and Charlotte counties. To meet associated future demand, not only must new water supplies be developed but demand must continue to be managed through existing and future measures, such as water conservation and reclaimed water initiatives.

Section 4. Recreation/Aesthetic

The water use associated with the recreation/aesthetic category is comprised largely of use by golf courses, parks, and cemeteries. As discussed previously, it was decided that the reporting threshold for this category would include all permitted or reported users.

Reclaimed water use was not calculated as part of the demand projections of this category because data are limited and the demand calculations represent "raw" demand. Demand management measures will be accounted for in the estimation of existing and future sources available to meet projected demand.

Table IVA-6. Five-in-10 (Average Annual) and 1-in-10 (Drought Year) Public Supply Demand Projections (mgd).

COUNTY	1995	2000		2005		2010		2015		2020		Additional	
	Base Year[1]	Avg	1/10	Avg	A/10	Avg	1/10	Avg	1/10	Avg	1/10	Avg	1/10
Charlotte	16.0	18.4	19.5	20.7	21.9	23.2	24.6	25.6	27.1	28.2	29.9	12.2	13.9
DeSoto	3.3	3.8	4.0	4.0	4.3	4.3	4.6	4.6	4.9	4.9	5.2	1.6	1.9
Hardee	3.2	3.1	3.3	3.2	3.4	3.3	3.5	3.5	3.7	3.7	4.0	0.5	0.7
Highlands	10.6	13.1	13.4	14.7	15.6	16.4	17.4	17.1	18.1	17.8	18.9	7.2	8.3
Hillsborough	120.8	130.1	138.0	138.4	146.7	147.2	156.1	157.4	166.9	163.2	173.0	42.4	52.2
Manatee	34.4	38.3	40.6	41.4	43.9	44.9	47.6	47.9	50.8	51.1	54.2	16.7	19.7
Pasco	40.8	44.4	47.1	47.7	50.5	51.2	54.3	54.6	57.9	58.2	61.7	17.4	20.9
Pinellas	119.3	124.9	132.4	127.9	135.6	131.0	138.9	132.4	140.4	133.8	141.9	14.5	22.6
Polk	64.2	74.6	79.1	81.4	86.3	88.8	94.1	96.4	102.2	104.6	110.8	40.3	46.6
Sarasota	46.7	51.6	54.7	56.6	60.0	62.3	66.0	68.0	72.1	74.7	79.1	28.0	32.5
Totals	**459.4**	**502.4**	**532.5**	**536.0**	**568.2**	**572.8**	**607.1**	**607.5**	**644.0**	**640.2**	**678.6**	**180.8**	**219.2**

[1]A 1-in-10 scenario was not constructed for the base year of this, or any other, categories of water use.
The individual components of these projections are shown in Appendix IVA-3.

1.0 Methods and Assumptions for Base Year Demand

For golf courses, 1995 demand was determined based on the water use associated with golf courses in each county, and the number of golf course holes per county. Demand for landscape uses was based on water use associated with large landscapes in each county, and the county-wide population. As such, population and per capita water use information were obtained from the RWSP public supply water use projections. The data and detailed projection methods and assumptions are included in the technical memorandum produced for the recreation/aesthetic water demand projections (Appendix II-1).

Golf Courses. Water use data associated with golf courses were obtained from the 1995 Estimated Water Use Report. Table A-5 shows the estimated and reported withdrawals for permits meeting the reporting threshold (SWFWMD, 1997b). Golf course water use within each county was calculated, then the number of holes associated with golf courses existing in 1995 for each county was determined via a telephone survey conducted in August 1999. Each golf course was contacted to determine the number of golf course holes existing in 1995, if reclaimed water was used in 1995, and the current (1999) use of reclaimed water. In addition to survey responses, information gathered from the Internet ("The Golf Guide") and the National Golf Foundation's (NGF) list of golf course holes and other data were used to determine the number of golf course holes in the region (NGF, 1998).

The collective water use associated with golf courses in each county was divided by the number of golf course holes present within each county in 1995. This was used to calculate the average number of gallons of water used per day per hole (gpdph) for each county in 1995. The average water use per hole in 1995 varied from 4,074 gpdph in DeSoto County to 10,860 gpdph for Hillsborough County as shown in Appendix IVA-4, Table IVA-4-1. The collective water use of golf courses per county represents the water use associated with golf courses in 1995; the quantity of water used per hole was used to estimate future demand.

Landscapes. For the RWSP, landscape water use refers to irrigation for parks, medians, attractions, cemeteries and other large self-supply green areas. For each county, base year landscape-related water use was obtained from the data in the 1995 Estimated Water Use Report. Projected future water demands associated with landscape use was projected as a function of population. Therefore, the 1995 base year water use was divided by the county-wide population, estimated as part of the public supply population projections for each county in 1995 (see Public Supply Demand, Section 3). The resulting county-wide average per capita water use for green space irrigation was used to calculate future demand.

2.0 Methods and Assumptions

Golf Courses. Future demand associated with golf courses was estimated based on historical trends. Data related to the historical growth in the actual number of golf course holes from 1984-1994 was obtained from *Water Use Demand Estimates and Projections*, or WUDEP (SWFWMD, 1997), while the number of holes from 1994-1998 was obtained from data supplied by the NGF. Through the use of linear regression, the relatively steady growth in golf course holes was used to project golf course water use through 2020 (Figure IVA-2). The previously-determined quantity of water used per golf course hole was applied to the number of holes to calculate water use through 2020. Although there are variations from year to year and from county to county, there is a general upward trend in the growth of golf course holes.

The growth of golf course holes for all counties is statistically significant at the 90 percent confidence level when compared to a straight line trend to 2020. That confidence level, together with the historical trend, provided the basis for the assumption that the trend would likely continue through 2020 (Figure IVA-2). This assumption was reinforced by information from the NGF stating that an accelerating demand for golf courses would continue until at least 2015 due to expected increased demands of "Baby Boomers" as they reach retirement age, and "Echo Boomers," the children of Baby Boomers. The resulting numbers of golf course holes were determined from the linear projection for each county at five year increments from 1995 to 2020. The number of golf course holes for each year, in each county, was multiplied by the associated gpdph resulting in a total projected water use of 77.16 mgd in 2020, as shown in Table IVA-7.

Landscapes. Projecting future demand for uses associated with permitted water uses for large green spaces was a relatively simple process. The county-wide average per capita water use for green space irrigation, as described in the discussion of the base-year demand, was multiplied by the anticipated population in each county for 2000, 2005, 2010, 2015, and 2020. The population projections are based on those described in the public supply section of this chapter.

2.1 Projected Demands in an Average Versus 1-in-10 Year

The water uses described in this category are affected by drought conditions; therefore, demand must be calculated for such conditions. As described previously, the 1-in-10 Year Drought Subcommittee agreed that irrigation simulation models used for agricultural demand projections should be used to estimate recreational self-supply demand.

Climatic variables, such as temperature, sunlight, humidity and wind, etc., affect the amount of water loss from plants and therefore the irrigation requirements. There are a number of models that consider such climatic parameters to determine the water need of plants. Irrigation requirements were derived using the District's agricultural water use allocation program (AGMOD). AGMOD is based on a modified Blaney-Criddle procedure and utilizes historical temperature, effective rainfall, and solar radiation data to calculate the estimated irrigation requirements necessary to produce optimum crop yield for grass under specified rainfall scenarios. For the RWSP, AGMOD input parameters were designed to produce estimated irrigation requirements for average and 1-in-10 scenarios.

For each county in the planning region, irrigation allocations were developed for each reporting category by using AGMOD and incorporating typical site conditions for grass, including geographic location, climatology, soil type, irrigation system, and growing season(s).

To determine the differences in irrigation requirements based on an average year, and those in a drought year (1-in-10), a model simulation was made for each county, using county specific parameters. The input parameters were: county name, main irrigation system efficiency of 75 percent, use of effective rainfall, no auxiliary irrigation system, predominant soil per county, 10 acre area, and a discharge of 1,000 gallons per minute (gpm). The output of the program indicated that the percentage increase in

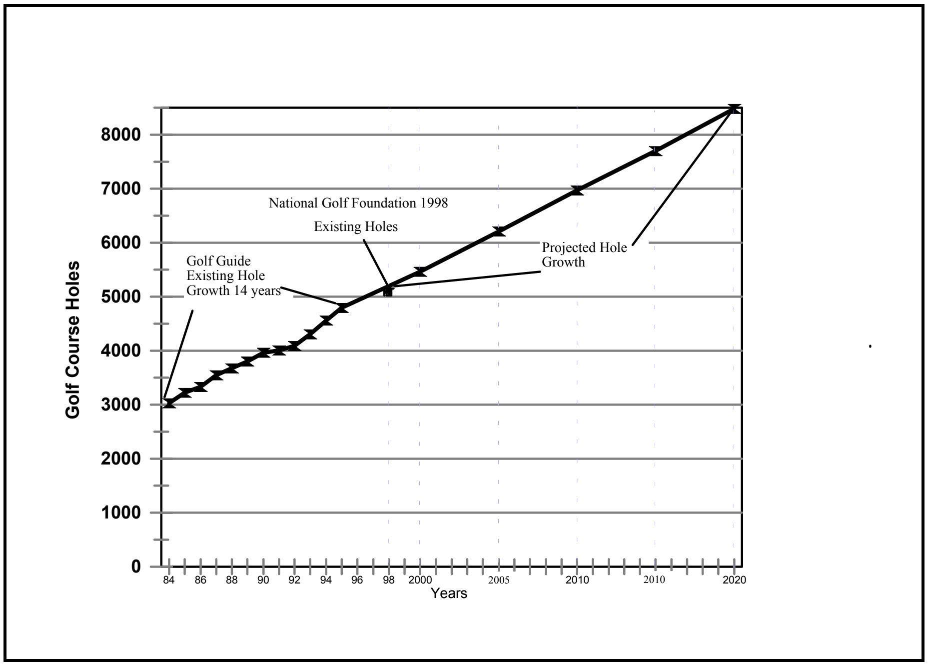


Figure IVA-2. A Projection of Golf Hole Growth in the Planning Region.

Table IVA-7. Five-in-10 (Average Annual) Golf Course Demand Projections (mgd).

COUNTY	1995	2000	2005	2010	2015	2020	Additional Demand (mgd)
Charlotte	2.02	2.48	2.92	3.37	3.82	4.25	2.23
DeSoto	0.29	0.31	0.35	0.38	0.29	0.45	0.16
Hardee	0.12	0.13	0.16	0.20	0.23	0.27	0.15
Highlands	2.64	2.85	3.22	3.59	3.96	4.32	1.68
Hillsborough	8.31	9.74	11.14	12.55	13.96	15.37	7.06
Manatee	3.80	4.34	5.15	5.96	6.77	7.58	3.78
Pasco	3.20	3.89	4.47	5.06	5.65	6.23	3.03
Pinellas	7.59	7.95	8.20	8.44	8.68	8.92	1.33
Polk	8.85	10.46	12.71	14.97	17.22	19.46	10.61
Sarasota	6.51	7.20	7.97	8.75	9.53	10.31	3.8
TOTAL	**43.33**	**49.35**	**56.29**	**63.27**	**70.11**	**77.16**	**33.83**

optimum irrigation requirements for the 1-in-10 year event as opposed to the average year event was 30 percent for golf courses and 26 percent for landscape irrigation. The projected water use for each sub-category in an average year was multiplied by this percentage value to produce a projected water use for a 1-in-10 year. Table IVA-8 shows the average and the 1-in-10 demand for the recreation/aesthetic category through 2020.

3.0 Summary of Recreation/Aesthetic Demand.

Recreation/aesthetic water use projections are based largely on historical trends and represent about 11 percent of the total additional demand projected for the planning region. Increased water use in this category can be largely attributed to golf courses and the growth of golf courses can be attributed to growth in the region's population. In addition, there appears to be an increasing demand for the sport and golf course growth appears to be outpacing population growth. In fact, the irrigation need for golf courses is a considerable portion of total projected demand for the region. The greatest opportunity for reducing the amount of fresh water resources used to irrigate golf courses may be the use of reclaimed water.

Section 5. Summary of Demand Projections in the SWUCA

Over the next 20 years the District will be working toward addressing the water resource issues in the SWUCA through several major initiatives including: 1) the collection and analysis of hydrologic data, 2) the development of ground-water flow, solute transport, and integrated models, 3) the setting of MFLs for the Floridan aquifer, rivers, and lakes, and 4) the funding of water supply and water resource development projects. Because of the magnitude of the District's current and future efforts in the SWUCA, a brief discussion of projected water demands in this portion of the larger planning region is provided. Table IVA-9 shows the projected average and 1-in-10 demand in the SWUCA, NTB area, and the planning region as a whole through 2020.

1.0 Agriculture

The majority of the projected increase in agricultural water demand for the planning region will occur in the SWUCA. As illustrated by Table IVA-9, the projected increase in agricultural demand through 2020 for the SWUCA is 103.4 mgd. This represents approximately 84 percent of the projected increase in agricultural demand for the entire planning region through 2020. Ninety five percent and 63 percent of the estimated agricultural water demand for Polk and Hillsborough Counties, respectively, occurs in the portion of these counties located in the SWUCA. Most of the commodities grown in Hillsborough County are concentrated in the SWUCA; however, the majority of the projected increase in water use for strawberries and nurseries in Hillsborough County (77 percent and 57 percent, respectively) is anticipated to occur outside the SWUCA.

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

Table IVA-9 includes the portion of projected demand within the SWUCA that is related to the I/C, M/D, and PG category. The rate of increase in water demand for this category in the SWUCA is consistent with the increase in this category in the portion of the planning region outside the SWUCA.

Table IVA-8. Five-in-10 (Average Annual) and 1-in-10 (Drought Year) Recreation Demand Projections (mgd).

COUNTY	1995	2000		2005		2010		2015		2020		Additional	
	Base Year	Avg	1/10	Avg	A/10	Avg	1/10	Avg	1/10	Avg	1/10	Avg	%
Charlotte	2.13	2.61	3.39	3.07	3.99	3.54	4.59	4.00	5.19	4.46	5.79	2.33	109
DeSoto	0.40	0.43	0.56	0.47	0.61	0.51	0.66	0.44	0.56	0.60	0.78	0.20	50
Hardee	0.24	0.25	0.32	0.29	0.37	0.33	0.42	0.37	0.48	0.42	0.53	0.18	75
Highlands	3.58	3.93	5.06	4.43	5.71	4.93	6.36	5.36	6.91	5.78	7.45	2.20	61
Hillsborough	12.34	14.09	18.15	15.78	20.33	17.48	22.52	19.15	24.68	20.83	26.85	8.49	69
Manatee	4.62	5.24	6.78	6.13	7.93	7.02	9.08	7.90	10.22	8.78	11.37	4.16	90
Pasco	4.26	5.04	6.51	5.71	7.38	6.39	8.26	7.07	9.13	7.74	10.00	3.48	82
Pinellas	10.29	10.77	13.89	11.09	14.30	11.40	14.70	11.68	15.06	11.95	15.41	1.66	16
Polk	12.94	15.21	19.59	17.92	23.09	20.62	26.58	23.38	30.14	26.12	33.69	13.18	102
Sarasota	8.79	9.67	12.47	10.63	13.71	11.59	14.95	12.55	16.19	13.51	17.44	4.72	54
Totals	**59.6**	**67.3**	**86.7**	**75.5**	**97.4**	**83.8**	**108.1**	**91.9**	**118.6**	**100.2**	**129.3**	**40.6**	**68**

Table IVA-9. Five-in-10 (Average Annual) and 1-in-10 (Drought Year) Demand Projection Summary (mgd) for the SWUCA and NTB Portions of the Planning Region and the Planning Region as a Whole (1995 - 2020). [1]

Category	1995	2000		2005		2010		2015		2020		Additional		% change
		Avg	1-in-10	Avg	1-in-10	Avg	1-in-10	Avg	1-in-10	Avg	1-in-10	Avg	1-in-10	Avg
SOUTHERN WATER USE CAUTION AREA (SWUCA)														
Agriculture	530.1	546.7	791.5	569.6	823.6	592.5	855.7	613.1	884.7	633.5	913.8	103.4	373.7	20
Public Supply	198.8	223.9	237.3	243.9	245.0	266.1	282.1	287.3	304.5	309.1	327.7	110.3	128.8	55
Commercial/ Mining/Power	95.1	98.0	98.0	100.9	100.9	104.0	104.0	107.1	107.1	110.3	110.3	15.2	15.2	16
Recreation	35.0	39.9	51.5	45.7	59.0	51.6	66.5	57.2	73.8	63.1	81.5	28.1	46.5	80
TOTAL	**859.0**	**908.5**	**1,178.3**	**960.1**	**1,228.5**	**1,014.2**	**1,308.3**	**1,064.7**	**1,370.1**	**1,116.0**	**1,433.3**	**257.0**	**574.2**	**30**
NORTHERN TAMPA BAY (NTB) AREA														
Agriculture	57.7	62.9	86.5	66.5	90.8	69.8	95.2	73.5	99.9	77.2	104.5	19.5	46.8	34
Public Supply	260.6	278.5	295.2	292.1	323.2	306.6	325.0	320.3	339.5	331.1	350.9	70.5	90.4	27
Commercial/ Mining/Power	28.4	29.3	29.3	30.3	30.3	31.1	31.1	32.0	32.0	33.0	33.0	4.6	4.6	16
Recreation	24.6	27.4	35.2	29.8	38.4	32.2	41.6	34.7	44.7	37.1	47.8	12.5	23.3	51
TOTAL	**371.3**	**398.1**	**446.2**	**418.7**	**482.7**	**439.7**	**492.9**	**460.5**	**516.1**	**478.4**	**536.2**	**107.1**	**165.1**	**29**
PLANNING REGION (SWUCA and NTB Quantities Totaled)														
Agriculture	587.8	609.6	878.0	636.1	914.4	662.3	950.9	686.6	984.6	710.7	1018.3	122.9	430.5	21
Public Supply	459.4	502.4	532.5	536.0	568.2	572.8	607.1	607.5	644.0	640.2	678.6	180.8	219.2	39
Commercial/ Mining/Power	123.5	127.3	127.3	131.2	131.2	135.1	135.1	139.1	139.1	143.3	143.3	19.8	19.8	16
Recreation	59.6	67.3	86.7	75.5	97.4	83.8	108.1	91.9	118.6	100.2	129.3	40.6	69.7	68
TOTAL	**1230.3**	**1306.6**	**1624.5**	**1378.8**	**1711.2**	**1454.0**	**1801.2**	**1525.2**	**1886.3**	**1594.4**	**1969.5**	**364.1**[2]	**739.2**	**30**

[1] The Northern Tampa Bay area encompasses all areas of the planning region that are not in the SWUCA, including the very northern portion of Polk County (see Figure I-4).

[2] Does not include the 68 mgd of cutbacks in Northern Tampa Bay ground-water withdrawals which would adjust the total demand to 432 mgd.

Because the majority of large water users, including phosphate mines and power plants, are located in the SWUCA, most (77 percent) of the projected increase in demand will occur in the SWUCA.

3.0 Public Supply

The increase in public supply demand in the portions of Hillsborough and Polk counties in the SWUCA represents 35 percent and 63 percent, respectively, of the total projected increase in public supply demand in these counties. Approximately 61 percent of the total increase in public supply demand for the entire planning region occurs in the SWUCA. This increase is based upon a 50 percent population increase in the SWUCA, compared to a 36 percent overall population increase in the entire region.

4.0 Recreation/Aesthetic

Twenty-nine percent and 90 percent of the projected increase in recreation/aesthetic water demand in Hillsborough and Polk counties respectively will occur in the portion of these counties located in the SWUCA. Table IVA-9 shows the projected demand under average and 1-in-10 conditions in the SWUCA for this category. The projected increase in recreation/aesthetic demand in the SWUCA comprises about 70 percent of the projected increase in this category for the entire planning region.

Section 6. Summary of Projected Demand in the Planning Region

Demand projections presented in this sub chapter indicate that an additional 364 mgd of water must be made available to meet 2020 demand in the planning region. Table IVA-9 is a summary of the projected demand for the SWUCA, the NTB area, and the planning region as a whole and Table IVA-10 summarizes the projected demand by county. More than three quarters of the projected additional demand is accounted for in the agriculture and public supply categories.

Some stakeholders have pointed out that these demand projections do not altogether reflect their expectations for the next 20 years. The projections have been characterized as higher or lower than anticipated depending on the perspective of the reviewer. It is acknowledged that the projections represent estimates of demand, based on best available data, historical trends, and assumed conditions that may exist in the future. Although the RWSP is not required to be updated until 2005, efforts to collect data and refine models related to water use demand projections are in progress and will continue over the next five years.

District staff has identified some improvements which can be made before the 2005 update of the RWSP in order to provide more accurate projections in which all stakeholders can have greater confidence. Specific tasks, which are anticipated to improve demand projections in subsequent RWSPs, are described in the following paragraphs.

Table IVA-10. Five-in-10 (Average Annual) Demand Projections Summary by County (mgd).

County	Base Year	Planning Horizon					Additional Demand	
CHARLOTTE	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**	**mgd**	**%**
Agriculture	24.9	25.3	27.0	28.7	29.7	30.6	5.7	23
Public Supply	16.0	18.4	20.7	23.2	25.6	28.2	12.2	77
I/C, M/D, PG	1.54	1.59	1.64	1.68	1.73	1.79	0.25	16
Rec/Aesthetic	2.1	2.6	3.1	3.5	4.0	4.5	2.3	114
Sub-Total	**44.5**	**47.9**	**52.4**	**57.2**	**61.0**	**65.1**	**20.5**	**46**
DESOTO	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**	**mgd**	**%**
Agriculture	84.6	89.6	95.2	100.8	106.4	112.0	27.4	32
Public Supply	3.3	3.8	4.0	4.3	4.6	4.9	1.6	49
I/C, M/D, PG	0.78	0.80	0.83	0.85	0.88	0.90	0.12	15
Rec/Aesthetic	0.4	0.4	0.5	0.5	0.4	0.6	0.2	50
Sub-Total	**89.1**	**94.6**	**100.5**	**106.7**	**112.3**	**118.4**	**29.3**	**33**
HARDEE	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**	**mgd**	**%**
Agriculture	60.8	62.5	64.1	65.6	67.3	68.8	8.0	13
Public Supply	3.2	3.1	3.2	3.3	3.5	3.7	0.5	16
I/C, M/D, PG	4.42	4.56	4.70	4.84	1.98	5.13	0.71	16
Rec/Aesthetic	0.2	0.3	0.3	0.3	0.4	0.4	0.2	100
Sub-Total	**68.6**	**70.5**	**72.3**	**74.0**	**76.2**	**78.0**	**9.4**	**14**
HIGHLANDS	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**	**mgd**	**%**
Agriculture	64.9	67.7	69.9	72.1	74.4	76.6	11.7	18
Public Supply	10.6	13.1	14.7	16.4	17.1	17.8	7.2	68
I/C, M/D, PG	0.11	0.12	0.12	0.12	0.13	0.13	0.02	16
Rec/Aesthetic	3.6	3.9	4.4	4.9	5.4	5.8	2.2	61
Sub-Total	**79.2**	**84.8**	**89.1**	**93.5**	**97.0**	**100.3**	**21.2**	**27**
HILLSBOROUGH	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**	**mgd**	**%**
Agriculture	85.9	89.5	94.8	99.8	104.2	108.6	22.7	26
Public Supply	120.8	130.1	138.4	147.2	157.4	163.2	42.4	35
I/C, M/D, PG	16.85	17.37	17.89	18.43	18.98	19.55	2.70	16
Rec/Aesthetic	12.3	14.1	15.8	17.5	19.1	20.8	8.5	69
Sub-Total	**235.9**	**251.1**	**266.9**	**282.9**	**299.7**	**312.2**	**76.3**	**32**

Table IVA-10. Five-in-10 (Average Annual) Demand Projections Summary by County (mgd).

County	Base Year	Planning Horizon					Additional Demand	
MANATEE	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**	**mgd**	**%**
Agriculture	111.7	113.1	117.6	122.2	125.4	128.6	16.9	15
Public Supply	34.4	38.3	41.4	44.9	47.9	51.1	16.7	49
I/C, M/D, PG	8.04	8.29	8.54	8.80	9.06	9.33	1.29	16
Rec/Aesthetic	4.6	5.2	6.1	7.0	7.9	8.8	4.2	91
Sub-Total	**158.7**	**164.9**	**173.6**	**182.9**	**190.3**	**197.8**	**39.0**	**25**
PASCO	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**	**mgd**	**%**
Agriculture	20.5	22.3	23.8	25.2	27.2	29.2	8.7	42
Public Supply	40.8	44.4	47.7	51.2	54.6	58.2	17.4	43
I/C, M/D, PG	11.71	12.07	12.44	12.81	13.19	13.59	1.88	16
Rec/Aesthetic	4.3	5.0	5.7	6.4	7.1	7.7	3.5	82
Sub-Total	**77.3**	**83.8**	**89.6**	**95.6**	**102.1**	**108.7**	**31.4**	**41**
PINELLAS	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**	**mgd**	**%**
Agriculture	1.2	1.1	1.0	1.0	0.9	0.9	(0.3)	-25
Public Supply	119.3	124.9	127.9	131.0	132.4	133.8	14.5	12
I/C, M/D, PG	0.30	0.31	0.32	0.33	0.34	0.35	0.05	17
Rec/Aesthetic	10.3	10.8	11.1	11.4	11.7	11.9	1.7	16
Sub-Total	**131.1**	**137.1**	**140.3**	**143.7**	**145.3**	**147.0**	**15.9**	**12**
POLK	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**	**mgd**	**%**
Agriculture	119.1	122.6	126.1	129.6	133.0	136.4	17.3	15
Public Supply	64.2	74.6	81.4	88.8	96.4	104.6	40.3	63
I/C, M/D, PG	78.88	81.32	83.76	86.28	88.87	91.53	12.65	16
Rec/Aesthetic	12.9	15.2	17.9	20.6	23.4	26.0	13.1	102
Sub-Total	**275.1**	**293.7**	**309.2**	**325.3**	**341.7**	**358.5**	**83.4**	**30**
SARASOTA	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**	**mgd**	**%**
Agriculture	14.2	15.9	16.6	17.3	18.1	19.0	4.8	34
Public Supply	46.7	51.6	56.6	62.3	68.0	74.7	28.0	60
I/C, M/D, PG	0.88	0.90	0.93	0.96	0.99	1.01	0.14	16
Rec/Aesthetic	8.8	9.7	10.6	11.6	12.6	13.5	4.7	54
Sub-Total	**70.6**	**78.1**	**84.7**	**92.2**	**99.7**	**108.2**	**37.7**	**53**

- In this RWSP, population projections for the public supply water use sector have been based upon widely accepted data: BEBR, and county comprehensive plan documents. Although utility service area data are the most preferable, it was not plausible to make use of it due to the reasons described previously in this chapter. Data based on service areas are presumed to reflect actual use patterns, growth patterns, and the collective use of those utilities that must be involved in the process for the development of necessary future supplies. The District will continue to work with public supply utilities and their corresponding local planning departments toward reconciling population data and collection methods.
- Limited data exist on which to base water demand projections for the I/C and M/D category. No foundation on which to build projections is known at this time and there is no clear historical pattern of water use on which to base future projections. District staff has projected demand using the best available data. Although past demands are not necessarily the best indicator of future demands, it is recognized that some degree of correlation with historical use provides a greater level of confidence in the projections. The District will continue to work toward the development of more accurate methods of projecting demand in this category.
- There have been apparent discrepancies between baseline data contained in the Regulatory Data Base, and data that I/C and M/D permittees assert to have submitted. The reasons for such discrepancies are many, but can be generally attributed to data entry procedures which are consistent with specific permit requirements, but do not necessarily coincide with the manner in which required data are reported. District staff is committed to improving upon the use and interpretation of data contained in the Regulatory Data Base.
- The agricultural water use projections have endured significant scrutiny. The basis for the projections is irrigated acreage. In order to improve the projections of irrigated agricultural acreage, District staff intend to monitor actual changes in acreage for key commodities, as reported, on an annual basis. Acreage projections will be adjusted, if necessary, to reflect changes in trends.

Chapter IV. Water Supply Development Component

Sub Chapter B. Determination of Water Supply Deficits and Traditional and Alternative Supply Sources

Part A. Background

Historically, water supply in the planning region has principally been provided by ground water from the Upper Floridan aquifer. The process of identifying future available water supplies for the RWSP included an evaluation of existing ground-water sources. This was necessary to determine the projected shortfall in "current" water sources and the amount of alternative sources that will be necessary to meet projected additional water demands (water supply deficit). Water supply development in the region is constrained primarily due to impacts of withdrawals on surface-water features (e.g., lakes and wetlands), surface-water courses, aquifers, and legal existing uses of water. As MFLs are established in the planning region, water supply will be constrained based on impacts of water supply development projects on these flows and levels.

Part B of this Chapter is a discussion of water supply constraints in the planning region, the ability of water sources to supply 1-in-10 drought demands, and the potential quantities of water that are available to meet projected demands.

Part B. Water Supply Constraints and Deficits

Section 1. Northern Tampa Bay (NTB)

Several actions have transpired over the past decade that affect the future availability of ground water in the NTB area including signing of the Partnership Agreement and adoption of the MFLs rule and corresponding recovery and prevention strategies. As discussed in Chapter I, ground-water withdrawals from 11 wellfields in the NTB area (Figure IVB-1) have impacted lakes and wetlands in the area (SWFWMD, 1996). A large portion of the NTB area exhibits stressed surface-water features caused by excessive ground-water withdrawals. The affected area generally corresponds to the area where model-derived drawdowns in the surficial aquifer are within the one foot drawdown contour. Cumulative drawdowns in the surficial aquifer are shown in Figure IVB-2 and discussed in more detail in SWFWMD (1996). In the NTB area, movement of the freshwater/saltwater interface is considered to be localized and not of regional concern.

The Partnership Agreement between the District and Tampa Bay Water and its member governments requires a reduction in ground-water withdrawals from the 11 wellfields in Tampa Bay Water's central system and provides District funds to develop alternative water supply projects to replace lost wellfield capacities. The Agreement specifies that by the end of 2002, Tampa Bay Water will reduce ground-water withdrawals from its central wellfield system from 158 mgd to 121 mgd, and to 90 mgd by the end of 2007 (a decrease of about 68 mgd). From a water supply planning perspective, the reduction in ground-water withdrawals can be viewed as water demand that must be met with future sources of water. Much of this demand, however, is currently being planned for and developed as part of the

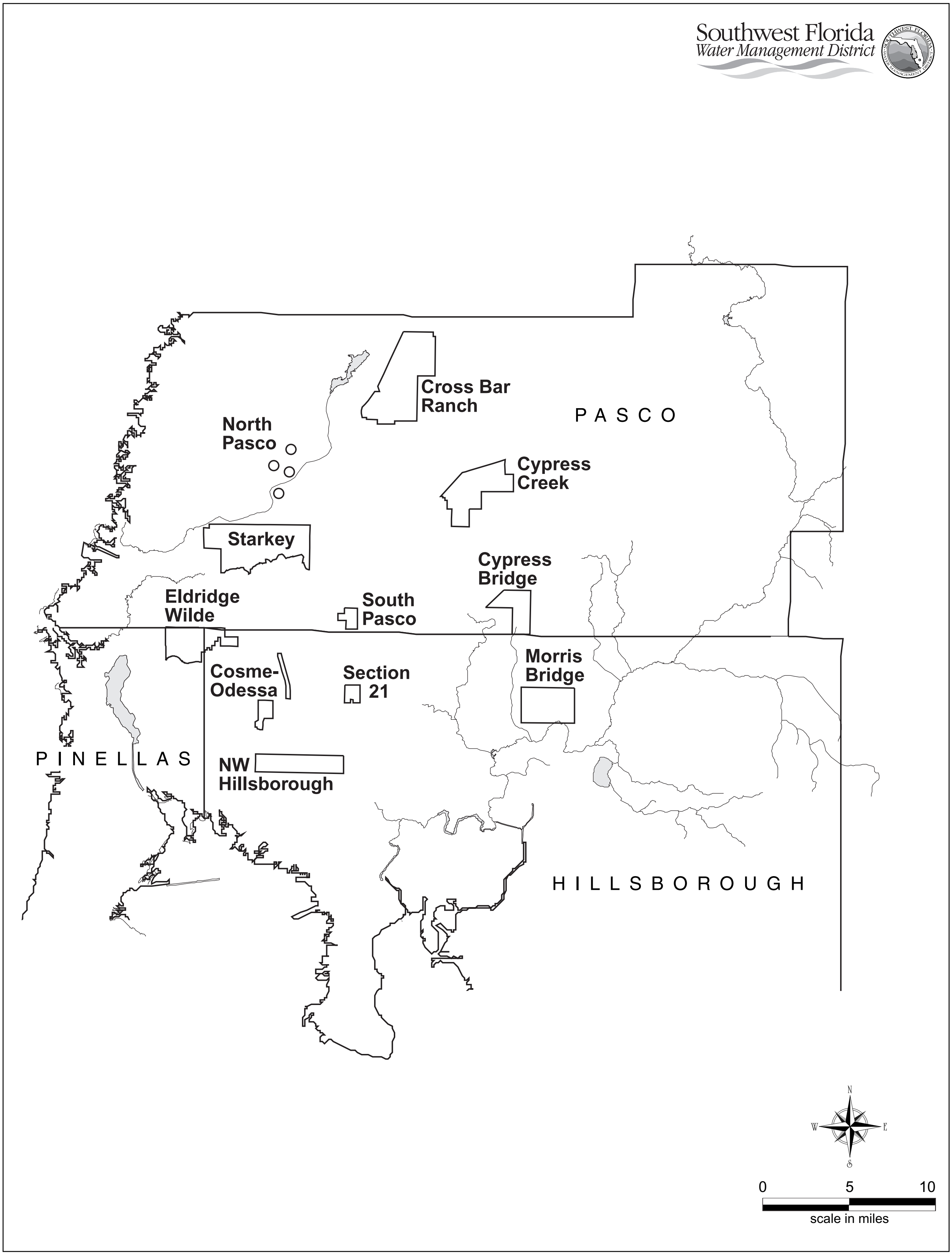


Figure IVB-1. Wellfields in Tampa Bay Water's Central System.

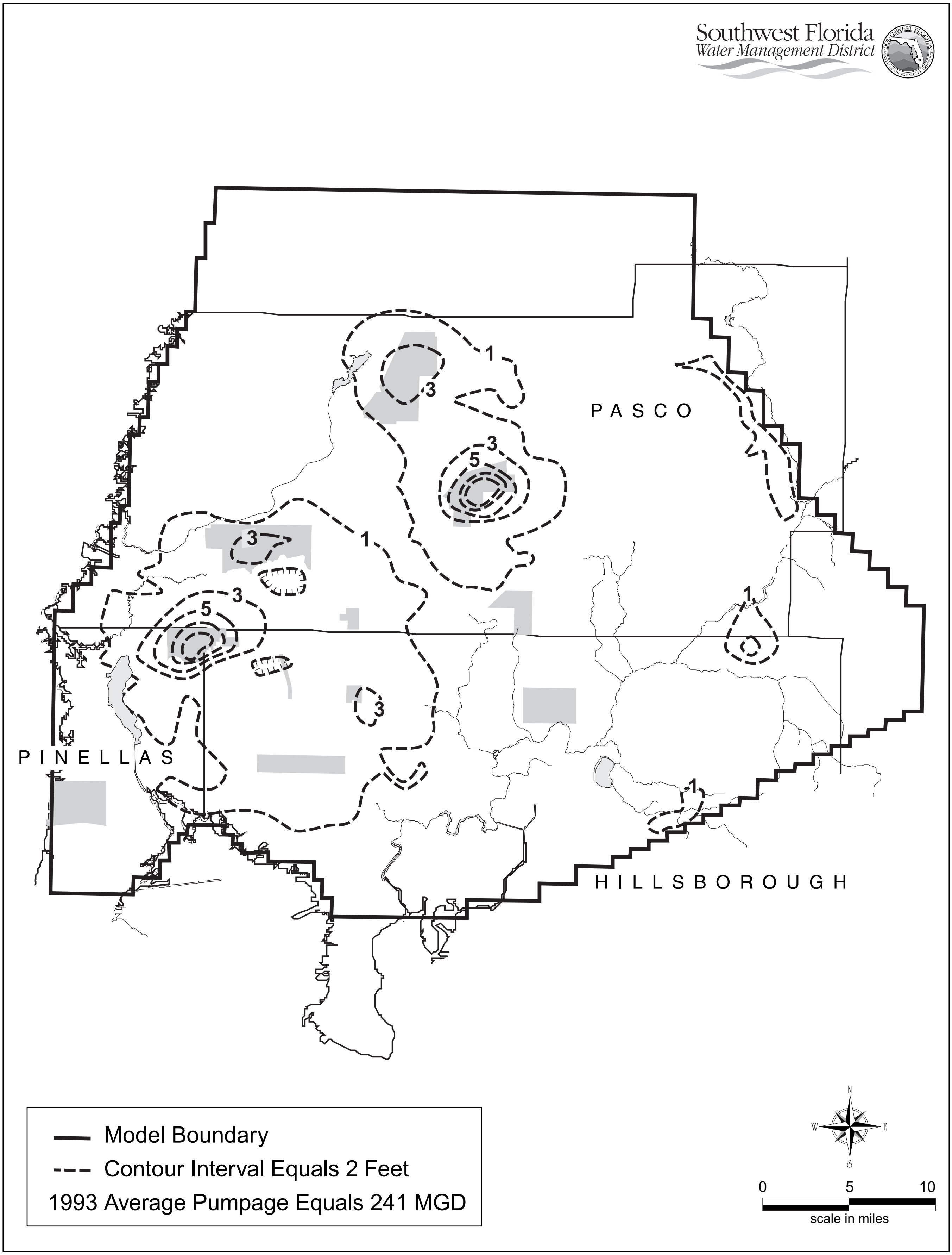


Figure IVB-2. Surficial aquifer Drawdown in the Northern Tampa Bay Area.

Partnership Agreement. Water supply projects include a 25 mgd seawater desalination facility at the Big Bend Power Plant on Tampa Bay and 60 mgd (66 mgd peak capacity) from the Enhanced Surface Water System (see Chapter IVC, Part B, Section 4).

MFLs, as described in Chapter III, were adopted by the Governing Board in 1999 (Chapter 40D-8, F.A.C.). New water withdrawals in the region must not cause water levels or flows to fall below adopted MFLs unless the withdrawal is part of a recovery strategy. Corresponding recovery and prevention strategies (Chapter 40D-80, F.A.C.) were also adopted that describe the regulatory means for achieving adopted MFLs.

Section 2. Southern Water Use Caution Area (SWUCA)

Ground-water withdrawals in the SWUCA have resulted in landward movement of the freshwater/saltwater interface in coastal areas and the lowering of lake levels along the sand ridges of Highlands and Polk counties. In 1994, as described in Chapter I, the Governing Board approved a minimum level in the Upper Floridan aquifer over the entire SWUCA to "significantly" halt saltwater intrusion in the Upper Floridan aquifer and stabilize lake levels. The level, as proposed, was based on the annual-average 1991 potentiometric surface. The allocation of new ground water withdrawals from the Upper Floridan aquifer would be based on the minimum level in the SWUCA as well as aquifer levels that were similarly developed for the ETB WUCA and HR WUCA, and which were also based on the annual-average 1991 potentiometric surface. The effect of these levels on the allocation of ground water for a given period of time was that, if the annual average aquifer levels for the previous five-year period were below the respective levels in each of the three areas, the District would not issue any new WUPs for withdrawals from the Upper Floridan aquifer. If the average annual aquifer levels for the previous five years were above these levels, the District would issue permits only for those quantities that would not cause the minimum level to be violated. This essentially implemented a cap on the allocation of new ground-water withdrawals from the Upper Floridan aquifer in the region until a recovery in water levels was achieved. Though portions of the SWUCA water use permitting rule were overruled during an administrative rule challenge and the proposed minimum level subsequently withdrawn, the hearing officer found the proposed minimum level to be valid and based on sound science. With respect to the base year for the plan (1995), an evaluation of the five-year annual average potentiometric surface of the Upper Floridan aquifer in the SWUCA indicates that the proposed minimum levels were close to being met for 1995 (Figure IVB-3). It should be noted that the District is scheduled to establish minium flows in the Alafia and upper Peace rivers and minimum levels for priority lakes and the Upper Floridan aquifer in the SWUCA in the 2001 to 2002 timeframe.

Section 3. Water Supply Deficits

Over the course of the planning horizon, it is apparent that additional water supplies will need to be developed throughout the planning region. For the RWSP, the amount of water supply needed to meet projected water demands out to the year 2020 was determined assuming that all future water supplies would come from sources other than fresh ground water. This was based largely on noted impacts of ground-water withdrawals on water resources in the NTB area and SWUCA (SWFWMD, 1996; SWFWMD, 1993) and previous direction from the Governing Board. Requests for ground-water withdrawals in the future will continue to be evaluated on a case-by-case basis.

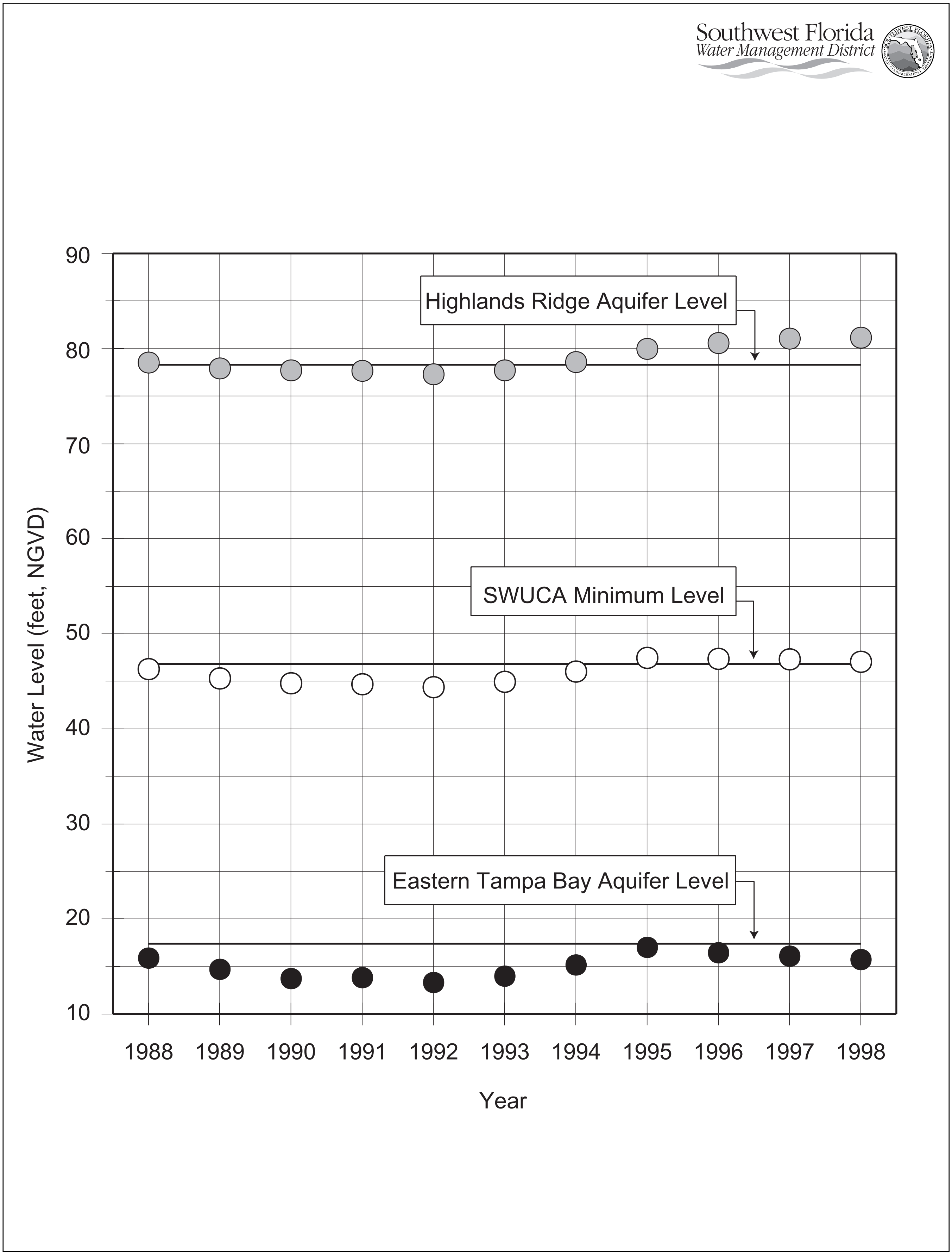


Figure IVB-3. Previously Proposed SWUCA Minimum Level, aquifer levels for the ETB WUCA and HR WUCA, and the respective Moving Five-Year Average Aquifer Levels.

In the NTB area, projections of 2020 water demand totaled about 107 mgd. However, because Tampa Bay Water is being required to reduce ground-water withdrawals from their central system wellfields, an additional 68 mgd of water supply must be accounted for in the future. The total amount of water the region must develop by 2020 is therefore 175 mgd. This 68 mgd is currently being developed as part of the Partnership Agreement.

In the SWUCA, it was concluded, based on previous Governing Board policy and acceptance of the previously proposed minimum levels, that the Upper Floridan aquifer could sustain the approximate level of annual-average ground-water withdrawals experienced during the period from 1991 to 1995. However, future demands would have to be met by sources other than fresh ground water.

As previously stated, there are currently no minimum levels adopted for the SWUCA. Following adoption of minimum levels and a recovery strategy in 2001, it is possible that the region will be in a recovery mode and increases in actual levels to the adopted minimums will be required. This would require that some of the potential sources of water identified to meet future demands in this RWSP would be used to achieve recovery in the region.

Future "water supply deficits" were calculated as the difference between projected demands for the 2020 planning horizon and demands calculated for the 1995 base year (Table IVA-9). Including wellfield cutbacks in the NTB area, it is anticipated that additional water demand in the planning region through the year 2020 will be approximately 432 mgd. Based on evaluation of water supply sources that could potentially be developed (see Part D of this Chapter), it was determined that up to 678.1 mgd may be available to meet this demand. In the SWUCA, there is an additional demand of about 257 mgd compared to potentially available sources of about 348.5 mgd. In the NTB area (i.e., the remaining portion of the planning region), the additional demand, including 68 mgd for wellfield cutbacks, is about 175 mgd, as compared to potentially available sources of about 329.6 mgd. Included in Table IVB-1 for the NTB area are the quantities of water associated with Tampa Bay Water's seawater desalination and Enhanced Surface Water projects that are currently being developed. In addition to the sources identified in the NTB area, Tampa Bay Water is pursuing development of a 6 mgd ground-water wellfield in the Brandon area. It is therefore concluded that sufficient sources of water are available within the planning region to meet projected demands through 2020. As evidenced from the summary of demands in Table IVA-9 and the summary of potentially available sources in Table IVB-1, it is further concluded that there are areas of the planning region that have limited access to alternative water supplies and that a regional approach to meeting future demands for water needs is highly desirable. The assumptions used to quantify potentially available sources of water are discussed in later sections of this chapter, as well as in Chapter IVD where potential options for developing these supplies are discussed.

Part C. 1-in-10 Year Drought Level of Certainty

The "level-of-certainty planning goal" for the RWSP is to be based upon meeting the needs of reasonable and beneficial uses for the 1-in-10 year drought event. The concern for providing sufficient water supply for the 1-in-10 drought condition is the potential for impacts to water supply "constraints" in the region. These constraints are principally impacts to legal existing uses, surface features (e.g., flowing water bodies, lakes, and wetlands) and saltwater intrusion.

Table IVB-1. Potential Water Availability in the SWUCA and NTB Portions of the Planning Region and the Planning Region as a whole.

	Conservation		Desalination		Reclaimed Water	Surface Water[1]	Total
	Agricultural	Non-Agricultural	Seawater	Brackish Ground Water			
SOUTHERN WATER USE CAUTION AREA (SWUCA)							
Charlotte	1.8	4.4		2.5	5.2	18.7	32.6
DeSoto	6.5	0.9			0.6	64.6	72.6
Hardee	4.0	0.6			0.6		5.2
Highlands	4.5	1.9			0.9	4.4	11.7
Hillsborough	3.9	5.3	10		6.8		26
Manatee	7.5	6.4	20		13.5	33.1	80.5
Polk	7.5	12.5			19.5		39.5
Sarasota	1.1	10.6	20	11.7	11.7	25.3	80.4
Total	**36.8**	**42.6**	**50**	**14.2**	**58.8**	**146.1**	**348.5**
NORTHERN TAMPA BAY (NTB) Area[2]							
Hillsborough	2.3	14.2	25		53.2	94.9	189.6
Pasco	1.7	9.9	25		9.7	2.8	49.1
Pinellas	0.1	25.7		15.3	46.4		87.5
Polk	0.4	3.0					3.4
Total	**4.5**	**52.8**	**50[3]**	**15.3**	**109.3**	**97.7**	**329.6**
PLANNING REGION (SWUCA and NTB Quantities Totaled)							
Total	**41.3**	**95.4**	**100**	**29.5**	**168.1**	**243.8**	**678.1**

[1]With the exception of the Alafia River, which is part of Tampa Bay Water's Enhanced Surface Water System, surface water sources were generally assigned to the county and "area" in which the point of withdrawal occurs as described in Table IVB-2. A portion of the available flows from the Alafia and Hillsborough rivers and the TBC will be used to replace the scheduled reduction in capacities (68 mgd) of the central system wellfields.

[2]The Northern Tampa Bay area encompasses all areas of the planning region not included in the SWUCA, including the very northern portion of Polk County (see Figure I-4).

[3]Quantities of water for seawater desalination assigned to the Northern Tampa Bay area include 25 mgd from Tampa Bay Waters Big Bend plant.

Drought is generally defined as a period of little or no rainfall. The effects of drought are largely dependent on the activities being conducted. For instance, in agriculture, drought can occur in days or weeks. If sufficient rainfall is not received, supplemental irrigation may be necessary to ensure the growers objectives are achieved. For natural systems, drought may occur on the order of a few to several months. For example, under normal conditions wetlands surrounding a lake provide water storage during periods of high rainfall. Lake level declines are moderated by a slow release of this water when there is little or no rainfall.

Natural systems are adapted to drought and expected to periodically experience low water levels. The effect of water withdrawals is to increase the frequency of occurrence and duration of low water levels. The lowering of water levels in surface-water features will generally lag behind the lowering of ground-water levels in response to ground-water withdrawals.

The extent to which surface features are impacted is largely dependent on the hydrogeologic setting. Generally, it is the persistent long-term lowering of surface-water levels that causes the degradation of natural systems. The methodologies developed and used by the District to establish minimum levels incorporate the effects of drought.

Movement of the regional freshwater/saltwater interface largely occurs because of changes in ground-water levels. As ground-water levels are lowered, the rate of landward and upward movement of the interface increases; and, as levels are increased, the rate of landward and upward movement decreases. Because the regional response of the interface to changes in water levels is relatively slow, it is more appropriate to look at long-term changes than short-term changes in water levels when concerned about regional saltwater intrusion.

With respect to providing for water supply needs during a 1-in-10 drought, it is anticipated that many future water supply development projects will incorporate aquifer storage and recovery (ASR) and/or aquifer recharge components to meet water demands. Although much of this water will be accessed using wells, recharging the aquifer will generally offset the impacts of future ground-water withdrawals. It is expected that there will be periods when water demands are low and recharge is high, as well as periods when water demands are high and recharge is low. Long-term water management objectives will need to consider optimizing long-term annual-average water levels to prevent degradation of the natural systems. Future allocations of water supply will probably be based on the annual average quantity that can be supplied by the proposed project. With techniques such as ASR and aquifer recharge, the ground-water system will continue to be capable of providing water supply during future 1-in-10 droughts.

Part D. Sources

The RWSP process included an assessment of existing and potentially available sources of water supply. Sources of water available to meet current and future water demands in the planning region include:

- Surface water/storm water
- Reclaimed water
- Conservation

- Brackish ground water
- Seawater
- Limited fresh ground water

Many water users throughout the region have implemented conservation measures to reduce their water demands. Such conservation measures have helped the water supply system to support more users with the same quantity of water and hydrologic stress. For purposes of the RWSP, conservation is considered a water supply source.

In the future, water demands will likely be met with the sources listed above. However, management techniques and technologies such as improved water treatment methods, ASR, and aquifer recharge systems will be required to meet the projected demands.

The goal of the RWSP is to identify sufficient sources of water within the planning region to meet projected water demands. In Chapter IVD of this document, a list of water supply options and cost estimates is provided to assist users in determining how best to meet their particular demands. The following discussion summarizes the status of various water supply sources and the potential for those sources to be used to meet projected water demand in the region.

Section 1. Ground Water

The planning region can be subdivided into two distinct regions: the NTB region, which occupies the Central West Central Florida Ground-Water Basin (CWCFGWB), and the SWUCA, which encompasses the Southern West Central Florida Ground-Water Basin (SWCFGWB) (Figure IVB-4). As discussed in the Geology/Hydrogeology Section of Chapter I, the NTB region generally contains a two aquifer system separated by a semi-confining layer of clay. The ground-water system is karstic with variable confinement between the unconfined surficial sand aquifer and the underlying confined Upper Floridan aquifer. In the SWUCA, the aquifer system thickens from north to south and a multi-aquifer system which includes the surficial, intermediate, and Upper Floridan aquifers exists. The confining beds generally thicken from north to south and the system is well-confined over most of the basin except the extreme northern and eastern portions along the Lake Wales Ridge.

Fresh ground water is almost always the preferred source for public water supply and other uses. In 1998, approximately 84 percent (965 mgd) of the 1.1 billion gallons per day used in the planning region was from ground-water sources. The majority of this was withdrawn from the Upper Floridan aquifer (about 866 mgd). In the SWUCA, ground-water sources also include the surficial and intermediate aquifers. Water supply from permitted withdrawals from these sources in 1998 was about 14 mgd and 85 mgd, respectively. As discussed in Part A of this Chapter, due to regional saltwater intrusion and lowered lake levels in the SWUCA and environmental degradation of wetlands and lakes in NTB, ground-water sources to supply future demand are becoming increasingly limited.

The District is periodically questioned about the existence of freshwater springs in the Gulf of Mexico and the possibility of utilizing them for water supply. Although the existence of a number of offshore springs has been documented, there is no evidence that the quality of water is suitable for development

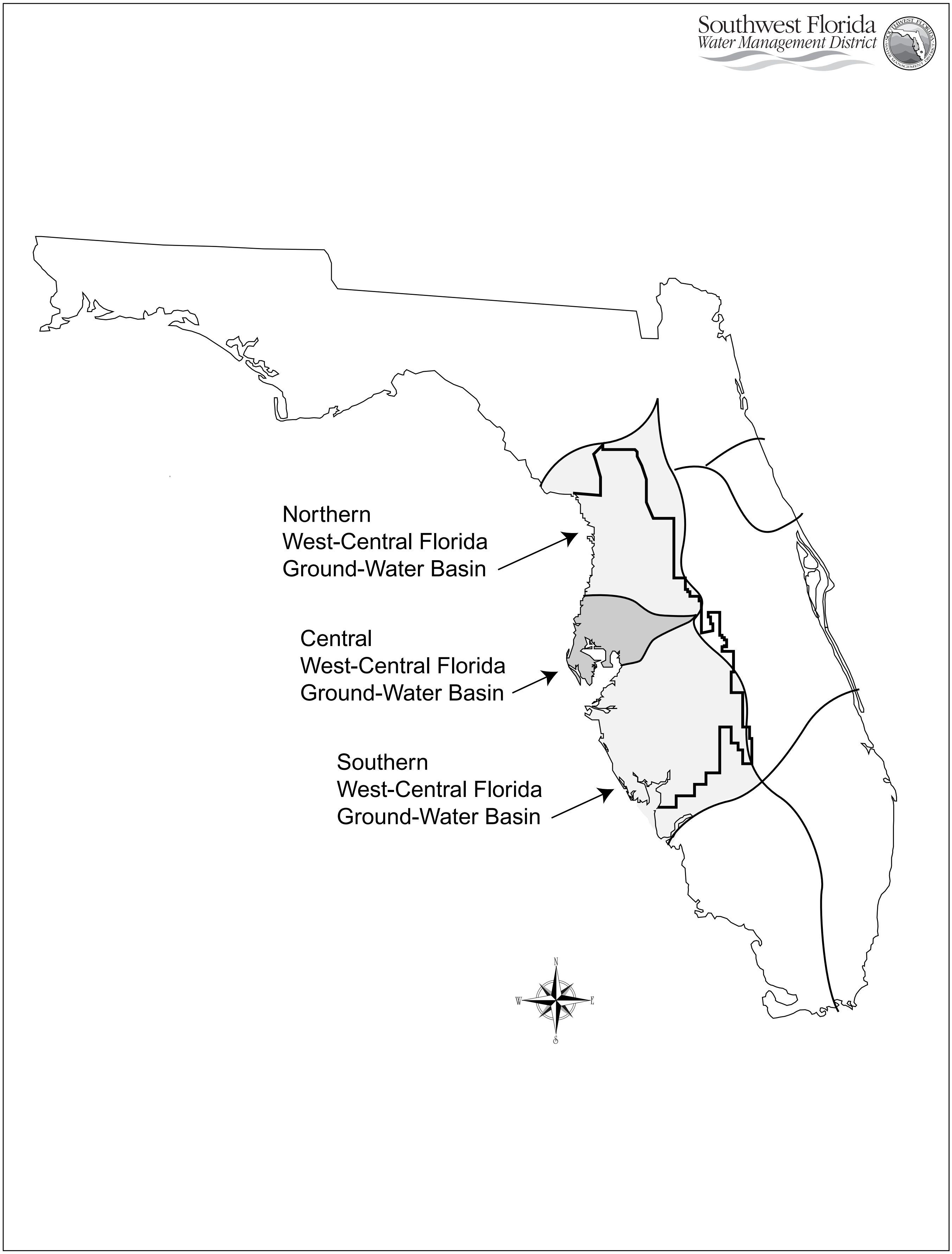


Figure IVB-4. Location of the Central West-Central Florida Ground-Water Basin (CWCFGWB) and the Southern West-Central Florida Ground-Water Basin (SWCFGWB).

of an economically feasible water supply. Because the saltwater/freshwater interface, the boundary between fresh ground water and saline ground water in the Floridan aquifer, is located onshore in most of the planning region, it is highly unlikely that fresh ground water is discharging offshore through the springs. This statement is supported by water quality investigations of a number of springs located directly on the coastline or a short distance offshore (Jones and others, 1997; Jones and others, 1998). The quality of the water discharging from these coastal springs is brackish at best. The District is beginning a reconnaissance program to locate and study offshore springs. It is hoped that this study will provide definitive data on the issue of both the existence of offshore springs and their magnitude of discharge and water quality.

Section 2. Surface Water/Storm Water

Within the planning region, the major river systems include the Anclote, Hillsborough (including the Tampa Bypass Canal (TBC)), Alafia, Braden, Little Manatee, Manatee, Myakkahatchee Creek, Myakka, Peace, and Shell Creek. As is typical in west-central Florida, flows are highest during the four-month summer rainy season (June through September) and are lowest at the end of the spring dry season in May. Historical flow records at select stations are shown in Appendix IVB-1.

Major public supply utilities utilize the Hillsborough River, TBC, Braden River, Manatee River, Peace River, Myakkahatchee Creek and Shell Creek. The Hillsborough River, Braden River, Manatee River, and Shell Creek all have in-stream dams that form reservoirs for storage. The City of Tampa, which relies on the Hillsborough River, as well as the TBC, for most of its water needs, currently withdraws an annual average quantity of about 64 mgd from these sources. The City of Bradenton utilizes the Evers' reservoir on the Braden River and currently diverts about 5.5 mgd for public supply needs. Manatee County withdraws about 25 mgd from Lake Manatee which is an in-stream impoundment on the Manatee River. The City of Punta Gorda currently withdraws 3.7 mgd from the Shell Creek reservoir. Table IVB-2 contains information on current use and permitted quantities of the major river systems in the planning region.

Prior to determining the availability of surface water to meet projected demands, general criteria were developed to ensure, at a planning level, that existing uses and the water supply needs of natural systems would be protected (CH2M Hill, 2000). These criteria were developed to quantify, on a planning level only, the amount of water that is potentially available. The amount of water to be developed in the future will ultimately be determined through the permitting process. Surface water availability was determined based on evaluation of historical flow and withdrawal data. For most of the rivers, the period of record analyzed was from 1965 to 1998. For those rivers where data for this period were incomplete, the available period of record was used. Water availability was determined by applying the general criteria to this period for each of the rivers. Since many of the rivers in the region do not yet have established minimum flows, it was necessary to assume a minimum flow criteria before estimating water availability. For the RWSP, the minimum flow was assumed to be the flow that is equaled or exceeded 85 percent of the time (P85). This was based largely on the minimum flow for the PR/MRWSA's WUP for withdrawals from the Peace River, which was actually the 87^{th} percentile. Compared to criteria used by other water management districts, which varied from the P90 to P95, this number appeared to be conservative and reasonable to use for planning purposes, in lieu of site specific information.

Table IVB-2. Summary of Surface-water Withdrawals in the Planning Region (mgd).

Water Body	Mean Flow[1]	10% of Mean Flow	Permitted Average Withdrawal Limits[2]	Current Use[3]	Theoretical Available Additional Withdrawals[4]	Days/Year with New Available Water[5]	Practical Available New Water (mgd)[6]
Anclote River near FPL Powerline[10,13]	44	4.4	0	0	2.8	310	2.8
Hillsborough River at Dam [7]	250	25	101	64	<1	1	0
Tampa Bypass Canal at S-160[7]	87	8.7	40	7.2	<1	7	0
Alafia River at Bell Shoals Rd.[8]	260	26	26	4.3	3.4	29	0
Little Manatee River at FPL Reservoir[14]	97	9.7	18	3.7	2.1	190	2.1
Manatee River at Dam [9]	150	15	35	25	2.9	58	2.9
Braden River at Dam	71	7.1	7.0	5.5	2.3	77	2.3
Myakkahatchee Creek at Diversion	36	3.6	2.1	1.3	1.2	85	1.2
Myakka River near I-75[10]	250	25	0	0	19	310	15
Peace River at Treatment Plant[11]	760	76	32.7	8.1	40	296	40
Shell Creek at Dam	220	22	5.4	3.7	17	234	10
Josephine Creek at WMD Boundary[10]	45	4.5	0	0	4.4	310	3.0
Cow Pen Slough at I-75[12,10]	44	4.4	0	0	4.3	309	4.3
TOTAL			**267.2**	**122.8**	**99.4**		**83.6**

[1] Mean flow based on recorded USGS flow plus reported WUP withdrawals added back in when applicable. Maximum period of record used is 1965-1998. Flow records for TBC (1975-1998), Manatee River (1981-1998), Braden River (1993-1998), and Myakkahatchee Creek (1981-1998) are shorter.
[2] Based on individual WUP permit conditions, which may or may not follow the current 10% diversion limitation guideline. Also see General Notes.
[3] Based on average reported withdrawals during the period 1994 through 1998.
[4] Equal to remainder of 10% of total flow, after permitted uses allocated, with min flow cutoff for new withdrawals of P85 and max system diversion capacity of twice median flow (P50). Accounts for existing min flows (Peace River)
[5] Based on estimated number of days that any additional withdrawal is available considering current permitted quantities and withdrawal restrictions.
[6] Based on practical considerations of permittability, facility operation, withdrawal schedule, local need, and cost.
[7] Hills. and TBC withdrawal estimates based on maximum Tampa permitted withdrawals of 82 mgd from the Hills River - can include up to 20 mgd from the TBC, and Tampa Bay Water Permitted allocation.
[8] Permitted withdrawals include Tampa Bay Water allocation and Cargill Fertilizer permitted withdrawals from Lithia and Buckhorn Springs.
[9] Manatee River yield is based on a 10% total withdrawal up to the median flow, but then allowing a 20% withdrawal during flows above the median.
[10] There are no current or permitted withdrawals on the Myakka River, Anclote River, Josephine Creek, or Cow Pen Slough.
[11] Based on permitted quantity of WUP (valid until 2016), referenced to average annual withdrawal of 10% of historical flows, as measured at the USGS gauge at Arcadia.
[12] All values estimated based on similar sized water bodies, no gauged report.
[13] Three mgd from Anclote River applied to Starkey Wellfield could potentially yield an additional 9 mgd from the wellfield.
[14] Available supply based on WUP withdrawal schedule and RWSP withdrawal criteria. Most available water is available when flows are above P85 but below WUP minimum flow criteria.

Diversions for water supply were zero when flows were below the assumed minimum flow. Therefore, 15 percent of the time there were no calculated withdrawals from the rivers. This ensured that during periods of low flow, sufficient water would be available to sustain natural systems.

The second criterion for determining surface water availability was to limit total withdrawals, including new and existing, to 10 percent of the total daily flow of the river when the flow exceeded the P85. Individual withdrawals were limited to 10 percent of the total daily flow at the point of the withdrawal. This is consistent with the ecological guideline used by the District during the 1980s and early 1990s to evaluate potential surface water withdrawals. In lieu of site-specific information and for planning purposes, this number appeared reasonable. Figure IVB-5 illustrates the effects of these first two withdrawal criteria using flows in the Peace River for 1995. The upper line is the observed flow and the lower line is the flow that would result from diversions according to the criteria discussed above. The area between the two lines represents the total amount that would potentially be available from the river for water supply. It is evident from this figure that the majority of water will be available during periods of high river flows; whereas, there is little or no water available when flows are near or below the P85. Two additional criteria were to limit maximum withdrawals as a practical engineering limitation to twice the median flow of the river and ensure protection of existing permitted withdrawals from the rivers.

The Peace River can be used as an example to illustrate how the amount of water available from each river to meet future demand was determined. Using the established withdrawal criteria (P85 and 10 percent diversion) discussed above, the Peace River could contribute an annual average quantity of 76 mgd. The PR/MRWSA is permitted to withdraw an annual average of 32.7 mgd but is currently utilizing an annual average of only 8.1 mgd. The amount of water available to meet future demand is calculated by subtracting the currently utilized amount (8.1 mgd annual average) from the quantity available (76 mgd annual average), which equals an annual average of 67.9 mgd.

The quantity available for the development of potential options for each river was determined by subtracting the permitted withdrawal (if there was one) from the quantity of water available. Using the Peace River as an example, the permitted withdrawal for the PR/MRWSA (32.7 mgd annual average), was subtracted from the quantity available (76 mgd annual average) which leaves an annual average of 43.3 mgd. Water supply development options for the unutilized portions of permitted withdrawals were not identified for the RWSP. This was because existing projects and infrastructure developed by the permittees generally addressed these quantities.

The total amount of surface water in the planning region that is potentially available to meet future demands ranges from about 144 to 244 mgd. The lower end of this range is the amount of surface water that has been permitted but is currently unused. Approximately two-thirds of the currently permitted but unused surface water is allocated to Tampa Bay Water to assist the utility in reducing wellfield withdrawals and meeting demands through 2010. The upper range includes this amount plus an additional 99 mgd which is the amount of water that is potentially available based on the established withdrawal criteria, and that is currently not associated with a WUP. The following is a discussion of water availability for each of the major river systems.

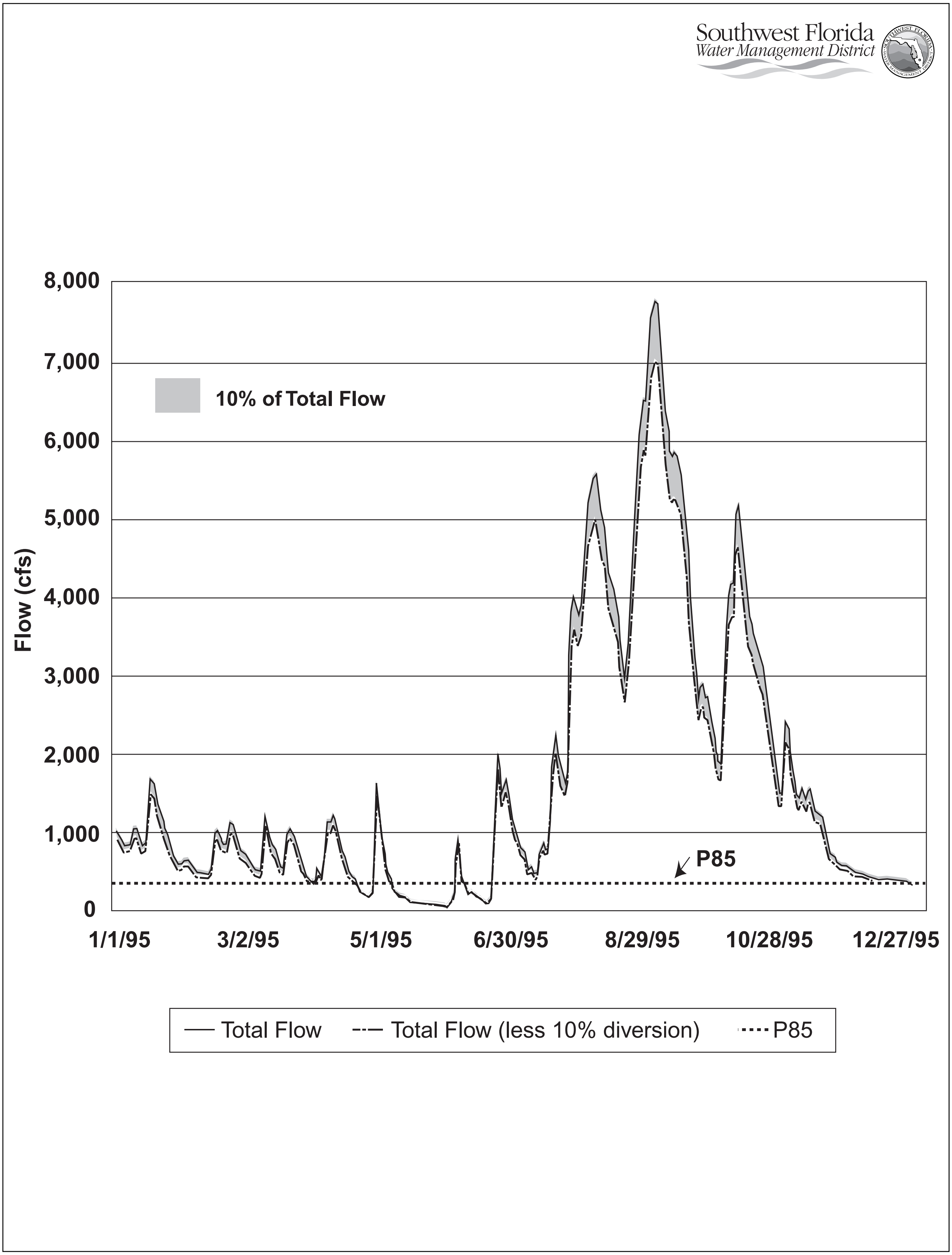


Figure IVB-5. Hydrograph of Peace River Flow in 1995 Illustrating the Effect of the 10 Percent Diversion and P85 Withdrawal Criteria on River Flow.

1.0 Anclote River

The Anclote River originates in south-central Pasco County, and discharges to the Gulf of Mexico at Tarpon Springs. The headwaters are poorly defined, and consist of mostly agricultural and natural lands.

The lower one-third of the watershed is heavily developed with residential dwellings (SWFWMD, 1988c). The watershed is about 120 square miles, and contains several recording stations with long-term streamflow data. The mean discharge for the period of record from 1965-1998 at the most downstream gauging station is 69 cfs (44 mgd) (CH2M Hill, 2000). Currently, there are no permitted withdrawals from the river. Average annual potential yield from the river is 2.8 mgd based on 10 percent of daily flows above the P85.

2.0 Hillsborough River

The most hydrologically significant river within the NTB area is the Hillsborough River, with a watershed of approximately 650 square miles. The interactions between the Hillsborough River watershed and the Upper Floridan aquifer are quite complex, and result in large wetland areas that act as ground-water discharge points in some areas, and perched surface-water storage basins in others.

Although most of the river systems in the NTB area are fed almost totally by overland flow or surficial aquifer discharge, the Hillsborough River receives significant contributions from the Upper Floridan aquifer. The river system originates in the Green Swamp, but much of the baseflow entering the river is discharged from the Upper Floridan and surficial aquifers along the course of the river. Several reaches of the river have direct contact with the Upper Floridan aquifer, and many springs are found along the bottom and banks. The banks of the Hillsborough River have been developed for residential use in lower reaches of the river, and the river is dammed for public water supply ten miles upstream from its mouth. The greater part of the headwaters and upper reaches of the river is undeveloped. The mean discharge for the period from 1965-1998 at the Dam is 387 cfs (250 mgd) (CH2M Hill, 2000). The City of Tampa is permitted for average annual withdrawals of up to 82 mgd from the river based on historical flow data and their permit diversion schedule. Recently, Tampa Bay Water was permitted to withdraw additional quantities of water from the river during periods of high flow. Applying their permit diversion schedule to historical river flows for the period 1975 to 1995 results in an average annual yield of 31 mgd. Based on the withdrawal criteria of 10 percent and the P85 minimum flow, there is little or no additional yield that can be developed from the Hillsborough River.

3.0 Tampa Bypass Canal

The Tampa Bypass Canal (TBC) System was built by the U.S. Army Corp of Engineers to provide flood protection for the Tampa metropolitan area. The canal system was completed in 1984, and extends 18 miles from McKay Bay to the Trout Creek area. The canal system breaches the Upper Floridan aquifer in some areas, and acts as a conduit for ground-water exchange to and from the canal. During the dry season, the City of Tampa augments their reservoir with up to 20 mgd on an annual average basis from the TBC through a water use permit held by Tampa Bay Water. The mean discharge for the period of record from 1975-1998 at the TBC (S160) is 134 cfs (87 mgd) (CH2M Hill, 2000). Average withdrawals from the TBC for the period of 1993-98 were 7.2 mgd. As part of the recovery plan for the NTB wellfields, Tampa Bay Water was also permitted to withdraw additional quantities of water from the TBC during periods of high flow. Applying their permit diversion schedule to historical flows for the period 1975 to 1995 results in an average annual yield of up to 29 mgd. Based on the withdrawal criteria of 10 percent diversions and the P85 minimum flow, there is little or no additional yield that can be developed from the TBC.

4.0 Alafia River

The largest part of the Alafia River basin is located in Hillsborough County. The drainage area of the entire basin is approximately 460 square miles. The mean flow at Bell Shoals Road is 403 cfs (260 mgd) (CH2M Hill, 2000). The headwaters of the Alafia River system are located in Polk County, where the land has been mined extensively for phosphate ore. The Alafia River extends about 23 miles from its mouth at Hillsborough Bay near Gibsonton, eastward to the confluence of its two major tributaries: the North Prong and South Prong. Below the confluence of the North and South Prongs, the river has three major tributaries: Turkey, Fishhawk, and Bell Creeks. Currently, no water is diverted from the river. Cargill Inc., withdraws annual average quantities of 4.3 mgd at Lithia and Buckthorn Springs, which supply baseflow to the river. As part of the recovery plan for the NTB wellfields, Tampa Bay Water was recently permitted to withdraw approximately 22 mgd based on historical flows. Based on the withdrawal criteria of 10 percent diversions and the P85 minimum flow, there is about 3.4 mgd of additional yield that can be developed from the Alafia River.

5.0 Little Manatee River

The Little Manatee River basin straddles the Manatee-Hillsborough county line. The river extends almost 40 miles from its mouth at Tampa Bay near Ruskin eastward towards its origins in southeastern Hillsborough County. The area of the drainage basin is approximately 225 square miles. Several small tributaries contribute flow to this river system, including Dug, Cypress, and Carlton Branch Creeks. Tidal effects in the Little Manatee are discernable up to 15 miles upstream from the mouth (SWFWMD, 1988a). Florida Power and Light (FPL) withdraws water from the Little Manatee River to maintain a cooling pond reservoir for power generation use. The mean flow for the period of record from 1965-1998 at the FPL site is 151 cfs (97 mgd) (CH2M Hill, 2000).

Average annual diversions for the period from 1994-98 were 3.7 mgd. Under a SWFWMD permit agreement, FPL is permitted to withdraw an annual average of 18 mgd based on historical flow and their diversion schedule. There is about 2.1 mgd of additional yield that can be developed from the Little Manatee River based on the established withdrawal criteria.

6.0 Manatee River

The Manatee River basin is located completely within Manatee County. The river originates in northeast Manatee County, near Duette, and flows 45 miles to its mouth at the south end of Tampa Bay. The Manatee River system drainage area is approximately 330 square miles, including 83 square miles of the Braden River system. A dam was built on the river in 1968, impounding about six miles of the river's middle reach forming Lake Manatee. Since tidal influences reach approximately 20 miles upstream from the mouth or 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 mean flow for the period of record from 1981-1998 at the Manatee River Dam is 232 cfs (150 mgd) (CH2M Hill, 2000). The Manatee County Utility Department is permitted for average annual withdrawals of 35 mgd. Average annual diversions for the period from 1994-98 were 25 mgd. There is little or no additional water available from the Manatee River based on the established withdrawal criteria limiting withdrawals to 10 percent of total flows and the P85 minimum flow.

7.0 Braden River

The Braden River discharges to the tidal reaches of the Manatee River about eight miles from Tampa Bay. From its confluence with the Manatee River, the river channel extends seven miles southeasterly and then about 12 miles easterly to its headwaters. The upper reaches of the system consist of channelized tributaries in central Manatee County. No gauging stations presently exist on the Braden River. A water-supply reservoir, Ward Lake (38 acres), was created in 1938 by damming the river just south of State Road 70. The size of the reservoir was enlarged in 1985 creating the Bill Evers Reservoir (230 acres). The river is tidally influenced below the dam. The mean discharge for the period of record from 1993-1998 at the Braden River is 110 cfs (71 mgd) (CH2M Hill, 2000). The City of Bradenton Utility Department is permitted for average annual withdrawals of seven mgd. Average annual diversions for the period from 1994-1998 were 5.5 mgd. Average annual potential yield from the river is 2.3 mgd above the permitted amount based on 10 percent of daily flows above the P85.

8.0 Myakka River

The Myakka River has been designated as a Wild and Scenic River and an Outstanding Florida Water. It extends 69 miles from its mouth at Charlotte Harbor northeasterly to its origins near northeast Manatee County and has a drainage area of approximately 550 square miles (SWFWMD, 1988b). Major tributaries are Owen and Deer Prairie Creeks. Most of the tributary channels of the system are bordered by extensive swampy areas. Although the Myakka River receives very little natural ground-water baseflow, it has recently been determined that significant quantities of ground water withdrawn for agricultural operations have been seeping into the Myakka River and augmenting flows, especially during the dry season.

Seventy-three percent of the river's annual flow occurs during the wet season, and the river has a broad, seasonally-inundated floodplain. Much of the watershed is composed of widespread marshes. The Upper and Lower Myakka Lakes are located along the Myakka River, and have a combined surface area of 1,380 acres. The mean flow for the period of record, from 1965-1998, at the Myakka River near Sarasota is 387 cfs (250 mgd) (CH2M Hill, 2000). There are currently no permitted withdrawals from the river, although the Blackburn Canal diverts river flows during some periods of the year and provides flood protection. Average annual potential yield from the river is 19 mgd based on 10 percent of daily flows above the P85.

9.0 Peace River

The Peace River system begins at the Green Swamp and flows in a southerly direction to Charlotte Harbor. The Peace River watershed comprises approximately 1,800 square miles. Peace Creek drains approximately 93 square miles in the northeast part of the basin, serving as an outlet for several lakes near the towns of Lake Alfred and Haines City. Saddle Creek Canal drains 231 square miles in the central and western portions of 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 4,553 acres. In this area, surface-water drainage is ill-defined. South of Bartow to about Ft. Meade, the watershed has been significantly altered by phosphate mining activities. Major tributaries south of Ft. Meade include Horse Creek, Joshua Creek, and Charlie Creek. The PR/MRWSA operates a regional water supply facility in southwest DeSoto County that contains an 85-acre off-stream reservoir and nine ASR wells. An additional 11 ASR wells have been added as a part of an ongoing expansion of the PR/MRWSA. Mean flow at the Peace River water treatment plant from 1965 through 1998 was 1,176 cfs (760 mgd) (CH2M Hill, 2000). The PR/MRWSA is permitted to deliver an annual average of 32.7 mgd from the Peace River. The Authority, however, is able to withdraw 10 percent of the total flow of the river up to a maximum of 90 mgd when the flow, as measured at the Arcadia stream gauge, is above 130 cfs (84 mgd) for the purpose of maximizing storage in its onsite reservoir and/or ASR system. Average annual diversions for the period from 1994-98 were 8.1 mgd. Average annual potential yield from the river is up to 40 mgd above the amount permitted to the PR/MRWSA based on 10 percent of daily flows above the P85.

10.0 Shell Creek

The Shell Creek/Prairie Creek watershed is about 400 square miles in extent and empties into the upper reaches of Charlotte Harbor. It is the largest sub-basin in the Peace River watershed. Shell Creek was impounded in 1964 by the construction of a dam, which created an 835-acre in-stream reservoir used for municipal supply by the City of Punta Gorda. The mean flow for the period of record from 1965-1998 at the Shell Creek reservoir is 340 cfs (220 mgd) (CH2M Hill, 2000). The City of Punta Gorda Utility Department is permitted for average annual withdrawals of 5.4 mgd. Average annual diversions for the period from 1993-98 were 3.7 mgd. Average annual potential yield from the river is 17 mgd above the permitted amount based on 10 percent of daily flows above the P85.

Section 3. Reclaimed Water

Reclaimed water is defined by the FDEP as water that is beneficially reused after being treated to at least secondary wastewater treatment standards by a domestic wastewater treatment plant (WWTP). The use of reclaimed water decreases the reliance on potable water supplies, as well as reduces the discharge of WWTP effluent to surface waters.

The use of reclaimed water as a non-potable water supply has a long history in Florida. The City of Tallahassee started one of the first reclaimed water systems in Florida in the mid 1960s. By the late 1970s the City of St. Petersburg had the largest reclaimed water system in the United States. The City currently provides an average daily flow of 20 mgd for residential irrigation and industrial/commercial use. Over the past decade, the District has provided more than $120 million in grant funding to over 125 reclaimed water projects.

There are five basic types of reclaimed water systems. These types are defined by usage and treatment standards.

- Slow-Rate Land Application Systems; Restricted Public Access: Although these systems produce high quality water, the public is restricted from contact. This water is used for edible crop irrigation, pasture irrigation, and some cooling towers and process water.
- Slow-Rate Land Application Systems; Public Access Areas; Residential Irrigation; and Edible Crops: Many of these systems produce reclaimed water that meets most or all drinking water standards. This water is used for edible crop irrigation, residential irrigation, golf courses, street cleaning, dust control, fire protection, decorative fountains, cooling towers and process water.
- Rapid-Rate Land Application Systems; Rapid Infiltration Basins and Absorption Fields: These systems enable high quality reclaimed water to percolate into the soil and ultimately the aquifer. Ground Water Recharge and Indirect Potable Reuse: The reclaimed water used in these systems typically meets all drinking water standards. This water is used for ground-water recharge by injection, and discharge into surface waters that can be used for drinking water.
- Industrial Uses of Reclaimed Water: The reclaimed water used in these systems can be of restricted public access quality or higher. This water is used for cooling towers, process water, and steam generation.

The quality of reclaimed water varies and was not a limiting factor in the planning analysis performed as each type of reclaimed water has a set of criteria that must be met before the reclaimed water can be used. Complete descriptions of the various regulations governing reclaimed water are contained in Chapter 62-610, FAC.

To determine the current availability of reclaimed water in the region, District staff inventoried existing WWTPs and those that are currently under construction, with treatment capacities of one mgd or larger. The one mgd threshold was chosen because it would account for approximately 96 percent of all the wastewater flows in the planning region and because of the economic and regulatory infeasibility of suppling reclaimed water from the hundreds of smaller plants. There are 75 WWTPs with capacities of one mgd or larger included in the inventory (Figure IVB-6). Data on WWTPs were gathered using a variety of methods, including questionnaires, FDEP reports, District reports, and phone calls to each utility. The data collected on each of the plants included the projected 1995 to 2020 design capacity, wastewater flows, and reuse flows.

In 1995, 50 WWTPs were providing customers with 67 mgd of reclaimed water. The majority of these plants were providing reclaimed water for irrigation. While 67 mgd is a large amount, it represents only 23 percent of the 296 mgd of reclaimed water that was available. The remaining 229 mgd of reclaimed water was disposed of into surface waters or injected into deep wells.

The percent of WWTP flows utilized in reclaimed water systems (utilization rate) varies by utility. At best, only 40 to 50 percent of WWTP flows actually go to reclaimed water customers. The 1995 capacity, flow, and reuse at WWTPs in the planning region are included in Appendix IVB-2.

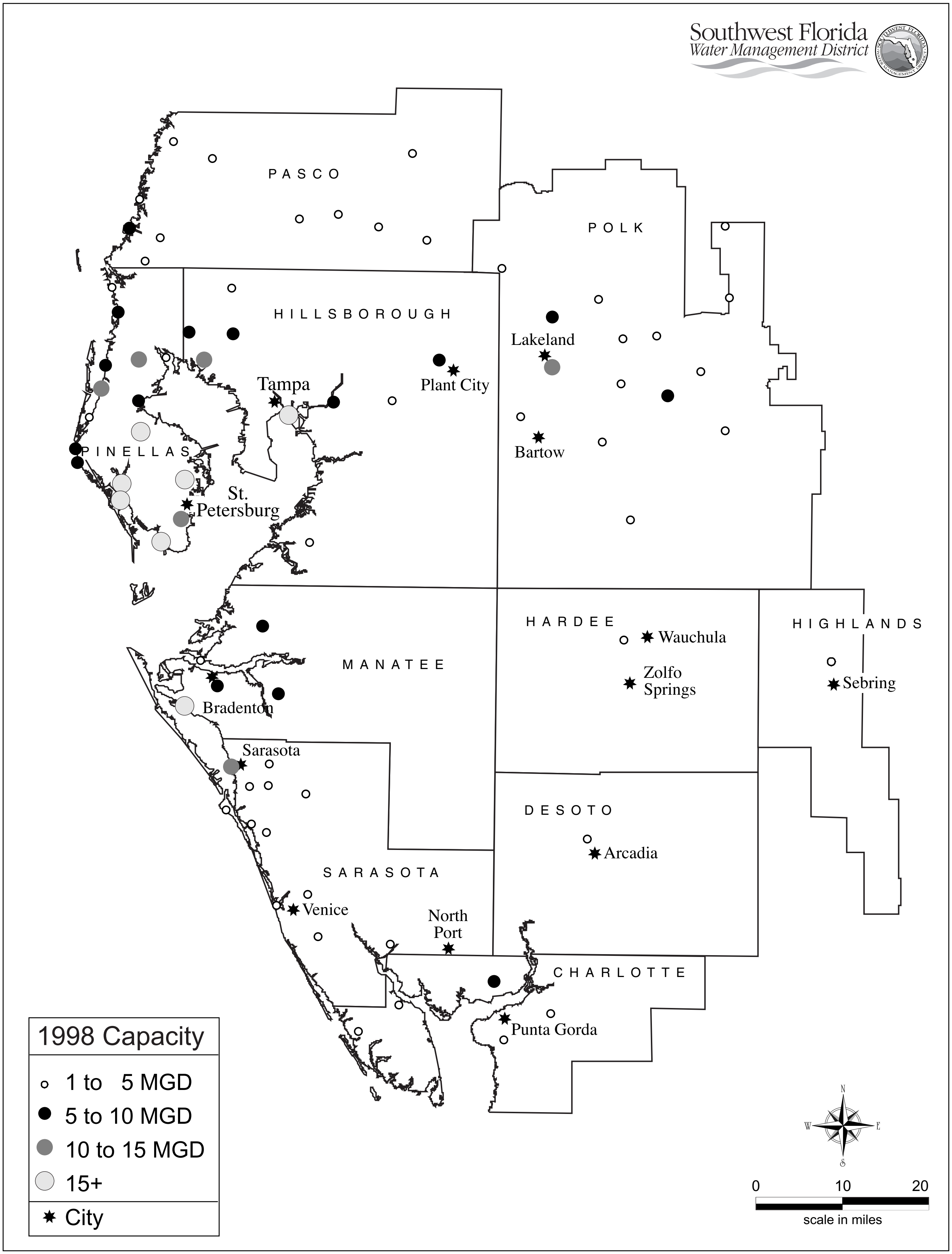


Figure IVB-6. Location of Wastewater Treatment Plants in the Planning Region with Capacities of One MGD or Greater.

The highest utilization rates (40 to 50 percent) occur in coastal areas which typically have large populations and, therefore, large WWTP flows. The coastal areas also tend to have limited irrigation water supplies. In rural areas limited WWTP flows reduce the potential for the development of reclaimed water systems.

Utilization is also limited by seasonal supply and storage. The daily and seasonal supply of reclaimed water from a WWTP is normally fairly constant, however, the daily and seasonal demand from customers for that supply can be highly variable. A reclaimed water utility's utilization rate is limited by the peak demand/supply ratio.

A utility cannot expand its system beyond peak flow demand. For example, a reclaimed water system with a one mgd flow normally is limited to supplying 0.5 mgd (50 percent utilization) on a yearly basis. This is because during the dry season demand for reclaimed water for irrigation can more than double. The key to increasing utilization beyond 50 percent is developing seasonal storage to capture and store reclaimed water that is available during the wet season when demand is low. This stored reclaimed water can then be used to augment the daily reclaimed water flows to meet peak demand in the dry season. In order to store these large volumes of seasonally available reclaimed water, surface-water reservoirs and/or reclaimed water ASR systems will be required. In addition to seasonal storage, systems may have the opportunity to increase utilization by supplementing their reclaimed water systems with "other" water sources during peak demand periods, thereby enabling the system to develop a larger customer base.

Another reclaimed water issue of concern is reclaimed water offset. Reclaimed water offset is defined as the amount of traditional water sources (ground water, surface water) that is replaced by reclaimed water usage. Customers tend to use more reclaimed water than potable water because reclaimed water is generally less expensive. For example, a single family residence using potable water for irrigation (e.g. about 300 gpd) will tend to limit irrigation due to the expense associated with metered, potable water. The same single family residence that has converted to an un-metered, flat-rate, reclaimed water irrigation supply will tend to use up to four times (1,200 gpd) as much reclaimed water as potable water. In this example, the offset rate would be 25 percent. A power plant or industry using 1 mgd of potable water for cooling or process water, after converting to reclaimed water, will normally use the same amount (1 mgd) of reclaimed water as potable water. In this example, the offset rate would be 100 percent. Most reclaimed water utilities provide service to a wide variety of customers, and as a result, the average reclaimed water offset rate is estimated to be 60 percent. The District is actively pursuing ways for utilities to increase reclaimed water utilization and offset. For example, efficiency can be further enhanced with practices such as efficient irrigation design and modifications.

To estimate future reclaimed water availability, each county's estimated percentage increase in public water supply demand (1995-2020) was determined (Chapter IVA, Part B, Section 3). Since WWTP flows are related to public water-supply demand, the percentage increase in public water supply demand was multiplied by the actual 1995 WWTP flows in each county to obtain an estimated 2020 WWTP flow by county. (Table IVB-3).

Table IVB-3. Wastewater Treatment Plant Flows By County (mgd).

County	Actual 1995 WWTP Flow	Projected Increase 1995 to 2020 (%)	Projected 2020 WWTP Flow
Pasco	14.34	+43	20.51
Pinellas	118.5	+12	132.72
Hillsborough	85.31	+35	115.25
Manatee	23.65	+48	35.00
Sarasota	20.55	+40	28.85
DeSoto	.85	+47	1.25
Charlotte	5.39	+77	9.54
Polk	26.13	+63	42.54
Hardee	1	+15	1.15
Highlands	1	+55	1.55
Total	**296.72**		**388.36**

The self-supply and small utility estimations were not included in the reclaimed water calculations, as they would not contribute significantly to the supply of wastewater to the systems identified as suitable to supply reclaimed water.

To calculate future reclaimed water availability, the estimated 2020 WWTP flow was multiplied by two potential reclaimed water utilization rates; 50 percent (existing system build-out average) and 75 percent (the District's target build-out average). Actual 1995 reuse was then subtracted to arrive at the estimated 2020 reuse availability. The available reuse amounts were multiplied by the estimated offset rates of 60 percent (existing systems average) and 75 percent (the target systems average for the RWSP). The potential amounts of reclaimed water available (2020 WWTP flow of 388 mgd), potential utilization (post 1995 at 75 percent is 224 mgd) and potential offsets (168 mgd at 75 percent beneficial offset) are included in Table IVB-4.

Table IVB-4. Potential Reclaimed Water Availability, Utilization, and Estimated Offsets (mgd).

Region	1995 WWTP Flows	1995 Reuse	Projects Planned and Constructed by 2005	Total Projected 2020 WWTP Flows	Post 1995 Projected 2020 Reuse (50%)	Post 1995 Projected 2020 Reuse (75%)
Planning Region	296	67	128	388	127	224
Beneficial Offset (60%)		40			76	134
Beneficial Offset (75%)		50			95	168

Section 4. Conservation

Water conservation is considered by the District to be an alternative water supply, and is defined as the beneficial reduction of water use through mandatory or voluntary actions resulting in (1) the modification of water use practices, (2) the reduction of unaccounted-for losses, or (3) the installation and maintenance of low volume water use systems, processes, fixtures or devices.

Since the mid-1980s, water users in the planning region have been able to rely on the District for financial and technical assistance in the implementation of local water conservation efforts. Water users are encouraged to work with District staff for assistance with the implementation of water-saving programs and water conservation education.

Water savings have been achieved in the planning region through a combination of regulatory, economic, educational and incentive-based measures. While codes and ordinances requiring water efficiency are encouraged, these typically affect new water uses. Economic measures, such as water-conserving rate structures for customers of public supply systems, are also encouraged. If well-developed and customized to suit the customer base, such measures can be effective. Since education is crucial to any well-planned and implemented program, water conservation education is an essential part of any conservation option. Offering incentives to achieve needed water conservation is a widely-used practice not only within the planning region, but on a national and international scale, as well.

1.0 Non-Agricultural Water Conservation

Ayres Associates, Inc., (Ayres) was the consulting firm selected to assist District staff in identifying the specific conservation measures that could be implemented by the water users in the public supply, domestic self-supply, recreation/aesthetic, industrial/commercial and mining/dewatering (I/C and M/D) categories in the planning region. Before identifying future potential water conservation options, it was necessary to inventory the existing and planned future conservation measures within each category. Surveys were conducted with permittees in all non-agricultural categories in conjunction with efforts to determine projected future demand. Questions related to each permittee’s past, present and planned future water conservation efforts were included on the surveys. Responses to these surveys were used as one data set to determine future potential savings from the implementation of conservation measures. Where responses to survey questions were not provided, District reports were used. These included the *Retrofit Programs and Reuse Projects Summary Report (SWFWMD, 1998)* the *Water Conservation in the Tri-County Area of the Southwest Florida Water Management District* Report (SWFWMD 1998), and various Basin Five-Year Plans.

Potential conservation measures that may be applicable for each category in the region were evaluated for individual water savings potential and cost effectiveness. Such measures included both voluntary and mandatory measures, and offered both indoor and outdoor water savings. Voluntary measures are those in which non-agricultural permitees or utility water customers may choose to participate; mandatory measures are those which a local government or utility may choose to enforce on water users within its jurisdiction or service area. For the purposes of calculating potential savings, the domestic self-supply category for which conservation measures are applicable includes both domestic self-supply and small utilities.

Based on the evaluation of all potentially applicable measures, specific ones were selected for further analysis. The measures considered for analysis include:

- High-efficiency clothes washer rebates
- Plumbing retrofit kit give-aways
- Ultra low volume (ULV) toilet rebates
- ULV urinal rebates
- Residential water use surveys
- Water-efficient landscape and irrigation system rebates
- Industrial, commercial and institutional (ICI) water use surveys
- Large landscape water use surveys
- Rain sensor shut-off device rebates
- Water budgeting

The further analysis included factors which affect the effectiveness of water conservation practice. Some of the secondary factors which were also considered during evaluation and ranking of the water conservation measures included:

- Applicable water use categories
- Number of water users that may participate within each category
- Water savings rate of each measure
- Potential acceptability of the measure to participants and the implementing entity
- Compatibility with existing programs, or those that may be implemented concurrently
- Functional life of the measure
- Short term and long term effectiveness of a measure
- Cost-effectiveness ratio
- Level of ease with which a measure can be implemented
- Possibility of implementation on a regional basis

"High efficiency clothes washers" is an example of how the secondary factors influence the decision-making process. Public acceptability is still very low, mainly because of high cost. Therefore, although this measure has a significant savings potential, it was not included in the list of potential conservation options until such time as the public can be expected to participate in a program.

A program period was determined for each option that could be implemented within each water use category in each county. An estimate of potential savings was based on several assumptions, including an assumption that options would begin to be implemented in 2000, and continue through 2020. The future savings attributable to water conservation took into consideration the rate of growth projected to occur in each category as projected in the future water use demand projections, discussed in Chapter IVA. It is important to note that although eight percent is considered to be the most appropriate rate to be used for non-agricultural water conservation, it is different from the rate used to evaluate other options described in this plan.

Equipment, research and development, and training costs were considered as "fixed" costs in estimating the costs of each measure. Such costs are anticipated to be incurred only once by each agency implementing a given measure, and only during the first year of the program. In addition to fixed costs, the actual cost of providing rebates, surveys, etc., was incorporated. The total cost per measure was discounted at eight percent to convert all programs to year 2000 dollars. This rate was used because it is the rate the District uses to calculate cost-effectiveness ratios for similar project proposals under the Cooperative Funding Program (see Chapter VI), and is considered to be reasonable for conservation programs.

It is important to note that interactions between two or more of the conservation measures listed exist and could alter the overall water savings and program costs. For example, an "overlap" of savings can occur for water users participating in both water efficient irrigation system rebates and residential water use surveys. However, for the RWSP, each measure was evaluated individually and the combined costs and full potential of water savings for each measure were considered separately. This was necessary to identify appropriate and potentially effective conservation measures. However, it is recognized that this method could count a part of the savings twice, if for example, more than one exterior water conservation measure was selected for a specific water use sector. At the same time, costs would theoretically be less if two measures were implemented concurrently by one agency since start-up costs may only need to be incurred once. It was not possible to take into account the interaction or the overlap between the measures without first selecting the conservation measures. To account for the possible overlap, the participation rate (or saturation rate) for different conservation measures was assumed to be lower than the full potential.

Water budgeting is the only mandatory measure included on the list of options, and is applicable to all non-agricultural water use categories in each county throughout the region. The concept of water budgeting primarily refers to water used for irrigation purposes, and includes the allocation of a specific amount of water to be used throughout the year. It is recommended the measure be implemented by a local government or a water supply utility with the ability to monitor water use, and the authority to enforce the budgets, using penalty rates or fines, for example. An amount of water savings is associated with this option since budgets encourage water users to irrigate only as needed, according to accepted principles, such as those included in Xeriscape™ landscaping.

Because each measure was evaluated for its regional implementation, the practices investigated included those which could be implemented similarly across the planning region and, therefore, the associated costs and savings could be measured and compared across the region. For that reason, some water conservation options with acknowledged water savings potential were not within the scope of investigation of the plan, but continue to be encouraged by the District. These include, but are not limited to, the implementation of measures such as water conservation rates, sub-metering of multi-family and commercial master-metered complexes, codes and ordinances requiring water efficiency, supply-side water conservation (leak detection, system audits, etc.), and development and dissemination of conservation education.

1.1 Public Supply and Domestic Self-Supply

Water conservation in the public supply sector has been, and is anticipated to be, the source of the majority of water savings in the planning region. Public supply systems lend themselves to the administration of conservation programs in that the water customer's water use is known, so the ability to focus and evaluate the program is facilitated. In addition, the utility system serves as a central program administrator, through which all activities can be coordinated. The success of public supply water conservation incentive programs is demonstrated by the 7.7 mgd in savings that has been achieved within the planning region since 1991 (SWFWMD, 1999). This savings is attributable to those programs to which the District provided financial assistance through the Cooperative Funding Program (see Chapter V). Nearly 4.5 mgd, or 57 percent of the savings have occurred in Hillsborough, Pasco and Pinellas counties.

Although some savings in the planning region have been achieved, future potential for savings for public supply systems in the region is still anticipated to be considerable. Some of the savings will occur due to national, state and/or local regulations. These regulations largely target interior plumbing fixtures and, to a limited extent, landscaping standards for homes and other development completed after the adoption of the regulations. However, plumbing efficiency improvements in older (primarily pre-1995) facilities are still anticipated to yield considerable water savings. In addition, exterior water use in general, and landscape irrigation in particular, present ample opportunity for water savings by customers of public water suppliers.

All of the measures included for evaluation, with the exception of ULV urinal rebates, are considered to be applicable in the public supply and domestic self-supply water use categories. In the public supply category, measures were evaluated at the utility level, where it was assumed each type of program would be implemented and, therefore, costs would be incurred by a public supply utility. The implementation of measures within the domestic self-supply category, and the associated costs and savings, were evaluated at the county level. The best opportunity to achieve water conservation was considered to be for a county-wide entity, such as a branch of county government, to lead the implementation of a conservation program for domestic self-supply water users.

In determining potential water savings that could be achieved through each type of measure, it was assumed that the measures identified for each utility/county would be implemented in 2000 and continue through 2020. Only a portion of all county residents were assumed to be motivated to actually participate in a program related to a particular measure. It was further assumed that only a portion of establishments would participate, considering factors such as the age of the plumbing fixtures (post-1995 would not be eligible) and the number and types of programs previously offered to public and domestic self-supply water users in each county. For these reasons, the participation rates vary for each program in each utility and county, and none were assumed to be as high as 100 percent.

1.2 Recreation/Aesthetic

For the RWSP, the recreation/aesthetic category includes golf courses, and large landscapes that obtain water directly from ground-water and surface-water sources, rather than from a public supply system. Although documented information was not available, it is generally accepted that some amount of water savings has been achieved by recreation/aesthetic water users through the use of irrigation efficiency, improved irrigation technology, and landscape BMPs. The potential water savings reflect the implementation of exterior water conservation measures. It is expected that the large landscape surveys and the rain sensor shut-off device rebates are the two measures that would be applicable for implementation in this category.

In determining potential water savings for golf courses and for large landscapes, the number of each type of facility was determined. The number of golf courses was determined from District data used for the demand projections (Appendix II-1). It was assumed that the total number of large landscapes, cemeteries, parks and playgrounds is equal to the number of golf courses in each county as identified in Chapter IVA as part of demand projections. As with public supply and domestic self-supply, participation rates depend on the nature of the program. Assumptions specific to each type of measure applicable to this category are provided in Chapter IVD.

1.3 Industrial/Commercial and Mining/Dewatering

The industrial/commercial (I/C) and mining/dewatering (M/D) category includes those factories, mines, power plants and other commercial enterprises that obtain water directly from surface and/or ground-water sources through a WUP. For the RWSP, the water conservation options most applicable for water users in this category were limited to water use surveys and landscape efficiency. Although it is acknowledged that water savings can be achieved by improving the efficiency of water-using industrial processes, the associated quantities and costs cannot be determined without a site-specific assessment of water use at each facility, or at least several similar facilities. Such an assessment was beyond the consultant scope of work. According to the surveys sent to I/C and M/D permittees while determining projected water demand (Appendix II-1), water use efficiency improvements related to industrial processes are being made to a limited extent. However, in only a few cases were survey respondents able to estimate the savings associated with the improvements (SWFWMD, 1999).

To date, District-related activities to affect water conservation in the I/C and M/D categories have been concentrated on education, and limited research. Conservation measures applicable to this category include ICI surveys and large landscape surveys. The number of permittees that could implement the measures were obtained from District data used for demand projections (Appendix II-1). Participation rates depend on the nature of the program; as with other categories the participation rate is always assumed to be less than 100 percent. Details related to how these options apply to the I/C and M/D category are described in Chapter IVD.

1.4 Non-Agricultural Water Conservation Summary

Through the implementation of all options available to local governments, private entities and other water users, it is anticipated that between 75 and 95 million gallons of water could be saved each day, at a cost of less than $2.00 per thousand gallons saved. This range represents the volume of water that could be saved by implementing voluntary measures only (75 mgd), versus the implementation of both voluntary and mandatory measures (95 mgd). Table IVB-5 indicates the potential non-agricultural water conservation that could be achieved in each category. The savings listed are considered by the consultants to reflect conservative estimates.

2.0 Agricultural Water Conservation

An important component of the RWSP is the identification of conservation options that potentially could be employed by agriculturists to stretch existing supplies of water over the next 20 years. Project consultants led by HSW Engineering, Inc., have assisted the District in identifying options and estimating potential water savings and associated costs. The following options have been identified:

Table IVB-5. Potential 2020 Regional Savings: Non-Agricultural Water Conservation.

Identified Measures	Total Savings (mgd)	Total Cost ($/Kgal)
Voluntary Measures		
Public Supply	60.0	$0.47
Domestic Self-Supply	12.6	$0.49
Recreation/Aesthetic	1.9	$0.60
I/C and M/D	0.2	$1.95
Mandatory Measures		
Water Budgeting	20.6	$0.16
Total	**95.3**	**$0.42**

Source:Ayres Associates, Inc., April 2000

- Conversion to more water-conserving irrigation systems
- On-farm decision support systems (irrigation scheduling programs)
- Tensiometers
- Shallow water table observation wells
- Automatic pump controls
- Variable rate pumping
- Water flow meters
- Laser leveling
- Seepage interception/horizontal wells
- Tailwater recovery/rainwater harvesting

Other potential conservation practices (pervious mulch, implanted reservoir tillage) were researched for possible inclusion in the model farm case studies designed to estimate water savings and associated costs. However, due to a lack of data relative to the use of these techniques in Florida-specific site applications, they were not included as conservation options in the RWSP.

2.1 Design of "Model Farms" to Estimate Water Savings and Associated Costs

To estimate the costs that might be incurred by a 'typical' agricultural operation to implement one or more of the identified conservation options, project consultants developed 20 'model' farms that are typical of a variety of different agricultural operations in the planning region. Commodities included in the model farm studies were citrus (flatwoods and ridge: Model Farms 1,2), tomatoes (Model Farms 3,4,5), field nurseries (Model Farms 6,7), container nurseries (Model Farm 8), sod (Model Farms 9,10), other vegetables/row crops (Model Farms 11,12,13), watermelons (Model Farms 14,15,16), cucumbers (Model Farms 17,18,19), and strawberries (Model Farm 20).

During the selection and development of the 20 model farm case studies, it was recognized that the model design parameters and case study results may not be directly transferrable to all operations within a given commodity category due to the relative degree of site-specific diversity. Further, the model farm designs should not be construed to represent a predetermined outcome of a particular regulatory directive. The model farm case studies should be viewed as a necessary construct to facilitate a standard basis for comparison of cost analyses and for estimation of water savings.

Cost estimates associated with the implementation of conservation options were developed from publicly available data and from direct contact with suppliers. Estimated water savings achievable through the implementation of conservation options were obtained by using the District's AGMOD program to calculate the estimated water use savings as water use efficiencies increase. Estimated water use efficiencies were obtained from literature sources, IFAS researchers, and industry experts. Estimated cost effectiveness ratios were then expressed in terms of estimated cost per acre and estimated cost per 1,000 gallons of water saved.

The estimated water savings derived from the individual model farm case study analyses under 5-in-10 (average annual) and 1-in-10 drought conditions are illustrated in Tables IVB-6 and IVB-7, respectively. The estimated savings associated with the various conservation options were based on a 75 percent participation rate by growers. This participation rate was selected based on an assumption that an acceptable level of financial assistance would be available in order to provide sufficient incentives for growers to participate in adopting the conservation options. Table IVB-8 is an estimate of the total amount of water savings that might be achievable in 2020 under average annual conditions through the implementation of agricultural conservation options (assuming adequate financial assistance to achieve a 75 percent participation rate). If no irrigation system conversions occurred but all applicable BMPs were implemented, an estimated 34 mgd could be saved. If all possible conversions to the most water-conserving irrigation system technologies were accomplished and all applicable BMPs were implemented, an estimated 41 mgd could be saved.

3.0 Potential for Water Conservation and Reuse to Meet Future Demands

Water conservation has tremendous potential to help meet future water demands. In Table IVA-9, 364.1 mgd of projected increase in demand from 1995 through 2020 is identified. Adding in the currently identified demand for environmental restoration of 68 mgd (the reduction in ground-water withdrawals required as part of the recovery plan associated with the adoption of minimum flows and levels in the northern Tampa Bay area) results in a total demand of 432.1 mgd. The discussion in Chapter VI, Part C., Potential Funding for Plan Implementation, explains that 215.5 mgd of the 432.1 mgd demand has been accounted for by projects that are either completed, under development, or planned with secured or pledged funding. This leaves 216.6 mgd that is not yet under development or planned.

Figure IVB-7 shows that if all of the non-agricultural water conservation options (95 mgd) and all agricultural water conservation options (41 mgd) are implemented and combined with the 168 mgd that can potentially be obtained from reclaimed water, the resulting 304 mgd could play a major role in meeting future demand.

Table IVB-6. Model Farm Savings 5-in-10 (Average Annual) Conditions.

Description of Model Farm/Irrigation System/BMP Scenario				**Water Savings in MGD**					
Model Farm Scenario ID	**Crop**	**Existing Irrigation System**	**New Irrigation System**	**2000**	**2005**	**2010**	**2015**	**2020**	**Average (2000 to 2020)**
1	Citrus-flatwoods	Microbe	No	7.18	7.43	7.68	7.92	8.17	7.68
2	Citrus - ridge	Microbe	No	7.05	7.27	7.49	7.71	7.92	7.49
3	Tomatoes, Myakka soil, fall or	Semi-Closed Seepage	No	2.83	3.01	3.20	3.40	3.59	3.21
4	Tomatoes, myakka soil, fall, spring	Semi-Closed Seepage	Drip	4.24	4.52	4.80	5.10	5.38	4.81
5	Tomatoes, myakka soil, fall, spring	Semi-Closed Seepage	Fully-Enclosed Seepage	3.96	4.22	4.48	4.76	5.02	4.49
6	Field nurseries	Semi-Closed Seepage	No	1.37	1.41	1.44	1.47	1.50	1.44
7	Field nurseries	Semi-Closed Seepage	Fully-Enclosed Seepage	1.92	1.97	2.02	2.06	2.10	2.01
8	Nurseries - container	Semi-Closed Seepage	Line Source Emitter (spaghetti tube)	0.03	0.03	0.03	0.03	0.03	0.03
9	Sod	Semi-Closed Seepage	No	4.26	4.82	5.38	5.77	6.16	5.28
10	Sod	Semi-Closed Seepage	Center Pivot Sprinkler	6.73	7.62	8.51	9.13	9.74	8.35
11	Other Veggies and Row Crops	Semi-Closed Seepage	No	1.56	1.59	1.61	1.64	1.66	1.61
12	Other Veggies and Row Crops	Semi-Closed Seepage	Fully-Enclosed Seepage	2.19	2.23	2.26	2.29	2.32	2.26
13	Other Veggies and Row Crops	Sprinkler	Drip	0.55	0.56	0.57	0.57	0.58	0.56
14	Watermelons	Semi-Closed Seepage	No	1.22	1.22	1.22	1.22	1.22	1.22
15	Watermelons	Semi-Closed Seepage	Fully-Enclosed Seepage	1.70	1.70	1.70	1.70	1.70	1.70
16	Watermelons	Semi-Closed Seepage	Drip	1.82	1.82	1.82	1.82	1.82	1.82
17	Cucumbers	Semi-Closed Seepage	No	0.80	0.81	0.83	0.84	0.85	0.83
18	Cucumbers	Semi-Closed Seepage	Fully-Enclosed Seepage	1.12	1.14	1.16	1.17	1.19	1.16
19	Cucumbers	Semi-Closed Seepage	Drip	1.20	1.22	1.24	1.26	1.27	1.24
20	Strawberries	Drip	No	1.95	2.11	2.27	2.40	2.53	2.25

Table IVB-7. Model Farm Savings 1-in-10 (Drought) Conditions.

Description of Model Farm/Irrigation System/BMP Scenario				**Water Savings in MGD**					
Model Farm Scenario ID	**Crop**	**Existing Irrigation System**	**New Irrigation System**	**2000**	**2005**	**2010**	**2015**	**2020**	**Average (2000 to 2020)**
1	Citrus-flatwoods	Microbe	No	12.53	12.96	13.40	13.84	14.28	13.40
2	Citrus - ridge	Microbe	No	11.28	11.62	11.97	12.31	12.66	11.97
3	Tomatoes, myakka soil, fall or spring	Semi-Closed Seepage	No	2.83	3.01	3.20	3.40	3.59	3.21
4	Tomatoes, myakka soil, fall or spring	Semi-Closed Seepage	Drip	4.24	4.52	4.80	5.10	5.38	4.81
5	Tomatoes, myakka soil, fall or spring	Semi-Closed Seepage	Fully-Enclosed Seepage	3.96	4.22	4.48	4.76	5.02	4.49
6	Field nurseries	Semi-Closed Seepage	No	1.56	1.60	1.64	1.67	1.71	1.64
7	Field nurseries	Semi-Closed Seepage	Fully-Enclosed Seepage	2.19	2.24	2.30	2.34	2.39	2.29
8	Nurseries - container	Semi-Closed Seepage	Line Source Emitter (spaghetti tube)	0.03	0.03	0.03	0.04	0.04	0.03
9	Sod	Semi-Closed Seepage	No	5.12	5.80	6.47	6.94	7.41	6.35
10	Sod	Semi-Closed Seepage	Center Pivot Sprinkler	8.10	9.16	10.22	10.97	11.72	10.03
11	Other Veggies and Row Crops	Semi-Closed Seepage	No	1.56	1.59	1.61	1.64	1.66	1.61
12	Other Veggies and Row Crops	Semi-Closed Seepage	Fully-Enclosed Seepage	2.19	2.23	2.26	2.29	2.32	2.26
13	Other Veggies and Row Crops	Sprinkler	Drip	0.55	0.56	0.57	0.57	0.58	0.56
14	Watermelons	Semi-Closed Seepage	No	1.22	1.22	1.22	1.22	1.22	1.22
15	Watermelons	Semi-Closed Seepage	Fully-Enclosed Seepage	1.70	1.70	1.70	1.70	1.70	1.70
16	Watermelons	Semi-Closed Seepage	Drip	1.82	1.82	1.82	1.82	1.82	1.82
17	Cucumbers	Semi-Closed Seepage	No	0.80	0.81	0.83	0.84	0.85	0.83
18	Cucumbers	Semi-Closed Seepage	Fully-Enclosed Seepage	1.12	1.14	1.16	1.17	1.19	1.16
19	Cucumbers	Semi-Closed Seepage	Drip	1.20	1.22	1.24	1.26	1.27	1.24
20	Strawberries	Drip	No	1.95	2.11	2.27	2.40	2.53	2.25

Table IVB-8. Estimated Water Savings of Model Farm Scenarios at Year 2020 (mgd), 75 Percent Participation, 5-in-10 (Average Annual) Rainfall Year.

Crop	BMPs Only	Full Conversion
Citrus	16.09	16.09
Tomatoes	3.59	5.38
Field Nurseries	1.50	2.10
Container Nurseries	0.03	0.03
Sod	6.16	9.74
Other Vegetables/Row Crops	1.66	2.32
Melons	1.22	1.82
Cucumbers	0.85	1.27
Strawberries	2.53	2.53
Totals	**33.63**	**41.28**

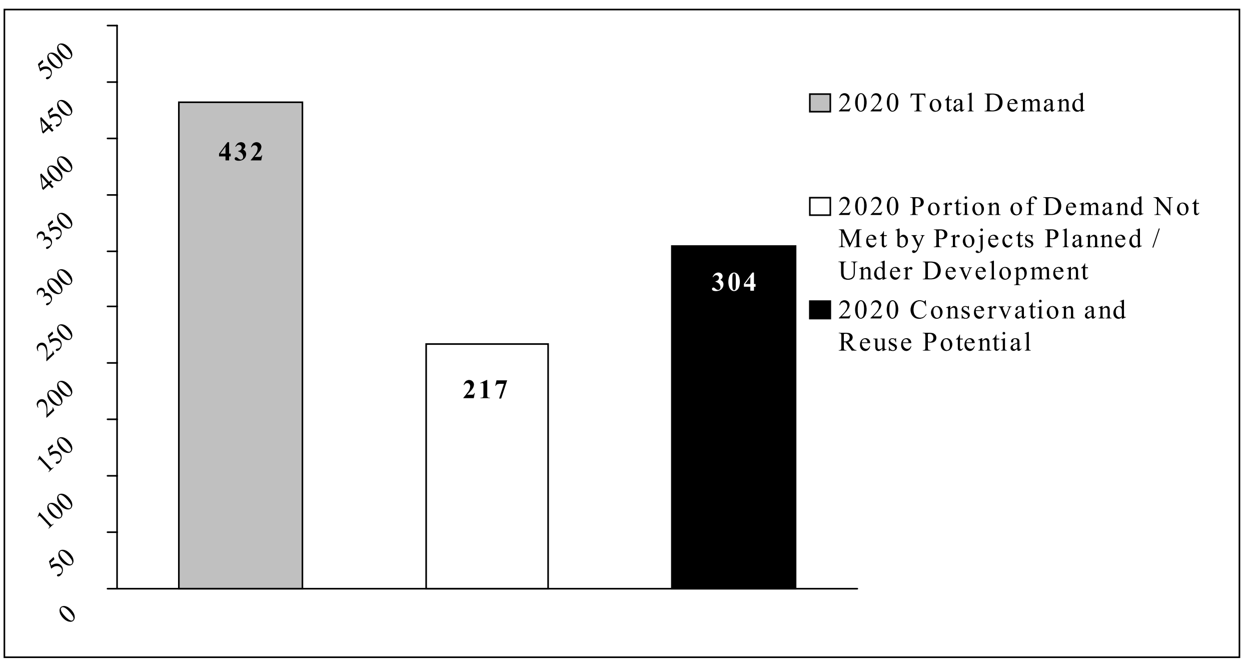


Figure IVB-7. Total Demand (mgd) in the Planning Region through 2020 versus the Quantity of Water (mgd) that Could Potentially be Saved or Developed through Conservation and Reclaimed Water Options.

The potential for water conservation to meet demands is particularly evident in the public supply and agricultural water use sectors. Figure IVB-8 shows that the additional regional demand for public supply is projected to be 181 mgd by 2020 and that the portion of this demand that is not accounted for by projects that are completed, under development or planned with secured or pledged funding is about 100 mgd. The Figure also shows that water conservation options have the potential to meet about 95 mgd of these demands, if all options are implemented.

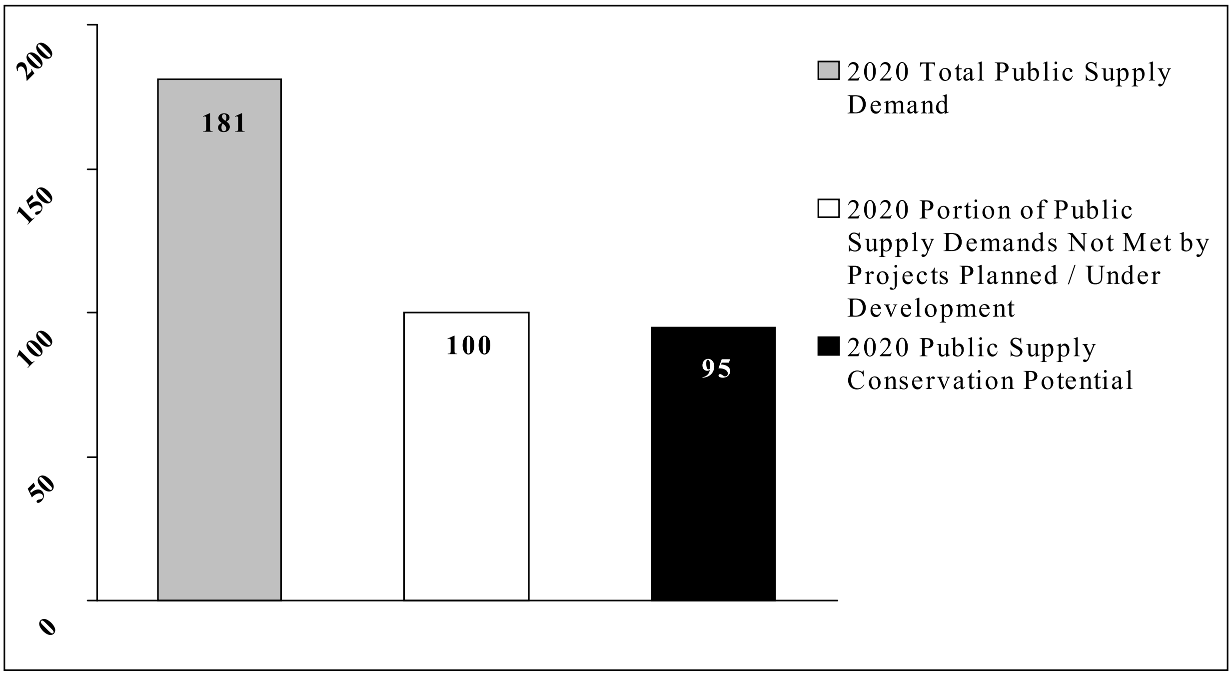


Figure IVB-8. Public Supply Demand (mgd) in the Planning Region through 2020 versus the Quantity of Water (mgd) that Could Potentially be Saved through Public Supply Water Conservation Options (does not include the 168 mgd reuse potential).

Figure IVB-9 shows that additional agricultural demands are projected to be 122 mgd by 2020 and that the portion of this demand that is not accounted for by projects that are completed, under development, or planned with secured or pledged funding is approximately 78 mgd. The Figure also shows that water conservation has the potential to meet 41 mgd of this demand.

Although the potential for water conservation and reclaimed water options alone to meet the 216.6 mgd 2020 demand does exist, there are a number of reasons why such a scenario may not be feasible. First, the District does not have the authority to prescribe the sources of water to users that they will develop to meet their demands. Second, the development of a variety of sources provides greater assurance that regional demands can be met. Developing only water conservation and reclaimed water options will likely render the region less able to address issues related to system variables such as demand peaking and seasonal stress.

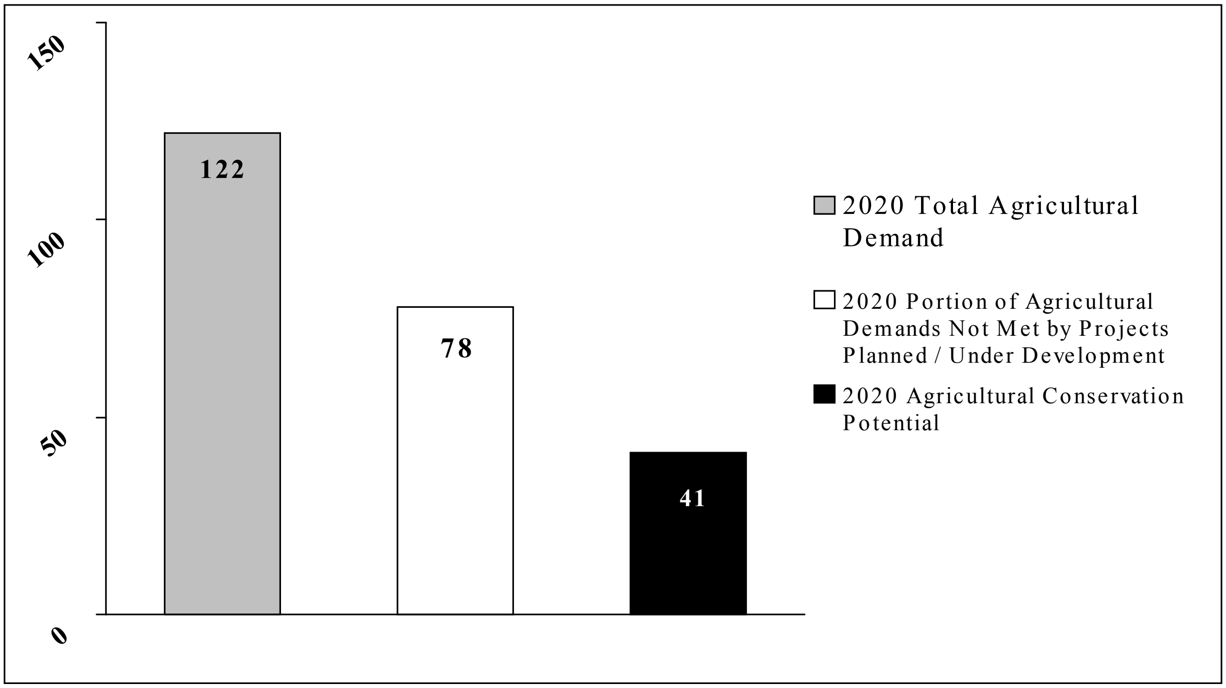


Figure IVB-9. Agricultural Demand (mgd) in the Planning Region through 2020 versus the Quantity of Water (mgd) that Could Potentially be Saved through Agricultural Water Conservation Options (does not include the 168 mgd reuse potential).

Third, the success of water conservation projects in particular, and reclaimed water projects to a lesser degree, is dependent upon the decisions of the end-user. The development of a variety of sources reduces the uncertainty associated with this dependency. Finally, in some areas of the District, great success has been achieved with the use of reclaimed water and water conservation, while success in other areas has been limited. The distribution and magnitude of conservation and reuse efforts must be heightened before these sources can begin to be considered sufficient to meet demands throughout the planning region.

While it may not be feasible for reclaimed water and water conservation projects to reliably meet all of the demands of the region over the next 20 years, it is the goal of the District to enhance these efforts to the greatest extent practicable. Ongoing efforts to include conservation and reuse in water supply planning will be continued. The significant role that conservation and reuse can play in water supply development in the region is emphasized in many of the District's existing programs. Planning documents such as the RWSP, the District Water Management Plan, Basin Plans and Comprehensive Watershed Management Plans identify water conservation and reclaimed water as key factors in addressing water supply issues. Regulatory efforts, such as permitting rules that require conservation plans in the water use caution areas and water restrictions, address demand management. In addition, substantial incentive programs such as the Cooperative Funding Program offer financial assistance toward the development of water conservation and reclaimed water projects.

The District has enhanced its outreach efforts to attempt to mobilize the community. Through efforts like the Water Conservation Task Force, formed in 2000, the benefits of and the awareness of the need for water conservation and the efficient use of reclaimed water are emphasized. Such efforts are planned to continue and even increase throughout the planning horizon.

Section 5. Brackish Ground Water

Brackish ground water is defined as ground water having impurity concentrations greater than drinking water standards (TDS concentration greater than 500 mg/l) but less than seawater (TDS equal to or greater than 35,000 mg/l) (SJRWMD, 1998 b). Within the planning region, brackish ground water is found principally in the near coastal portions of the Floridan and intermediate aquifers. Figure IVB-10 depicts the generalized location of the freshwater/saltwater interface (as defined by the 1,000 mg/l isochlor) in the high production zone of the Upper Floridan aquifer throughout the planning region. Generally, water quality in the aquifer declines (TDS increases) to the south and west in the planning region. A similar trend is observed in the lower portion of the intermediate aquifer though water quality in this aquifer is slightly better than in the Upper Floridan aquifer.

In contrast to seawater, brackish ground water is a more limited source of water. Though brackish ground water remains a viable source of water, it is important that future withdrawals of brackish ground water are planned and operated so as not to exacerbate regional movement of the interface. Factors affecting the development of brackish ground water include the hydraulic properties and water quality of the aquifer, rates of ground-water withdrawal, and well configurations (e.g., well depths and spacings). Though it is expected that the withdrawal of brackish ground water will cause some degradation of the aquifer, it is usually localized and can be moderated and controlled through the optimization of withdrawals and well configurations.

Historically, brackish ground-water desalination has been a more expensive source of water than traditional fresh ground-water or surface-water sources. Because of this, brackish ground water has primarily been used by public water suppliers and industries that have limited access to cheaper sources.

However, improvements in technology involving low pressure reverse osmosis (RO) and ultra-filtration membranes have substantially reduced operating costs for newer systems. Low pressure (up to 250 psi) RO systems can treat water containing up to 2,000 ppm TDS with an efficiency of about 90 percent; in contrast, high pressure (usually about 450 psi) RO systems are used to treat water containing from 2,000 to 10,000 ppm TDS with an efficiency of about 65 percent. As membrane efficiencies have increased, the operating pressures and energy needed to drive the process have declined, thus significantly reducing costs. In addition, most treatment facilities reduce their operating costs further through blending product water with a lower quality raw water.

The predominant treatment technology for brackish ground water in the District is RO. RO is a membrane separation process in which water from a pressurized saline solution is separated from the solutes (the dissolved material) by flowing through a membrane. Due to increased efficiencies of RO membranes, pressures and costs have been significantly reduced. The RO process results in fresh product water and a highly mineralized waste concentrate. Approximately 15 to 20 percent of the water used in the RO process becomes waste concentrate. The waste concentrate has a dissolved mineral content that is 4.5 to 6 times more concentrated than the source water and must be disposed of through

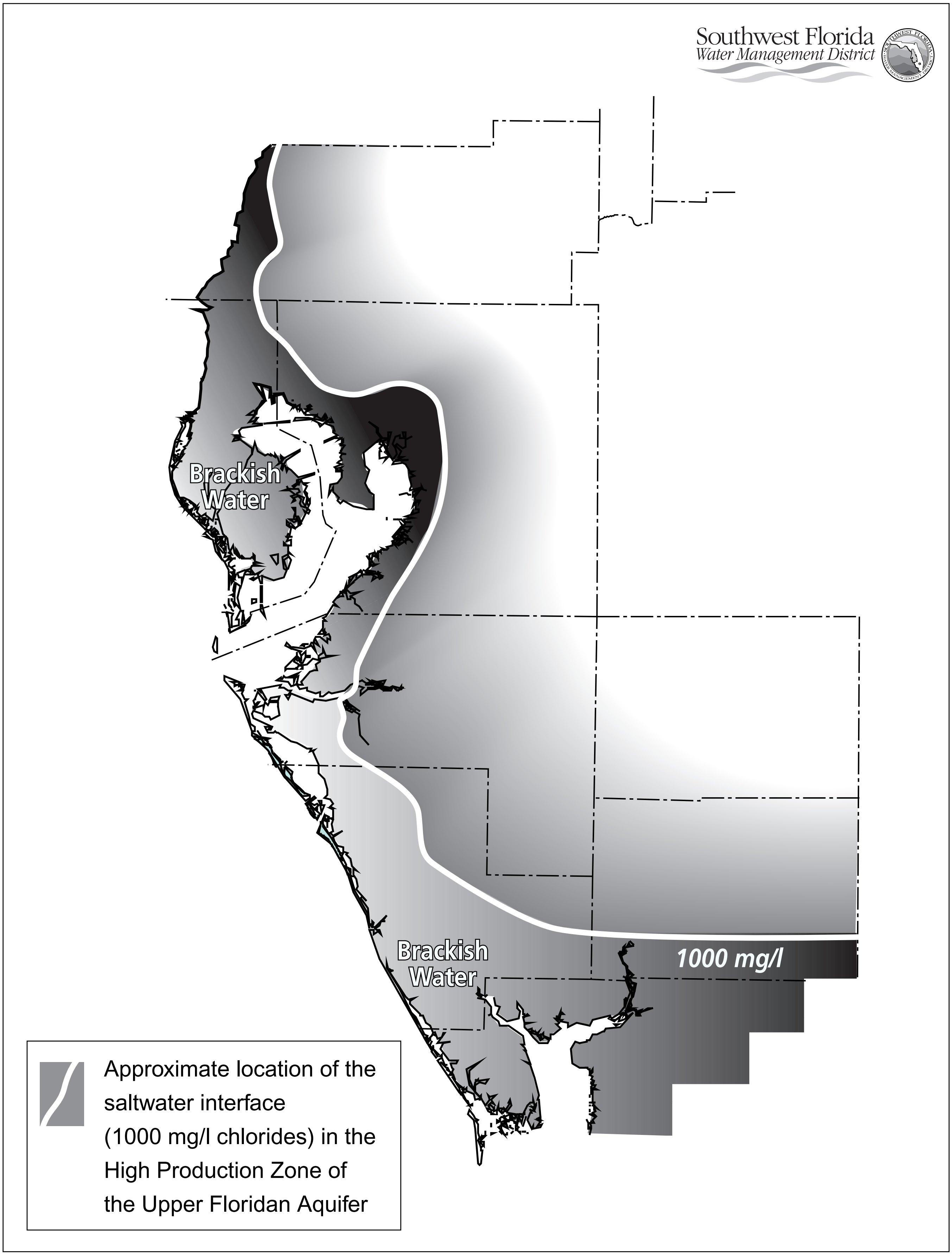


Figure IVB-10. Generalized Location of the Freshwater/Saltwater Interface in the Planning Region.

methods that include surface-water discharge, deep well injection, or dilution at a WWTP. Surface-water discharge is the predominant disposal method of waste concentrate due to its lower cost. However, due to environmental considerations, deep well injection and dilution at municipal WWTPs are becoming more prevalent.

Brackish ground-water desalination facilities within the planning region have mostly been located in Charlotte, Pinellas, and Sarasota counties, although Hillsborough and Manatee counties also contain brackish ground-water resources (Figure IVB-11). There have been 28 brackish ground-water desalination facilities in the region that have water use permits to supply potable water and/or that are permitted dischargers through the FDEP. Fifteen of these facilities have been issued WUPs through the District (Table IVB-9a) and the remaining 13 have operated below the District's permitting threshold (Table IVB-9b). In recent years, three facilities with WUPS and permitted withdrawals totaling 6.34 mgd, have been bought and retired by Sarasota County. As shown in Table IVB-9a, the total permitted capacity of the facilities requiring WUPs, not including the plants recently purchased by Sarasota County, was 37.9 mgd. From 1994 to 1998, the facilities in Table IVB-9a withdrew an estimated 28.4 mgd of brackish ground water and produced about 20 mgd of potable water. In the SWUCA, many of the existing plants withdraw from the lower permeable zone of the intermediate aquifer and the shallow portion of the Upper Floridan aquifer. Water quality concerns at these plants have generally been managed on a local, or wellfield, scale and do not appear to be directly related to the problem of regional saltwater intrusion in the high production zone of the Upper Floridan aquifer.

Because of the many factors involved, an analysis to determine the total amount of brackish ground water that is ultimately available for future water supply in the region was not performed. In determining the future availability of brackish ground water for the RWSP, it was decided to base this amount on the capacities that exist within the current brackish ground-water supply infrastructure and projects that are currently planned or under active consideration. The ultimate availability of this source in the future, whether new or through expansion of existing facilities, will be determined through the permitting process. As presented in the discussion of potential water supply options in Chapter IVD, a one mgd brackish ground water supply in Charlotte County was evaluated to provide an estimate of the cost to construct a brackish desalination facility in the southern portion of the planning region and was not meant to suggest a limit to the amount of this supply that may be available in the future. Therefore, future brackish ground-water supplies in the region may be provided by the currently unused capacities at existing plants and from three currently planned sites in the NTB area. A review of permitted capacities and current use from the 11 active facilities permitted by the District indicates there is an estimated 8.0 mgd (11.5 mgd of raw water converted using an efficiency of 0.7) of potable supply from brackish ground water that can be produced within the framework of the existing water supply infrastructure.

Tampa Bay Water and the City of Clearwater are currently in the process of developing brackish ground-water desalination plants in Pinellas County. The two plants being developed will be designed to supply up to five mgd each of potable water. In 1998, the City of Oldsmar and the District completed a feasibility analysis for developing a brackish ground-water supply for the City. The analysis concluded that the development of up to four mgd of potable water using brackish ground water at the City's treatment plant may be feasible.

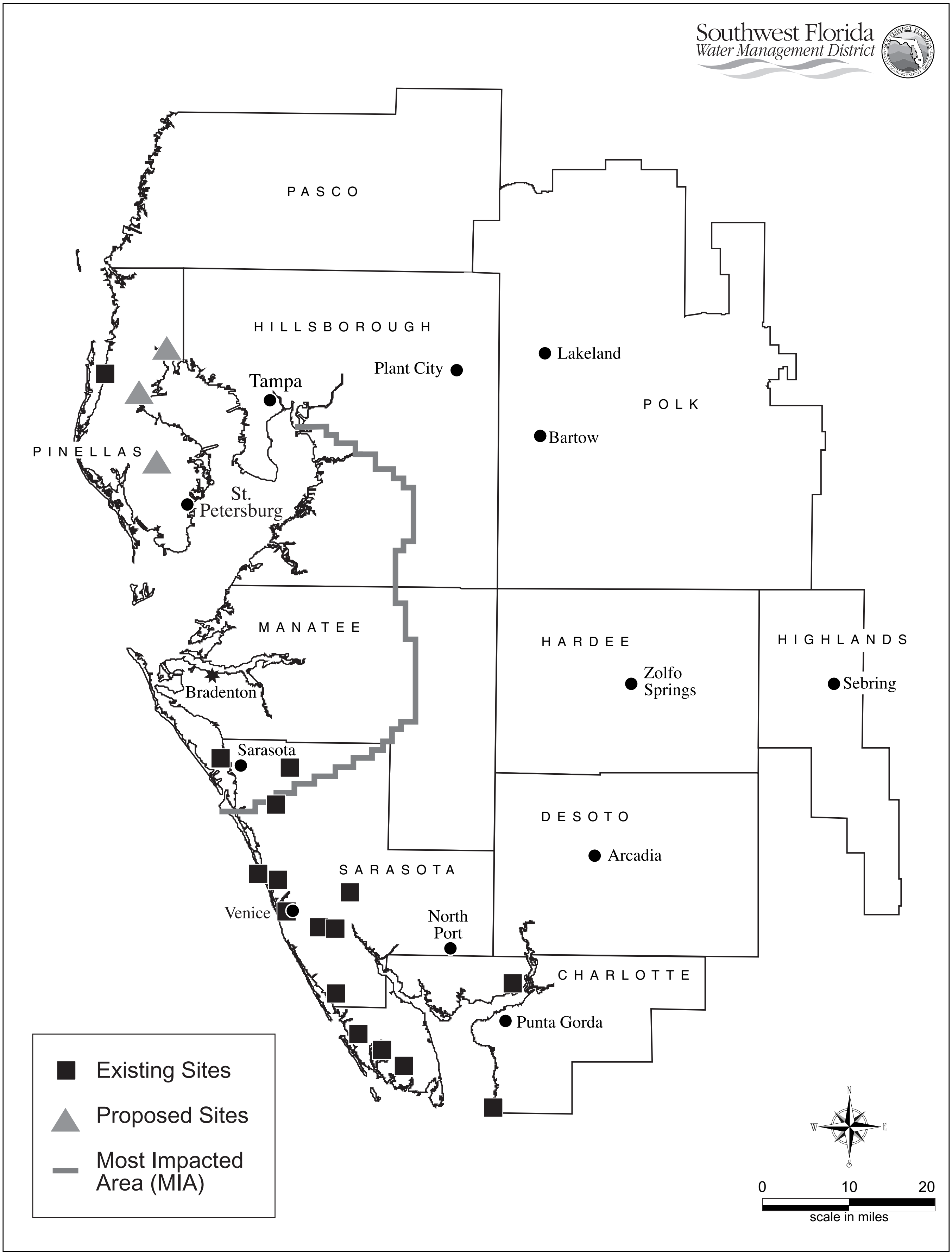


Figure IVB-11. Location of Existing Brackish Water Desalination Plants in the Planning Region.

Table IVB-9a. Large Scale Brackish Water Desalination Plants With Water Use Permits (mgd).

District WUP[6]	Name of Utility	County	Treatment Capacity	Permitted Withdrawal	5 Year Average Withdrawals[5]	Available in Permit	Source Aquifer	Water Quality TDS (mg/L)	Discharge Type
005807	Camelot	Sarasota	0.100	0.19	0.170	0.020	Int.	200 - 1000	Surface
001512	Charlotte Harbor	Charlotte	0.500	0.71	0.480	0.230	Int.	1200 - 1900	Surface
010224	City of Sarasota	Sarasota	6.000	6.0	4.750	1.250	UFA	2,100	Surface
005393	City of Venice	Sarasota	4.000	6.86	4.460	2.400	Int.	2,220 -4,080	Surface
002980	Dunedin	Pinellas	9.500	7.07	5.275	1.795	UFA	200 - 2200	WWTP[3]
004866	Englewood Water Dist.	Sarasota	2.500	5.36	3.150	2.210	Int.	2000 -4000	Deep Well
007494	Fiveland Investments	Sarasota	0.500	0.26	0.170	0.090	Int.	4,000	Surface
000718	Gasparilla Island	Charlotte	0.750	1.71	0.990	0.720	Int.	3,000 -7,000	Surface
006364	Plantation[1]	Sarasota	NA	1.5	NA	0.490	Int.	450 - 1000	WWTP[3]
002839	Rotunda West Utilities	Charlotte	0.500	1.34	0.780	0.560	Surf./ Int.	3,200 - 4,500	Surface
008836	Sara. County Carlton Plt[2]	Sarasota	12.000	7.30	6.000	1.300	UFA	1,000 - 2,000	Deep Well
006006	Southbay Utilities [1]	Sarasota	0.225	0.3	0.280	N/A	Int.	1450 - 4000	Surface
003522	SSU/Burnt Store	Charlotte	0.567	0.914	0.220	0.694	Int.	200 - 300	Surface
007448	Sun n Fun Resort Inc.	Sarasota	0.130	0.24	Insuffic. Data	Insuffic. Data	Int.	100 - 600	Surface
004836	Venice Gardens [1]	Sarasota	5.000	4.54	1.710	2.830	Int. /UFA	< 600 / < 4,000	Deep Well
Total			**42.3 [4]**	**44.294**	**28.435**	**14.589**			

[1] Based on discussions with John Knowles of Sarasota County, Sorrento, Southbay, Plantation, and Venice Gardens Utilities have been purchased by Sarasota County who has begun to service the water needs of these communities. Sarasota County has either removed or mothballed the Sorrento, Southbay, and Plantation utilities desalination infrastructure. However, Sarasota County may request to utilize the infrastructure and WUP quantities associated with Plantation and Venice Gardens Utilities to produce water to meet future water demands.
[2] Based on discussions with John Knowles, Sarasota County plans to apply for additional quantities up to 12 mgd for the Carlton RO Permit, to meet future needs.
[3] Waste concentrate is treated then diluted and disposed at a wastewater treatment facility.
[4] 42.272 mgd is the total capacity of all permitted facilities. However, the estimated total capacity of all facilities in use today is 37.047. Facilities not withdrawing water during the 1994-1998 time period.
[5] Five-year average withdrawals from 1994 through 1998, as reported in the SWFWMD's Estimated Water Use reports .
[6] Brackish water facilities were not included if they were discontinued before 1994.

Table IVB-9b. Small Scale Brackish Water Desalination Plants Without Water Use Permits (mgd).

Name of Utility	County	Treatment Capacity	Permitted Total Avg_Q	Source Aquifer	Water Quality TDS (mg/L)	Discharge Type[3]
Alligator Park [2]	Charlotte	0.060	No WUP	Int.	< 2000 [1]	SWP
Hunter Creek Village	Charlotte	0.170	No WUP	Int.	< 2000 [1]	SWP
Bay Lake Estates	Sarasota	0.050	No WUP	Int.	400 - 950	SWP
Ell-Cap 66	Sarasota	0.040	No WUP	Int.	450 - 900	SWP
Fairwinds MHP	Sarasota	0.030	No WUP	Int.	725 -1293	SWP
Kings Gate Club	Sarasota	0.050	No WUP	Int.	250 - 680	SWP
Kings Gate MHP	Sarasota	0.060	No WUP	Int.	300 - 740	SWP
Knight Island Utilities	Sarasota	0.030	No WUP	Int.	< 2000 [1]	SWP
Lake Tippecanoe	Sarasota	0.040	No WUP	Int.	< 2000 [1]	SWP
Lake Village MHP	Sarasota	0.050	No WUP	Int.	< 2000 [1]	SWP
Myakka State Park	Sarasota	0.050	No WUP	Int.	600 - 870	SWP
Venice Ranch MHP	Sarasota	0.035	No WUP	Int.	120	SWP
Windward Isles MHP	Sarasota	0.060	No WUP	Int.	< 2000 [1]	SWP
Total		**0.725**				

[1] This is a conservative water quality assumption for economic small scale low pressure reverse osmosis facilities.
[2] Estimated annual production from the plant operator who estimated 5 months of production at approximately 53,500 (gpd) and 7 months of production at 13,500 gpd.
[3] All concentrate discharges in this table were to surface/storm water ponds.

In summary, assuming an efficiency of 0.7 for future withdrawals, the potential amount of additional potable water supply from brackish ground-water consists of 8.0 mgd that is currently permitted but not yet developed; about 3.3 mgd from a potential expansion of Sarasota County's Carlton Reserve system to its maximum capacity of 12 mgd; an additional 3.2 mgd if Sarasota County's Venice Gardens facility is renewed; up to 10 mgd from two proposed brackish desalination plants to be developed in Pinellas County by Tampa Bay Water; 4 mgd as currently outlined for the 2010 time horizon by the City of Oldsmar; and 1.0 mgd from the water supply option presented for Charlotte County, for a total of about 29.5 mgd. Further development of brackish ground-water desalination beyond these projects is possible. As noted in Chapter IVD, it may be possible to use coastal brackish ground-water withdrawals to develop a water supply while stabilizing the landward migration of the interface. This idea will certainly need to be investigated further and will be pursued for future updates of the RWSP. However, it is generally believed that future development of brackish ground water will be on a localized scale and primarily used to supply coastal developments where access to freshwater supplies is limited.

Section 6. Seawater Desalination

Seawater is defined as water in any sea, gulf, bay, or ocean having a total dissolved solids concentration greater than or equal to 35,000 mg/l (SWFWMD, 2000). Seawater is readily accessible in the coastal regions of the District and can potentially be developed as a water supply on a very large scale.

Currently, there are no operating seawater desalination plants in the planning region. However, one of the cornerstone projects of the Partnership Agreement is the construction of a seawater desalination plant for Tampa Bay Water. This plant will be co-located with Tampa Electric Company's Big Bend Power Plant on Tampa Bay near Apollo Beach and will have a capacity of 25 mgd, expandable to 35 mgd. The District is providing $85 million toward the capital cost of this plant.

Water produced from this plant will be used to offset scheduled reductions in wellfield withdrawals and to meet future demand through the year 2010 in the NTB area. The estimated unit cost for delivery of this water to Tampa Bay Water's distribution system is $2.08 per 1,000 gallons over a 30 year period. This price sets a new standard for seawater desalination which historically has experienced costs ranging from approximately $4.00 to $8.00 per thousand gallons.

Two major problems associated with converting seawater to potable water have discouraged its development in the past. The first problem, excessive cost, has been minimized by recent technological improvements in the RO process (discussed in the previous section). These improvements have helped to narrow the gap in cost between seawater desalination and the development of traditional supplies such as ground water and surface water. The second major problem is the disposal of the waste concentrate. A National Pollution Discharge Elimination System (NPDES) permit from the USEPA must be obtained to discharge the concentrate into surface water. The planned desalination facility to be located at the Big Bend site will use an innovative design to dilute the waste concentrate in the same discharge pipe and discharge canal that returns the cooling water from the power plant to the Bay. About 20 mgd of concentrate will be mixed and diluted with up to 1.4 billion gallons per day (bgd) of seawater in the pipe. The end result will be a discharge water that is diluted to within approximately 1.5 percent of the ambient Bay water quality. An additional technical issue is determining the potential ecological effects of new seawater or surface water withdrawals.

Potential sites for large scale (at least 20 mgd) seawater desalination plants in the planning region have been identified as part of the RWSP process. The 20 mgd capacity was based on the economies of scale identified during the procurement process for Tampa Bay Water's seawater desalination plant at the Big Bend site. Four sites were evaluated and a discussion of these sites is presented in Chapter IVD. For planning purposes, it is estimated that 75 mgd of water supply can be provided through seawater desalination facilities located at these sites. This includes an additional 10 mgd at the Big Bend site, 25 mgd at the Anclote River site, and two 20 mgd options located in Manatee and Sarasota counties. When the 25 mgd currently planned for the Big Bend site is included, a total of 100 mgd of water supply could be produced in the planning region from seawater desalination. It is recognized that the potential exists to develop additional quantities of water through seawater desalination beyond what has been presented in this RWSP. Future updates of the RWSP will continue to investigate this technology and the potential for developing this resource.

Chapter IV. Water Supply Development Component

Sub Chapter C. Water Supply Projects Under Development

Part A. Background

The Southwest Florida Water Management District contributes substantial funds toward the development of sustainable water supplies on an annual basis. These funds come primarily from four sources, including:

- The Cooperative Funding Program of the Basin Boards
- The New Water Sources Initiative (NWSI) funded by the Governing Board and Basin Boards
- Water Supply and Resource Development Fund
- The Partnership Agreement (funded through the NWSI)

Determining whether these funds and associated projects should be categorized as "water resource development" or "water supply development," pursuant to the statutory definitions is very problematic. To give a comprehensive understanding of the substantial assistance provided by the District for overall water development, a general description of these programs and the water resource and supply development projects funded by them is provided below. Combined, District funding for water resource and water supply development in Fiscal Year 2000 totals $55,379,773, representing 28 percent of the District's total budget.

This "Sub Chapter" provides an overview of the District's ongoing programs and activities related to the implementation of water resource and water supply development projects. Included are overviews of the District's Cooperative Funding and New Water Sources Initiatives programs, and water supply projects funded through the Partnership Agreement with Tampa Bay Water.

Section 1. Cooperative Funding Program

The District is unique among the five water management districts in the State with its composition of eight Basin Boards. The Boards share the ad valorem millage capacity of the organization with the Governing Board and fund water resource management projects specific to each Basin. The Basin Board Cooperative Funding Program funds projects on a cost share basis primarily with local governments (although other entities, including private entities, are included). Projects include reuse, conservation, stormwater management, hydrologic investigations, and education, among others. Included here is a brief description of those projects which are water resource and supply development related, including reuse of reclaimed water and conservation projects.

As of Fiscal Year (FY) 1999, the Basin Boards have provided $121 million in co-funding for 450 water resource and supply development projects through the Cooperative Funding Program. As an indication of the success of this program, approximately 74 percent of the WWTPs in the District supplied reclaimed water as of 1998. These WWTPs supplied 140 mgd of reclaimed water and reused 40 percent of the wastewater generated in the District. Between 1990 and 1998, the volume of reclaimed water increased by 75 percent.

In some areas of the District, the demand for reclaimed water exceeds the available supply. As a result of the efforts of the District and local governments to develop reclaimed water supplies, reuse in the District is expected to increase from 140 mgd to greater than 200 mgd within the next decade. The combined effects of reuse, conservation and education have resulted in a declining trend in per capita water use throughout the District's 16 county area.

Section 2. New Water Sources Initiative (NWSI) Projects

The NWSI was established by the Governing Board as a part of its FY 1994 budget. FY 2000 represents the seventh year of NWSI funding. The purpose of this fund is to enhance financial assistance opportunities for alternative water supply projects. The Governing Board has allocated $10 million per year for eligible NWSI projects. Beginning in FY 1995, Basin Boards receiving benefits from the selected projects have matched the Governing Board's $10 million per year. NWSI projects generally receive 25 percent of their funding from the Governing Board, 25 percent from the appropriate Basin Board(s) and the remaining 50 percent from the cooperator. In addition, a number of NWSI projects have received federal funding assistance. As of FY 2000, the NWSI has provided approximately $93 million in District (Governing Board and Basin Boards) funds for such projects as reclaimed water, stormwater reuse, surface water, and desalination. The FY 2000 NWSI Project Status Report provides a comprehensive review of all NWSI projects.

A major milestone in 1998 which affected the District's NWSI program was the adoption of the Tampa Bay Partnership Agreement. The Partnership Agreement is further described below.

1.0 Partnership Agreement

The Partnership Agreement, entered into by the District, Tampa Bay Water, and its member governments, provides for the development of a safe, sustainable, cost effective water supply through a cooperative approach. The development of new water supplies will enable Tampa Bay Water to meet phased reductions in pumpage at the 11 wellfields in its central system. Under the Partnership Agreement, Tampa Bay Water must reduce the total pumpage from 158 mgd to 121 mgd by December 31, 2002; and to 90 mgd by December 31, 2007. In order to accomplish these reductions and to meet growing demands of its member governments, Tampa Bay Water must develop at least 85 mgd of new water supply by December 31, 2007. Of the total 85 mgd of new supply, 38 mgd must be in operation by December 31, 2002. Tampa Bay Water's New Water Plan, which was submitted to the District in June 1998 and subsequently approved in August 1998, describes new water supply projects that may be implemented to achieve these objectives. Tampa Bay Water's New Water Plan projects that are eligible for District funding are summarized in Part B, Section 4 of this Chapter.

To assist Tampa Bay Water in meeting these objectives, the District is providing up to $183 million in funding assistance for eligible projects. These funds are derived from the NWSI through FY 2007. Eligible projects include alternative sources such as seawater desalination and surface water as well as transmission mains (pipelines). Traditional ground-water projects are not eligible for District funding. Demand management is also a key element of the Partnership Agreement. Under the Agreement, Tampa Bay Water must achieve 10 mgd in conservation savings by 2000 and an additional 7 mgd by 2005. To help Tampa Bay Water meet these goals, four Basin Boards in the Tampa Bay area have committed to continue their Cooperative Funding Programs with local governments. These Basin Boards intend to continue to provide at least $9 million per year through 2007 for cooperatively funded conservation and reuse projects that effectively reduce potable water demand.

Part B. Overview of Water Supply Projects Currently Under Development

Section 1. Reclaimed Water

The objective of the District's reuse initiative is to expand the use of reclaimed water for appropriate purposes such as irrigation for landscaping and crops, ground-water recharge and industrial cooling and processing in order to offset existing or future demands for limited potable water supplies. In funding reclaimed water projects, the District requires that at least 25 percent of the reclaimed water must offset existing or planned ground- or surface-water withdrawals in order to qualify for funding consideration. This policy is intended to reduce the use of potable water for outdoor landscape irrigation and, where allowed by state regulations, provide an alternative source for agricultural irrigation. Millions of dollars of cooperative funding have been invested Districtwide to assist in developing reuse projects, including construction and expansion of reuse transmission lines, pump stations and storage facilities to deliver reclaimed water to golf courses, recreational fields, commercial entities, community green spaces and industrial users (Table IVC-1). These projects have been conservatively estimated to offset potable water use by approximately 92 mgd (“Retrofit Programs, Reuse Projects and Outdoor Water Conservation Efforts Summary Report,” 1999).

Table IVC- 2 provides a description of each of the active reclaimed water projects in the planning region developed through the Cooperative Funding Program. The District’s funding criteria for reclaimed water projects has been evolving since it was initiated in the mid-1980s. The District continues to provide funding assistance for the fundamental components of reclaimed water systems (i.e., feasibility studies, master plans, transmission mains, and facilities for pumping and storage). In those areas of the planning region where the fundamental components are completed or nearly completed for the majority of systems, funding assistance for the components typically associated with reclaimed water distribution may be considered as well. In order to fund reuse distribution projects, the District requires that reuse efficiency measures be built into the project’s implementation. Examples of such measures include regulatory requirements through codes and ordinances, and meters to measure actual use. When reclaimed water began to gain acceptance as an alternative secondary source over 10 years ago, the prevailing philosophy was that use should be unlimited, thereby providing an incentive for customers to agree to receive service. In recent years, the District has adopted the philosophy that reclaimed water is a valuable resource that can be managed to offset potable water demand. Much discussion in Chapter IVD of this document is devoted to the need to increase reuse efficiency and beneficial offset in order to meet goals for the development of reclaimed water as a resource. The projects listed in Table IVC-2 (SWFWMD, 1999c) reflect only those projects cooperatively funded by the District, and do not account for the reclaimed water projects ongoing in the region without District assistance.

Table IVC-1. Summary of Reclaimed Water Projects[1] Cooperatively Funded through FY 2000.

District Board Providing Funding	Reclaimed Water Made Available (gallons/day)	Traditional Water Offset (gallons/day)	Gallons of Storage (millions)	Amount ($) Budgeted by the District[2]
Alafia River	2,455,400	2,000,000	2.50	$1,681,418
Coastal Rivers	11,200	1,250,770	6.00	$9,520,148
Hillsborough River	8,195,400	7,065,000	12.12	$7,781,635
Manasota	37,870,085	26,215,885	159.29	$15,782,549
NW Hillsborough	9,405,400	5,100,000	5.00	$6,282,558
Peace River	21,198,440	3,271,440	12.60	$11,478,528
Pinellas-Anclote	57,265,018	20,159,613	66.38	$61,169,940
Withlacoochee	1,353,000	928,000	1.50	$1,163,491
Governing Board	35,561,835	23,406,435	165.71	$17,071,476
Total	**173,315,778**	**89,397,143**	**431.10**	**$131,931,743**

[1] Includes those projects within the planning region.
[2] FY 1987- FY 2000 totals, not including Partnership Agreement funding.
Source: Retrofit Programs, Reuse Projects, and Outdoor Water Conservation Efforts, December 1999, SWFWMD.

Over the next five years the District expects to continue providing financial assistance for reclaimed water system expansions. For most of the planning region, the fundamental components will continue to be the focus for project implementation. In addition, the regionalization of systems through interconnections to maximize utilization will occur in many areas of the planning region. The projects anticipated to be implemented over the next five years include feasibility studies, design and construction of transmission mains (including interconnections), distribution lines, storage (above-ground and ASR), and pumping facilities. Increasing the beneficial reuse of reclaimed water is a priority for the District, and for some of the local cooperators. The improvement of reclaimed water system efficiency will be investigated in several counties in the planning region.

Appendix IVC-1 lists the reclaimed water projects that are anticipated to be implemented within the next five years. Cooperators are listed, along with the financial assistance they plan to request from the District through the Cooperative Funding or NWSI programs. Others are projects which are expected to be initiated by the District (Basin Initiatives). Local financial cooperation will be sought for those projects.

Section 2. Conservation Projects

The District has developed and implemented both regulatory and non-regulatory water conservation programs. The District's non-regulatory water conservation program spans all water-use types, including agricultural, urban, industrial and recreational categories, and typically include public education components. Continuous education efforts are especially important given the District's rapidly growing

Table IVC-2. Active Reclaimed Water Projects in the Planning Region, (1995 - 2001).

Cooperator	General Project Description	Reuse (mgd)			Customers (#)		Costs		
		Produced	Offset[1]	Stored	Type	Total	Total	District	$/Kg
Charlotte County									
Charlotte County	Transmission	0.00	0.20	0.00	Comm	1	$50,000	$25,000	$0.06
	Transmission	1.20	1.20	0.00	Comm, Res	6	$2,760,000	$1,380,000	$0.55
Englewood Water	Pumping, Storage, Transmission	1.20	1.20	0.00	Comm	TBD	$460,000	$230,000	$0.09
Punta Gorda	Feasibility Study	n/a	n/a	n/a	n/a	n/a	$58,895	$29,448	n/a
Hardee County									
Wauchula	Pumping, Transmission	1.00	1.00	0.00	Ind	1	$5,274,000	$2,294,000	$1.34
Bowling Green	Pumping, Transmission	0.20	0.20	0.00	Ind	1	$370,000	$185,000	$0.45
Highlands County									
Sebring	Master Plan	n/a	n/a	n/a	n/a	n/a	$40,000	$20,000	n/a
Hillsborough County									
Hillsborough Co.	Transmission	8.00	4.10	0.00	Res, Comm	400	$7,000,000	$3,500,000	$0.84
	Transmission, Pumping, Storage, Telemetry	14.00	6.20	6.00	Res, Comm	4450	$14,570,000	$7,285,000	$0.10
	Storage Tank*	0.00	0.00	5.00	All	n/a	$2,000,000	$1,000,000	n/a
	Storage ASR	0.75	Var	1.25	All	n/a	$1,000,000	$500,000	n/a
Tampa	Feasibility Study*	0.00	0.00	0.00	All	n/a	$400,000	$200,000	n/a
	Design	0.00	0.00	0.00	All	n/a	$1,200,000	$600,000	n/a
Plant City	Feasibility*	0.00	0.00	0.00	All	n/a	$80,000	$40,000	n/a
Manatee County									
Manatee Co.	Storage (ASR)	n/a	n/a	1.00	Res, Rec, Comm, Ag	TBD	$800,000	$325,000	n/a
	Transmission, Pump, Storage	20.00	20.00	14.00	Res, Rec, Comm, Ag	TBD	$37,670,000	$11,980,97	$0.45
Tropicana	Transmission, Pumping	0.79	0.79	0.00	Ind.	1	$300,000	$150,000	$0.92
City of Bradenton	Transmission, Pump, Storage	4.80	4.80	2.00	Res, Comm, Ind, Rec, Ag	TBD	$4,770,000	$2,385,000	$0.24
Braden River Utilities	Transmission, Pumping	1.30	1.30	0.00	Res, Rec, Comm	TBD	$399,950	$199,975	$0.07
Pasco									
Pasco County	Transmission*	0.35	0.35	0.00	Rec	1	$906,621	$434,750	$0.62
	Transmission, Storage*	0.30	0.30	2.00	Rec	2	$755,000	$377,500	$0.61

Table IVC-2. Active Reclaimed Water Projects in the Planning Region, (1995 - 2001).

Cooperator	General Project Description	Reuse (mgd)			Customers (#)		Costs		
		Produced	Offset[1]	Stored	Type	Total	Total	District	$/Kg
Pasco County	Storage	0.00	0.00	5.00	All	n/a	$1,075,000	$537,500	n/a
	Transmission	0.08	0.08	0.00	Rec, Agr	2	$600,000	$300,000	$1.81
	Storage (Pond)	0.00	0.00	Var	All	n/a	$3,631,960	$238,491	n/a
	Interconnect, Storage	0.00	0.00	2.00	All	n/a	$6,540,000	$2,903,896	N/A
	Interconnect*	0.00	0.00	0.00	All	n/a	$3,200,000	$1,600,000	N/A
	Leachate* Distillation	0.65	0.65	0.00	Ind	1	$4,000,000	$1,113,000	$1.48
	Transmission, Storage*	0.00	0.00	2.00	All	n/a	$1,987,175	$688,700	n/a
	Interconnect, Storage*	4.00	2.00	2.00	Res, Comm, Rec, Agr	TBD	$6,165,000	$2,882,500	$0.07
Zephyrhills	Transmission*	0.30	0.30	5.00	Rec	2	$340,000	$170,000	$0.27
Aloha Utilities	Transmission	0.63	0.63	0.00	Rec	1	$1,848,244	$924,122	$0.71
Dade City	Transmission	0.85	0.85	0.00	Agr	1	$2,187,500	$843,750	$0.62
Pinellas									
Pinellas County*	Transmission	1.50	1.50	0.00	Res, Ind, Comm	250	$9,488,000	$4,744,000	$1.52
	Transmission, Storage, Pumping	8.00	2.80	6.00	Res, Comm	5,368	$30,771,290	$13,499,84	$2.65
	Transmission	3.75	1.00	0.00	All	n/a	$3,622,800	$1,811,400	$0.87
	Storage	0.00	0.00	5.00	All	n/a	$1,000,000	$500,000	n/a
	Feasibility Study	0.00	0.00	0.00	All	n/a	$150,000	$75,000	n/a
	Transmission, Storage, Pumping	TBD	TBD	TBD	Res	n/a	$670,000	$85,000	n/a
Oldsmar*	Transmission*	0.20	0.20	0.00	Res, Comm	1150	$793,112	$396,556	$0.96
	Transmission*	0.02	0.02	0.00	Res	TBD	$70,000	$35,000	$0.84
	Transmission	0.60	0.30	0.00	Res	180	$300,000	$150,000	$0.24
	Distribution	0.04	0.02	0.00	Res	115	$200,000	$100,000	$2.97
	Transmission	0.29	0.28	0.00	Res, Rec	134	$255,000	$127,500	$0.26
	Transmission	0.25	0.25	0.00	Res, Ind	501	$440,000	$220,000	$0.42
Pinellas Park	Transmission*	5.00	2.00	0.00	Res	4300	$3,314,511	$1,657,255	$0.40
	Transmission*	0.06	0.06	0.00	Res	2000	$1,920,020	$983,250	$7.08

Table IVC-2. Active Reclaimed Water Projects in the Planning Region, (1995 - 2001).

Cooperator	General Project Description	Reuse (mgd)			Customers (#)		COSTS		
		Produced	Offset[1]	Stored	Type	Total	Total	District	$/Kg
Pinellas Park	Transmission	0.20	0.20	0.00	Res, Comm	1700	$2,678,000	$1,339,000	$3.23
	Transmission	0.06	0.06	0.00	Res	1500	$1,067,250	$533,625	$4.29
	Distribution	0.47	0.32	0.00	Res	660	$1,907,460	$953,730	$1.80
Dunedin	Transmission*	0.71	0.71	0.00	Res	1300	$983,895	$491,947	$0.34
	Transmission	0.43	0.43	0.00	Res	945	$883,540	$441,570	$0.49
	Transmission, Storage, Pumping	0.23	0.23	1.00	Res	420	$906,800	$453,400	$0.95
	Transmission, Storage, Pumping	0.21	0.21	2.00	Res	620	$1,760,000	$880,000	$1.96
	Transmission, Distribution	1.00	0.76	0.00	Res	712	$222,420	$1,112,010	$0.70
Largo	Storage, Pumping*	0.00	0.00	10.00	All	n/a	$4,252,344	$2,126,167	N/A
	Transmission	1.00	1.00	0.00	Res	833	$1,232,000	$616,000	$0.30
	Transmission, Storage, Pumping*	0.60	0.60	5.00	Res, Comm, Rec	533	$4,806,436	$2,350,500	$1.93
	Transmission	0.26	0.13	0.00	Res	88	$226,650	$113,325	$0.42
	Distribution	0.80	0.49	0.00	Res	680	$2,000,000	$1,000,000	$1.39
Clearwater	Transmission, Storage, Pumping	0.15	0.15	5.00	Res, Comm	TBD	$4,862,180	$1,669,275	
	Transmission, Pumping*	2.60	2.60	0.00	All	n/a	$2,200,000	$1,100,000	$0.20
	Transmission	0.27	0.20	0.00	Comm, Rec	24	$868,000	$425,000	$1.05
	Transmission, Storage	0.55	0.39	1.00	Res, Comm, Rec	181	$4,928,300	$2,103,985	$2.65
	Transmission, Storage, Pumping	1.20	1.20	5.00	Res, Comm, Rec	600	$8,953,600	$3,285,900	$1.80
Belleair	Feasibility Study	0.00	0.00	0.00	All	n/a	$35,000	$17,500	N/A
St. Petersburg	Storage, Pumping	0.33	0.33	1.00	All	n/a	$800,000	$400,000	$0.64
	ASR Storage, Pumping	0.66	0.66	2.00	All	n/a	$450,000	$225,000	$0.16
Polk County									
Auburndale	Transmission- rehydration	2.00	n/a	n/a	n/a	n/a	$886,620	$443,310	n/a
Fort Meade	Pumping, Transmission*	0.40	0.40	0.00	Ind	1	$583,760	$291,880	$0.35
Lake Wales	Pumping,* Transmission	2.00	2.00	0.00	Ind	1	$48,000	$24,000	n/a
	Pumping, Storage, Transmission	1.00	0.50	4.00	Com	tbd	$5,870,000	$2,092,000	$2.83
Polk County	Pumping, Storage	1.00	1.00	5.00	Com, Res	n/a	$2,868,080	$1,434,040	$0.69
	Pumping, Transmission	2.00	2.00	0.00	Res, Comm	2689	$4,815,734	$2,407,867	$0.58

Table IVC-2. Active Reclaimed Water Projects in the Planning Region, (1995 - 2001).

Cooperator	General Project Description	Reuse (mgd)			Customers (#)		COSTS		
		Produced	Offset[1]	Stored	Type	Total	Total	District	$/Kg
Polk County	Pumping, Transmission	0.85	0.85	0.00	Res, Comm	tbd	$1,351,400	$560,382	$0.38
Winter Haven	Transmission	0.00	0.04	0.00	Rec	4	$188,000	$94,000	$1.19
	Reuse Feasibility	n/a	n/a	n/a	All	n/a	$200,000	$100,000	n/a
Sarasota County									
Sarasota County	Storage (ASR)	0.00	0.00	3.00	Res, Rec, Comm, Ag	n/a	$3,030,000	$1,515,000	n/a
	Transmission, Pump, Storage	2.80	2.80	52.00	Res, Rec, Comm, Ag	TBD	$4,263,440	$2,131,720	$0.37
	Transmission, Pumping	1.10	1.10	0.00	Res, Rec, Comm	TBD	$2,237,000	$1,118,500	$0.49
	Transmission*	0.07	0.07	0.00	Rec	TBD	$523,000	$261,500	$1.78
	Transmission *	1.30	1.30	0.00	Res, Rec	TBD	$457,000	$228,500	$0.09
	Transmission	0.36	0.36	0.00	Res, Rec	TBD	$829,000		$0.56
Sarasota Co. and Venice	Transmission, Pump, Storage	3.30	3.30	3.00	Res, Rec, Comm	TBD	$4,019,796	$2,009,898	$0.29
Venice	Transmission	0.90	0.90	0.00	Res, Rec, Comm	TBD	$2,362,038	$1,181,000	$0.63
Sarasota	Transmission*	0.35	0.35	0.00	Res, Comm	TBD	$400,000	$150,000	$0.28
	Transmission*	0.40	0.40	0.00	Res, Comm	TBD	$172,260	$77,570	$0.10
	Storage (ASR)	0.00	0.00	1.00	Res, Comm	n/a	$680,000	$340,000	n/a
North Port	Transmission,* Storage	0.86	0.86	0.60	Res, Rec	TBD	$990,000	$497,000	$0.28
Camp, Dresser &McKee	Inventory*	n/a	n/a	n/a	n/a	n/a	$19,923	$19,923	n/a
Englewood Water Dist.	Transmission*	0.62	0.62	0.00	Res, Rec	TBD	$497,490	$225,233	$0.19
Englewood Water Dist.	Storage (ASR)	0.00	0.00	1.00	Res, Rec	n/a	$460,000	$230,000	n/a
TOTALS		**113.14**	**86.89**	**159.85**		**32358**	**$249,202,49**	**$108,799,6**	**$0.71**

Source: (SWFWMD, 1999c)
* Project completed.
[1] For ASR, water produced/offset is an annual average.

Rec = Recreation Ag = Agricultural Var = Variable
Res = Residential Comm = Commercial Ind = Industrial

population and the need to constantly reinforce a conservation ethic aimed at changing the water-use habits of the populace. Such efforts include in-school programs as well as those aimed at broader public awareness and action. The following sections represent a brief summary of these efforts.

1.0 Indoor Conservation

The District continues to serve as an example of organizational commitment to conservation by retrofitting restrooms on District property with ULV plumbing fixtures and appropriate signage. Staff has developed a model plumbing code, and has provided technical assistance to numerous local governments in this regard. The District also participated in research to determine the water savings of various methods and continues to assist in the funding of large-scale plumbing retrofit programs. Since 1991, the District has assisted local utilities with the distribution of nearly 64,000 ultra-low volume toilets, and 484,000 plumbing retrofit kits (including water efficient shower heads, faucet aerators and other items). The programs, which cost the District and cooperating local governments a combined $17.2 million, yield an average savings of 6.5 million gallons of potable water per day (SWFWMD, 1999). Table IVC-3 provides information on indoor conservation projects cooperatively funded in the planning region.

The potential savings from water conservation in the industrial, commercial and institutional (ICI) water use sectors have been investigated. A pilot program for determining how water can be saved by ICI customers on public supply systems was conducted (1995-1997) in the Tampa Bay Area. As a result, educational water conservation information is available to ICI water users through the pilot program report and on a page dedicated to ICI conservation on the District's Website. In addition to those conservation efforts described, water conservation education remains a strong focus of the District, and funds are budgeted annually by the Basin Boards and the Governing Board for information and education efforts, including public service announcements, literature, in-school curricula and project grants which encourage water conservation. It is anticipated that these efforts will continue over the next five years. A description of indoor and outdoor conservation programs in progress is provided in Table IVC-4. It should be noted that local governments and utilities may be implementing conservation programs outside of the Cooperative Funding Program. Such efforts were considered in the water conservation report provided by Ayres Associates, Inc., as part of the regional water supply planning process (Ayres, 2000).

2.0 Outdoor Conservation

Outdoor water use, and associated savings, are difficult to measure since the plant materials, soils and irrigation systems and size of all irrigated areas are not the same. Outdoor water use can be a significant portion of the total demand placed on a water supply utility. Since the majority of this use is irrigation-related, the District emphasizes "environmentally friendly" landscaping (including Xeriscape™ and Florida Yards initiatives), outdoor water audits, leak detection surveys for utility systems and irrigation system efficiency analyses. This emphasis takes the form of public information and education, cooperative funding of demonstration projects, research, use of Xeriscape landscaping on District properties, development of a model landscape ordinance and the passage of a Xeriscape Incentive Rule.

Table IVC-3. Summary of Indoor Conservation Projects Cooperatively Funded in the Planning Region through FY 2000.

District Board Providing Funding	Number of Water Conservation Fixtures Installed	Traditional Water Offset (gpd)	Amount ($) Budgeted by the District
Alafia River	28,910	523,476	$767,091
Coastal Rivers	3,510	44,192	$47,989
Hillsborough River	100,650	2,258,607	$1,813,131
Manasota	4,000	60,000	$124,100
NW Hillsborough	71,775	1,546,430	$1,423,962
Peace River	2,176	53,170	$78,649
Pinellas-Anclote	367,180	3,368,678	$6,842,752
Withlacoochee	210	2,620	$2,008
Total	**578,411**	**7,857,173**	**$11,099,682**

Source: Retrofit Programs, Reuse Projects, and Outdoor Water Conservation Efforts, December 1999, SWFWMD.

The District's standing advisory committees have also been active in promoting outdoor conservation. The Green Industry Advisory Committee, for example, was the impetus for a three-year collaborative effort to determine the effectiveness of landscape water budgets, described earlier in this plan as a non-agricultural water conservation option. The development and production of *A Water-Efficiency Landscaping Guide for Local Governments*, is an example of a collaborative effort with the St Johns River and South Florida water management districts. The *Guide* provides technical assistance to local governments in the development of water-efficient landscape and irrigation requirements. In addition, projects related to landscaping efficiency have been funded through the District's Cooperative Funding Program since 1992. The District has provided nearly $2.4 million toward cooperative landscape demonstration, survey and rebate projects, for a collective estimated water-savings of 172,223 gpd (SWFWMD, 1999c). A list of active outdoor water conservation projects in the planning region is included in Table IVC-4.

In the spring of 2000, a Water Conservation Task Force was established to provide guidance related to water conservation efforts within the District. One of several objectives of a Governing Board water conservation initiative, the Task Force will assist in the general objectives to raise the awareness of the need for, and benefits of, water conservation, and identify opportunities to make water use a key consideration in growth management decisions. The 11-member Task Force represents each category of water users, local governments, developers, regional planning councils, and the environment in assisting the District to: 1) address the challenges and opportunities associated with each represented group related to water conservation, 2) develop a comprehensive water conservation resource, or library, 3) plan an annual Districtwide forum for information sharing, or summit, and 4) identify and develop appropriate incentive packages for all water users and stakeholders to enhance the implementation of water conservation Districtwide.

Table IVC-4. Active Indoor and Outdoor Conservation Projects in the Planning Region (1995 - 2001[1]).

Cooperator	Phases[2]	General Project Description	Savings (gpd)	Customers (#)	Costs ($)		
					Total	**District**	**$/Kgal Saved**
Charlotte County							
Punta Gorda	1	Rain Sensor Rebate	14,600	862	$40,868	$20,434	$0.68
Charlotte Harbor	1	Mobile Irrigation Lab	TBD	20	$12,893	$6,931	TBD
Hillsborough County							
Tampa	7	Toilet Rebate	726,181	19,832	$2,792,910	$1,305,960	$1.06
Tampa	1	Efficient Irrigation Rebates	36,000	200	$188,770	$63,770	$3.47
Temple Terrace	1	Toilet Rebate	3,432	162	$15,826	$7,913	$1.11
Hillsborough Co.	7	Toilet Rebate	1,833,432	55,653	$11,272,920	$1,725,000	$1.48
Hillsborough Co.	1	Project Greenhouse (Demo)	n/a	n/a	$100,000	$50,000	n/a
Hillsborough Co.	1	Plumbing Retrofit	72,330	7,490	$75,744	$40,000	$0.70
Pinellas County							
Clearwater	1	Toilet Rebate	56,986	1,734	$250,000	$125,000	$1.06
Clearwater	1	Rain Sensor Rebate	9,052	589	$40,000	$20,000	$1.39
Tampa Bay Water	1	Water Budget (Study)	n/a	n/a	$260,000	$120,500	n/a
St. Petersburg	1	Xeriscape Demonstration	n/a	n/a	$389,577	$194,789	n/a
St. Petersburg	5	Toilet Rebate	585,276	18,242	$3,000,000	$1,500,000	$1.41
St. Petersburg	1	Xeriscape Rebates	68,400	200	$76,250	$38,125	$0.37
St. Petersburg	1	Irrigation Audits	TBD	680	$200,000	$100,000	TBD
Pinellas County	2	Shallow Wells Rebates	462,000	2,000	$632,450	$316,224	$0.31
Polk County							
Lake Wales	1	Plumbing Retrofit	14,570	314	$76,930	$38,465	$1.27
Highlands Park	1	Rain Sensor Rebate	8,136	66	$3,960	$1,980	$0.15
Sarasota County							
Sarasota County	2	Toilet Rebate	75,000	2,500	$300,000	$150,000	$1.10
Sarasota County	1	Plumbing Retrofit	165,000	2,000	$12,000	$6,506	$0.05
Sarasota	1	Toilet Rebate	15,000	500	$100,000	$50,000	$1.83
TOTALS			**4,145,395**	**113,044**	**$19,841,098**	**$5,881,597**	**$1.19**

[1] All savings are anticipated to be realized by 2005. TBD= To Be Determined n/a = not applicable/savings not measurable
[2] Number of phases of the project completed to date, including those currently in progress, and those planned for FY 2001.

3.0 Agricultural Conservation

The District has a long history of commitment to providing assistance to agriculturists. These services are coordinated by the Technical Services Department of the Resource Regulation Division and cover a broad range of work efforts. The funding of agricultural research and demonstration projects is one of the longest-running assistance programs offered by the District. Since 1978, over $2 million has been contributed to fund over 100 projects. These projects have not only helped to conserve water, but have contributed to water quality improvements by helping to reduce fertilizer runoff and leaching. The District has funded research projects at all of the IFAS research and education centers throughout the District. Some projects have dealt with the design of tailwater recovery systems and the determination of specific crop water use requirements. Other projects include field irrigation scheduling and frost/freeze protection demonstrations as well as projects to address the implementation of BMPs.

Mobile irrigation laboratories operated in conjunction with the NRCS conduct efficiency and potential conservation evaluations of agricultural irrigation systems. Since 1986, mobile irrigation labs have evaluated irrigation systems at over 900 sites.

The District's water use permitting allocation program (AGMOD) was developed by the District's Technical Services irrigation engineer. Since 1989, this water use allocation program has been used by staff, consultants, and agriculturists to allocate reasonable and beneficial irrigation quantities for agricultural and recreational/aesthetic WUP applicants.

Since 1991, the Agricultural Ground and Surface Water Management (AGSWM) Program has been available to assist agriculturists in complying with District resource protection objectives. Through this program, the District, NRCS, and agriculturists partner to develop innovative ways to allow agriculturists to conduct crop production operations without adversely impacting the water resource. Several additional projects which will determine and/or evaluate best management practices and efficient irrigation are in progress. These projects (presented in Table IVC-5) will provide information to growers and assist them in increasing irrigation efficiency.

Since 1998, the Agricultural Conservation Partnership (AgCP) Program has been in place to provide opportunities for the District and agriculturists to contribute matching funds to develop field scale projects designed to benefit the water resource in the Upper Myakka River watershed. The AgCP represents one of two projects which have been funded partly through the NWSI, and partly as a Basin Initiative. The two projects offered detailed evaluations of agricultural irrigation systems and practices, and subsequent recommendations for improving water use efficiency.

Finally, it should be noted that many agriculturists have undertaken significant measures which have resulted in more efficient water use. Nonetheless, the conversion to more water-conserving irrigation technologies and the adoption of BMPs offer the potential for additional savings in the planning region.

As with reclaimed water, it is anticipated that the indoor, outdoor and agricultural conservation programs will continue to be implemented over the next several years. The aggressive conservation activities have helped the District and local cooperators to achieve goals for reducing water demand. Over the next five years, the District intends to allocate dollars for research projects in cooperation with

Table IVC-5. Active Agricultural Conservation Projects By Commodity-Type, (1995 - 2001).

Project Description	District Funding
All Commodities	
Mobile Irrigation Labs	$145,000
Increasing Irrigation Efficiency by Preventing Micro-irrigation Plugging	$25,000
Citrus	
Water Quality from Citrus Production in Highlands County	$126,000
Water Requirements and Crop Coefficient for Flatwood Citrus	$9,000
Effective Rainfall in Flatwood Citrus	$56,000
Irrigation methods to Reduce over Irrigation of Ridge Citrus	$3,000
Citrus Micro-irrigation Workshops	$17,000
Effects of Water Table Upflux on Citrus Production	$38,000
Soil Water Balance and Citrus Evapotranspiration	$150,000
Effective Rainfall on Ridge Citrus	$35,000
Effects of Micro-Irrigation Coverage on Citrus Irrigation	$37,000
Ornamental	
Nursery Water Requirements	$59,011
Classifying Landscape Species Water Use by Coefficient of Water Use	$42,265
Improved Irrigation Management in Container-Grown Landscape Plants	$37,500
Workshops: Improving Irrigation Application Efficiency in Nursery Production.	$25,000
Water Requirements for Landscape Trees	$160,000
Workshops: Improved Nursery Application Efficiency in Manatee County	$25,000
Strawberry	
Containerized Strawberry Transplants	$74,500
Alternative Treatment of Bare Rooted Strawberry Transplants	$30,000
Tomato	
Field Demonstration: Impacts of Water Table Depth	$80,000
Improved Best Management Practices	$80,000
Methods to Characterize and Reduce Runoff from Plastic-mulched Fields	$70,000
Feasibility of Tail Water Recovery	$105,000
Tomato Salt Tolerance	$30,000
Vegetable	
Effective Rainfall for Vegetable Production	$59,250
Total District Funding: Active Agricultural Projects	**$1,518,526**

the IFAS. Such projects are undertaken in order to provide information related to technology or practices that can be used by all agricultural water users to improve irrigation efficiency. Indoor water conservation projects will primarily include the offering of rebates to public supply customers for the replacement of high-volume plumbing fixtures with newer, more-efficient models. In addition, a research project is expected to be undertaken to test products which may be plumbed into homes to provide immediate hot water from sinks and showers. Outdoor programs will continue to target irrigation systems and practices.

Surveys identifying opportunities for increased efficiencies, and rebates for the modification of existing landscapes and irrigation systems, are expected to be offered to water use customers. In addition to such demand-side water conservation measures, the District's Leak Detection Program will continue to identify conservation opportunities on the supply side of water distribution systems. By providing technical expertise through comprehensive surveys using leak-detecting equipment, leaks can be located and repaired before substantial amounts of water are lost.

Appendix IVC-2 lists the indoor, outdoor and agricultural conservation projects that are anticipated to be implemented within the next five years. Some of the projects have been reported by local cooperators as those that they intend to undertake within the next five years. Those cooperators are listed, along with the financial assistance they plan to request from the District through the Cooperative Funding Program. Others are projects which are expected to be initiated by the District (Basin Initiatives). Local financial cooperation may or may not be sought for such projects.

Section 3. Aquifer Storage and Recovery (ASR) Projects

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, is known as ASR. Generally, the ASR process involves ". . . the storage of water in a suitable aquifer through a well during times when water is available, and recovery of the water from the same well during times when it is needed" (Pyne, 1994). Water injected into the aquifer is generally either potable, reclaimed or partially treated surface water. For potable water systems, the water withdrawn from storage in the aquifer is disinfected, retreated if necessary, and pumped into the distribution system. To date, the majority of ASR projects have been limited to storage and recovery of potable water. However, several projects are in progress to determine the feasibility of utilizing reclaimed water (treated effluent or storm water). Reclaimed water ASR (RWASR) presents several additional permitting issues over and above those associated with a potable water ASR project. Currently, there are no RWASR projects within the District that are fully permitted for routine operation.

The District, in cooperation with Manatee County, pioneered the use of ASR in Florida by developing the first potable water ASR system in the early 1980s. What was then a cutting edge technology has since become a common technique to expand water supplies in an environmentally sustainable manner. In the 1990s, the District provided partial funding for two projects; one with Manatee County, and the other with the City of St. Petersburg, to store reclaimed water for dry season irrigation use. The development of these projects is helping to address critical issues that will enable the eventual use of underground aquifers for storage of reclaimed water. Recently, studies have been initiated on the storage of partially treated surface water (i.e., filtered river water). This type of project, although extremely difficult to permit under the current rules without full treatment, has the potential to provide quantities of water that far exceed any ASR project currently being developed. The City of Tampa and the City of Bradenton initiated partially treated surface water ASR feasibility studies in 1999.

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; 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 (high TDS) may be used for storage, mixing of the injected water with native water is generally the limiting factor on recovery efficiency.

1.0 Hydrologic Considerations

Hydrologic conditions necessary to make ASR feasible include a moderately permeable storage zone, which is adequately confined above and below by lower permeability layers, and which contains fairly good to moderate water quality. These factors tend to minimize the mixing of the injected water with native water in the storage zone. The permeability of the storage zone is important since low permeabilities would limit the quantity of water that could be injected, while a very high permeability would allow the injected water to migrate farther and mix more with native water. The presence of confining layers is necessary to limit or prevent the injection 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 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 general, the recoverable percentage of injected water is typically 70 to 100 percent. 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 ground-water reserves. This can help to form or maintain a buffer zone between the stored water and surrounding brackish or poor quality native water to avoid geochemical plugging, or to build up a reserve for future recovery during droughts, emergencies, or anticipated times of higher demand.

2.0 Permitting Requirements

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

3.0 ASR Projects Within the District

The District has provided funding support for numerous ASR projects in the District. There are currently 21 ASR and recharge/recovery projects in various stages of completion within the District. There are ten projects involving the storage of reclaimed water (highly treated wastewater) that is available in large quantities during the wet season. There are six potable water projects, two that are currently operational. Three partially treated surface water ASR projects have been proposed and work on feasibility studies for the projects was initiated in the fall of 1999. There are additionally two projects that involve the recharge and recovery of water to and from an aquifer that are not traditional ASR projects. Table IVC-6 lists ASR and the recharge/recovery projects currently under development in the planning region, stage of development, yield, and cost. The District is providing funding for the development of all but three of the projects. Figure IVC-1 depicts the location of the ASR projects listed in Table IVC-6.

Section 4. Partnership Projects

The following section contains summaries of the water supply projects identified in Tampa Bay Water's "New Water Plan" that are eligible for District funding. These projects include the Enhanced Surface Water System, Seawater Desalination Project, and pipelines that will move water between sources, treatment facilities, storage facilities and ultimately into Tampa Bay Water's regional distribution system.

1.0 Enhanced Surface Water System (ESWS)

The ESWS consists of the Alafia River Project, Tampa Bypass Canal System (including Hillsborough River High Water), Tampa Regional Water Treatment Plant, South Central Hillsborough Intertie, and the Regional Reservoir. The District's share of the cost of the ESWS is yet to be determined. The following is a description of the individual components of the ESWS that are eligible for District funding.

1.1 Alafia River Project

The Alafia River project involves harvesting seasonally available excess surface water from the Alafia River for public supply use in the region. The withdrawal schedule for the Alafia River project was developed to minimize impacts to the overall riverine system by not withdrawing water during low river flow periods. The minimum flow selected corresponds to the 80th percentile, or the flow level that is exceeded 80 percent of the time during an average year. Proposed withdrawals will only occur when the river flow is at 124 cfs or greater, at which time only 10 percent of the flow will be withdrawn. The proposed maximum withdrawal is 80 cfs or 52 mgd. The proposed withdrawal location is the south side of the Alafia River at Bell Shoals Road. Construction of the intake and pump station is expected to be completed by December 2002.

Table IVC-6. Summary of ASR Projects in the District.

Project Site	Status	Test Well Annual Stored Volume Goal (MG)	Final System Goal: Annual Stored Volume (MG)	Final System Goal: 100 Day Dry Season Yield (mgd)	Final System Goal: Total Number of Wells	Approximate Cooperative Funding Total Project Costs (District share is half of reported costs)
Potable Water ASR Projects						
Manatee County (Lake Manatee)	Two ASR wells have been permitted and operational since 1986.	NA	180	1.8	2	Funding provided by the District in 1984.
	Four additional wells are being constructed.	NA	1,800-3,000	18 - 30	4	This project is not receiving cooperative funding
Peace River/Manasota Regional Water Supply Authority	Operational ASR system consisting of eight Suwannee Limestone wells and one Tampa well.	NA	1,080	10.8	9	Partial funding provided by the District when the PRMRWSA acquired the facility.
	Avon Park ASR feasibility program. Well constructed. Cycle testing pending.	180 - 450	TBD	TBD	TBD	Feasibility Program = $850,000
	Eleven additional Suwannee Limestone wells are under construction and testing.	NA	1,680	16.8[1]	11	Final System = $5,000,000 more for the 11 wells
City of Tampa (Rome Ave.)	The feasibility study, including construction and testing of one ASR well, was completed in 1997.	100	100	1.0	1	Feasibility Program = $700,000
	Seven additional ASR wells have been constructed and are in the process of being tested.	NA	900	9.0	7	Final System = $4,500,000 additional for the six wells
City of Tampa (Hillsborough River Water Treatment Plant Area)	A feasibility study which includes construction and testing is underway. A permit has been issued to construct 19 wells.	200 - 400	3,000	30	10 - 20	Not receiving Cooperative Funding at this time
City of Bradenton (Booster Facility)	Preliminary feasibility study has been completed. FDEP testing and well construction permit is pending.	90	90	0.9	1	Feasibility Program = $825,000
City of Punta Gorda	Feasibility study is underway. The ASR well is completed and testing is underway.	90	90	0.9	1	Feasibility Program = $780,000

Table IVC-6. Summary of ASR Projects in the District.

Project Site	Status	Test Well Annual Stored Volume Goal (MG)	Final System Goal: Annual Stored Volume (MG)	Final System Goal: 100 Day Dry Season Yield (mgd)	Final System Goal: Total Number of Wells	Approximate Cooperative Funding Total Project Costs (District share is half of reported costs)
Reclaimed Water ASR Projects						
Northwest Hillsborough	Feasibility Study Stage. Test well is constructed. Cycle testing is pending.	135	720 - 1,000	7.2 - 10	7 - 8	Feasibility Program = $ 1,070,000. Cost for final system not available.
City of St. Petersburg	Feasibility Study Stage. Construction of the initial test ASR well is in progress.	90 - 180	900 - 1,800	9 - 18	TBD	Feasibility Program = $800,000. Cost for final system not available.
Manatee County (SWRWWTP)	Feasibility study is underway. ASR well construction is complete. Cycle testing is pending. If successful, two more ASR wells are planned.	90 - 180	320	3.2	3	Feasibility Program = $800,000 ($948,400) Final System = $1,200,000[2] more.
Manatee County (NRWWTP)	Preliminary feasibility study stage. Permit application has not been submitted yet. Exploratory well construction completed April 2001. No ASR well has been constructed yet.	Test ASR well has not been constructed yet.	480	4.8	3	Feasibility Program = $600,000 ($582,021)[3]. Final system = $1,200,000[4] more.
City of Sarasota (Payne Park)	Preliminary feasibility study has been completed. The test ASR well construction is pending permit approval.	160	160	1.6	1	Feasibility Program = $680,000. Cost for final system not available.
North Sarasota County (Central County Utilities)	This project is in the feasibility study stage. Permitting of the test program pending FDEP approval. If successful, two more wells are planned.	157	480? (Waiting for more info)	4.8	3	Feasibility Program = $810,000. The two remaining wells are estimated to cost a total of $1,520,000[3] more.
South Sarasota (Venice Gardens)	This project is in the feasibility study stage. Permitting of the test program is pending FDEP approval. If successful, two more ASR wells are planned.	157	480	4.8	3	Feasibility Program = $1,100,000. The two remaining wells are estimated to cost a total of $1,930,000[3] more.

Table IVC-6. Summary of ASR Projects in the District.

		Test Well Annual Stored Volume Goal (MG)	Final System Goal			
Project Site	**Status**		**Annual Stored Volume (MG)**	**100 Day Dry Season Yield (mgd)**	**Total Number of Wells**	**Approximate Cooperative Funding Total Project Costs (District share is half of reported costs)**
Reclaimed Water ASR Projects (cont'd)						
Englewood	This project is in the feasibility study stage. The Test ASR well has been constructed. Cycle testing is on hold pending WQCE for color.	150	300	3.0	2	Feasibility Program = $920,000.
Largo/Clearwater/Pasco	This is a new project proposed for District Cooperative Funding. The feasibility study has not started.	90 - 180	900 total between two sites	9.0	8	Feasibility = $1,200,000 Final System TBD
Hillsborough County South/Central ASR	Preliminary feasibility study completed June 1999. Class V permit application deemed complete. Awaiting construction authorization. There are two sites, one at Cargill and one at TECO.	150	2,000	20	14 (seven at each site)	Test well construction and testing = $1,000,000. Final System cost TBD.
Partially Treated Surface Water ASR Projects						
City of Bradenton	This project is in the feasibility study stage. A permit application has been submitted to the FDEP, however, the City is reconsidering their project approach and may include treatment. The City is only considering an exploratory well at this time.	No ASR well at this time. However, a test ASR well should store 90 - 450	TBD	TBD	TBD	Feasibility Program is approximately $750,000.
City of North Port	This project is in the feasibility study stage. A permit application has been submitted and is being reviewed by the FDEP	90 - 180	90 - 180	9 - 18	1	Feasibility = $1,200,500

Table IVC-6. Summary of ASR Projects in the District.

Project Site	Status	Test Well Annual Stored Volume Goal (MG)	Final System Goal: Annual Stored Volume (MG)	Final System Goal: 100 Day Dry Season Yield (mgd)	Final System Goal: Total Number of Wells	Approximate Cooperative Funding Total Project Costs (District share is half of reported costs)
Partially Treated Surface Water ASR Projects (cont.)						
Lake Tarpon / Pinellas County	This project is new. The County is in the process of performing some preliminary exploratory well drilling to collect basic aquifer data. The County has not submitted a Class V permit application yet.	100 - 200	1,000 - 2,000	10 - 20	TBD	$210,000 has been approved to perform some exploratory work as part of the preliminary feasibility study. It is anticipated the final system for 2 billion gallons of annual storage is approx. $1.9 million.
Other Recharge - Recovery Projects						
Florida Power / Florida Institute of Phosphate Research (Hines Energy Complex in Polk County)	This project is in the feasibility study stage. The FDEP testing and well construction permit approval is pending.	90	90	9.0	1	Feasibility Program = $1,140,000
City of St. Petersburg "REWARD" Project	Recovery well has been drilled and the City is finishing up on piping and well head construction. City wants to be online by May	240	240	2.4	1	Estimated construction and testing is $450,000

[1] Upon completion total yield = 30 mgd. 12 mgd from existing plus 18 mgd from expansion.
[2] The original estimated cost was $800,000. Actual bid cost $948,400. District share equals $400,000.
[3] The original estimated cost was $600,000. Actual bid cost for wells only was $582,021. The District's share for this phase is estimated not to exceed $300,000.
[4] Not currently part of cooperative funding.

Term Definitions:
Preliminary Feasibility Report: Desktop analysis of existing data to evaluate the potential for ASR. This level of study generally includes an analysis of the water quality of the proposed injection water, availability and demand for this water, and hydrogeology of the potential ASR sites. Generally, this stage of study does not involve the installation of an ASR well, but may include a small diameter exploratory well to check TDS concentrations and the hydrogeology. An inventory of existing wells within one to two miles of each proposed ASR site is generally performed at this stage. The preliminary feasibility study is generally submitted with the Class V injection well permit application.
Final Feasibility Report: This report contains information obtained from the drilling and testing of one or more ASR wells. It would include the results of cycle testing, water quality analysis, and water level fluctuation as a result of injection and pumping. This report generally serves as the basis for expansion of the ASR system to achieve the project yield goal.
Final System: Includes all the necessary wells to store the overall project goal volume if feasibility is proven.
FDEP: Florida Department of Protection
MG: Million Gallons
WQCE: Water Quality Criteria Exemption FDEP = Florida Department of Protection
Feasibility Study Stage - Unless footnoted it includes demand projections, water quality assessment, permitting, site selection, well design, geologic testing, cycle testing, and final report.
Final System - Includes all the necessary wells to store the overall project goal volume if feasibility is proven.

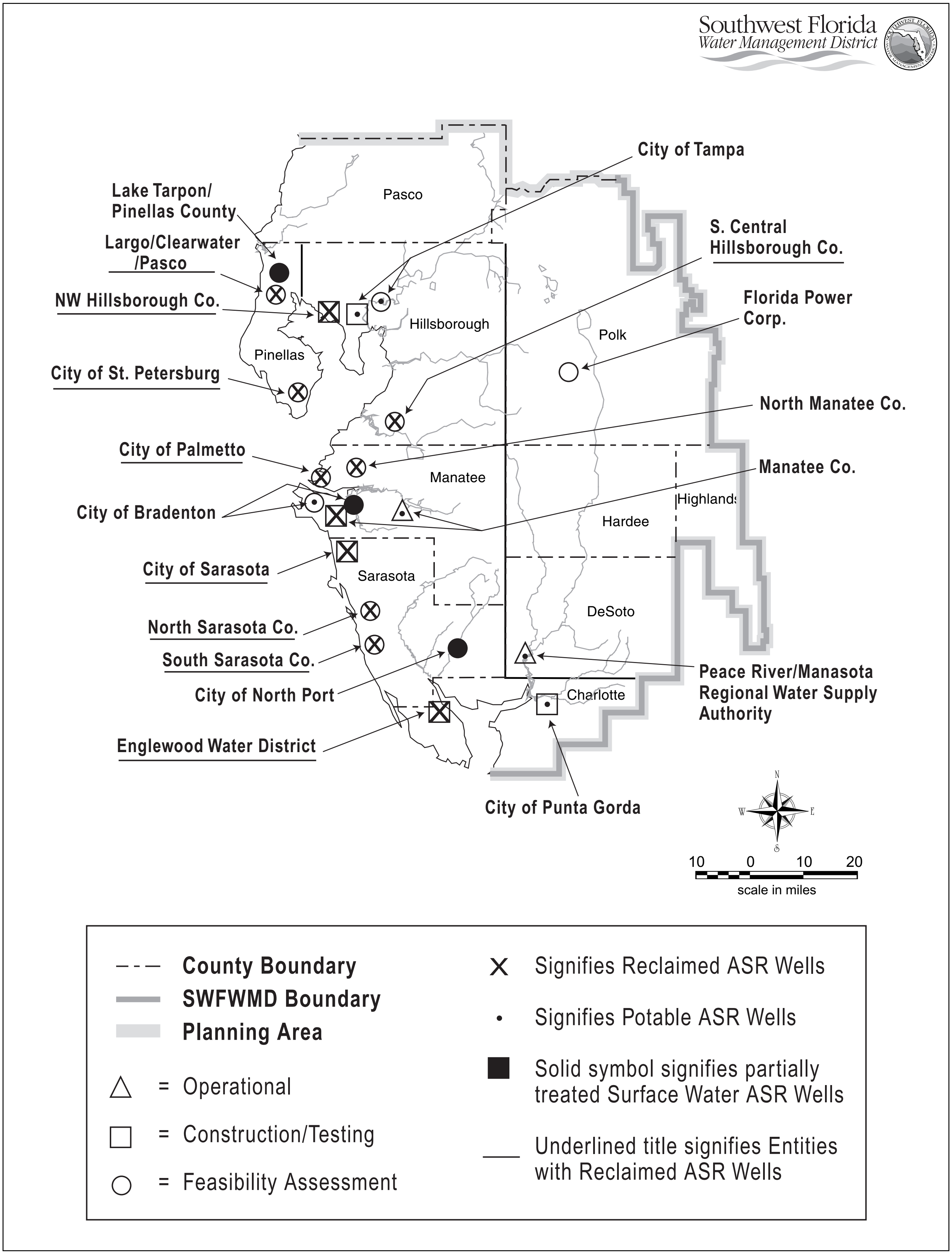


Figure IVC-1. Locations of ASR Projects in the SWFWMD.

1.2 Tampa Bypass Canal Water Supply Project (including Hillsborough River High Water)

The Tampa Bypass Canal (TBC) Water Supply Project involves the harvest of seasonally available excess surface water from the TBC and the Hillsborough River for public supply use in the region. The project will involve diversion of a percentage of high flows from the Hillsborough River through an existing flood control structure (S-161) into the TBC. The excess river flow, as well as flow originating from the TBC, will be withdrawn at a single pumping facility to be located on the east side of the TBC adjacent to flood control Structure S-162. Withdrawal schedules have been developed to ensure that the harvest of water from these systems does not interfere with existing permitted uses or cause unacceptable adverse environmental impacts. The long-term annual average combined yield from these two sources is estimated at 34 mgd (without the reservoir). Construction of the TBC intake and pumping station is expected to be completed by September 2002.

1.3 Tampa Bay Regional Reservoir Project

The purpose of the off-stream, above ground reservoir is to improve the reliability and dependable yield of the surface-water sources. The reservoir will store water during high flow periods that will be utilized when surface water is not available for withdrawals. The reservoir's anticipated storage capacity is approximately 15 billion gallons (48,000 acre-feet). Structurally, it will be an earthen embankment with an average height of 45 feet and an average water depth of 40 feet. The Tampa Bay Regional Reservoir project is made up of two components. The first is the reservoir that will be located near the Picnic area in southeastern Hillsborough County. The second is approximately eight miles of 84-inch transmission main that will connect the reservoir to the South Central Hillsborough Intertie near the Alafia River withdrawal location. Construction of the reservoir and pipeline is expected to be completed by October 2004.

1.4 South Central Hillsborough Intertie (pipeline)

The South-Central Hillsborough Intertie project involves the construction of two pipelines: approximately 10,200 feet of 84-inch diameter pipeline from the TBC Pumping station to the Tampa Bay Regional Water Treatment Plant (TBRWTP); and approximately 71,800 feet of 72-inch diameter pipeline from the TBRWTP to the Alafia River Pumping Station. The pipelines are sized to convey high flows from the TBC Pumping Station (up to 259 mgd) to the TBRWTP and to the reservoir, or to carry up to 60 mgd by gravity feed back from the reservoir to the TBRWTP. Water from the Alafia River Pumping Station (up to 52 mgd) can also be conveyed to the TBRWTP through the 72-inch portion of the pipeline or to the reservoir through the 84-inch pipeline. Construction of the South Central Hillsborough Intertie is expected to be completed by November 2002.

Enhanced Surface Water System (all components)

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1000 gallons
60 (66 peak capacity)	$274,000,000	$4,500,000	1.29

2.0 North Central Hillsborough Intertie (pipeline)

The North Central Hillsborough Intertie consists of approximately 78,000 linear feet of 84-inch diameter pipeline. The North Central Hillsborough Intertie will convey treated and blended surface water, ground water and desalinated seawater from the proposed TBRWTP to the regional system at the Morris Bridge Pumping Station. Construction of the North Central Hillsborough Intertie is expected to be completed by December 2001.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1000 gallons
N/A	$46,180,116	N/A	N/A

3.0 Seawater Desalination Project

The desalination project involves construction of a 25 mgd (expandable to 35 mgd) capacity desalination plant at Tampa Electric Company's Big Bend Power Plant Site and pipeline to deliver the water to the regional water treatment plant. The S&W Water development team was awarded the contract under a design, build, own, operate, and transfer (DBOOT) project delivery mechanism. In July 1999, Tampa Bay Water's Board approved a Water Purchase Agreement with S&W Water for the plant. The seawater desalination project is expected to begin water production in October 2002. The District has agreed to fund 90 percent of the capital cost of the facility.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1000 gallons
25	$96,000,000	$3,800,000	2.08

4.0 Loop 72 Phase A (pipeline)

This project proposes to construct approximately 10.5 miles of 72-inch diameter pipeline to enhance the reliability of the regional delivery system. The pipeline is proposed to convey treated water from the regional system in the vicinity of Morris Bridge to the Lake Park Water Treatment Plant in northwest Hillsborough County. This pipeline will provide additional hydraulic capacity, and is the first phase of a future looped system to enhance system reliability. The Tampa Bay Water Board of Directors has approved acquiring property only at this time for the project. Additional phases of implementation will be reconsidered when the system hydraulic analysis is further refined. The completion date for this project is yet to be determined.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1000 gallons
N/A	$38,700,000	N/A	N/A

5.0 Brandon/South-Central Connection (pipeline)

This project involves the connection of the South Central Hillsborough Regional Wellfield (SCHRW) to Tampa Bay Water's Regional System via the proposed Brandon Urban Dispersed Wells project pipeline. The connection will provide Tampa Bay Water increased flexibility in the use of the SCHRWF (rotational capacity) and allow full use of the capacity available at the SCHRWF for the Regional System. Evaluation of the preliminary opinions of cost, available excess capacity for Regional System use from the SCHRWF, and Hillsborough County's requirements for emergency supply indicate that a connection transfer capacity of 10 mgd would be the most appropriate. Hydraulic analysis indicates that the connection pipeline would need to be 24-inches in diameter. This project is expected to be completed in December 2002.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1000 gallons
N/A	$8,397,000	N/A	N/A

Section 5. Summary of the Existing Water Supply Projects

The degree to which water supply projects are being completed, even as the RWSP is being developed, demonstrates the District's continued commitment to water resource and water supply development. This commitment is not anticipated to lessen during the next five years, or even over the long-term planning horizon, assuming those conditions which affect the District's ability to provide assistance do not change significantly.

It is expected that by 2005, the projects identified in this Chapter will produce at least 113 mgd of reclaimed water while offsetting 87 mgd of potable water demand. In addition, the conservation projects currently under development or about to commence are expected to save more than three mgd before 2005. Successful implementation of the projects listed can potentially reduce the amount of additional demand by more than 90 mgd.

Chapter IV. Water Supply Development Component

Sub Chapter D. Water Supply Options

Part A. Background

The water supply development component of the RWSP requires the District to identify water supply options from which water users in the planning region can choose to meet their individual needs. In addition, the District is to determine the associated costs of developing these options. As discussed in Chapter IVB, the sources of water that are potentially available to meet projected water demand in the planning region include surface water/storm water, reclaimed water, conservation, brackish ground water, seawater and fresh ground water. With the exception of fresh ground water, investigations of these sources were conducted to support the development of the RWSP. The investigations were conducted to identify reasonable options for developing these sources, provide planning level technical and environmental feasibility analyses, determine costs to develop the options, and identify potential funding mechanisms.

Summaries of the analyses of individual options are presented in this Chapter. Options that have been identified are not intended to represent the District's more "preferable" options for water supply development. They are, however, provided as reasonable concepts that water users in the region may pursue in their water supply planning. It is anticipated that users will choose an option or combine elements of different options that best fit their needs for water supply development. Prior to future development of any water supply option it will be necessary to meet the conditions for issuance of and obtain all applicable permits. Following a decision to pursue an option identified in this plan, it will be necessary for the interested party(ies) to conduct more detailed engineering, hydrologic and biologic assessments to provide the necessary technical support for developing the option.

Preliminary technical and financial feasibility analyses were conducted on selected options for each water source. These were considered to be planning level analyses and were prepared to more fully develop concepts for water supply and resource development options. In addition, the analyses were to provide reasonable estimates of the quantity of water that could be developed and the associated costs for development. In order to standardize the approach to analyzing the technical and financial feasibilities, all water supply options were evaluated according to criteria developed by Hazen and Sawyer (1999). These criteria included standardized service lives for capital equipment, interest rates and discount rates. The service life for capital equipment was set at 20 years and the interest rate used was 7.1 percent, based on the average Moody municipal long term bond yield over the period 1983 to 1997. The present value of costs over the 20 year evaluation period were discounted to present value, in terms of 1999 dollars, using a discount rate of 3 percent. Costs for engineering and administrative services, and contingency fees were assumed to be 15 percent, 10 percent, and 20 percent of total capital costs, respectively. In addition, standardized values were established for common water supply components and operation and maintenance costs, such as: land, potable water treatment, ASR construction, well construction, pump stations, transmission lines, and wastewater treatment plants.

Each water supply option generally consists of four major components: supply, storage, treatment, and distribution. Storage presents a particular challenge for surface-water and reclaimed water options because, during the wet season, water is generally available in large quantities. The challenge is to capture and store the potentially high volumes of water that are available in the wet season to ensure maximum availability during the dry season when the water is most needed.

During the course of identifying water supply options and performing feasibility analyses, several issues were identified that can potentially affect the technical feasibility as well as the cost of developing the options. These issues include:

- Aquifer recharge and conveyance
- Level of treatment for aquifer recharge and storage
- Aquifer zones for recharge options
- Maintenance of water supply constraints

Aquifer Recharge and Conveyance

The cost of conveying water via pipelines can constrain the ability of a user group to utilize a given source of water. For example, agricultural users generally obtain fresh ground water by pumping it from wells on their property. Conveyance costs are minimal because water is moved only the short distance from the aquifer to the surface and then into the distribution system. Although there will be opportunities for agricultural users to make use of alternative sources such as surface water and reclaimed water, in general, they will need to continue to rely to a large degree on access to ground water. This is because the cost of conveying water from alternative sources will, in many cases, be prohibitive.

A major component of some of the proposed surface-water and reclaimed water options includes aquifer recharge and conveyance. Aquifer recharge and conveyance involves capturing excess water from rivers during periods of high flows and recharging it at various points in the Upper Floridan aquifer. This would increase the amount of available ground water and minimize the cost of conveyance since the aquifer would be the instrument used to convey water to users who could then capture it through ground-water wells. It should be noted that, prior to the injection and withdrawal of water into/from the aquifer, it will be necessary to meet the conditions for issuance of and to obtain all necessary permits. This would include demonstrating adequate water quality treatment prior to injection and evaluation of the impacts of proposed withdrawals.

Level of Treatment

A major factor affecting cost is the required level of treatment provided to water used to recharge the aquifer. Once surface water is captured, treatment is required prior to injection. In general, injected water is required to be of the same or better quality than the ambient water in the portion of the aquifer receiving the water. In formulating surface-water options for the RWSP, it was determined that the injected water would be treated to potable standards except where aquifer water quality does not meet these standards.

Aquifer Zones for Recharge

It may be necessary to identify areas of the Upper Floridan aquifer in which the quality of recharge waters is restricted (potable zones). This is necessary to avoid conflicts between potable and non-potable (e.g., partially treated surface water and reclaimed water) ASR options that may use the same aquifer zone for storage.

Maintenance of Water Supply Constraints
Constraints on water supply development in the region include impacts to surface-water features (e.g., lakes and wetlands), surface-water courses, and aquifers. Future water supply development opportunities may include options that provide water to these features during critical periods. This may enhance the water supply potential of some options while ensuring that the natural systems are suitably maintained.

Part B. Water Supply Options

Summaries of potential water supply options are presented in the following section. The information supplied for each option is conceptual and is intended for planning purposes only.

Section 1. Surface Water/Storm Water

Conceptual surface-water and storm water options were developed to meet projected water demands in the planning region. In determining the amount of surface water available from rivers, it was necessary to establish criteria that would protect existing users and natural systems. A complete discussion of these criteria, examples of how they were used, and the available quantities determined using the criteria are presented in Chapter IVB, Part D, Section 2.

Once the available amount of water was determined, 53 surface-water and 12 stormwater options were identified. The list of 65 options was reduced to a short list of 16 options. The short list contains options that are representative samples of the different types of options included on the long list. Options on the short list were submitted to a more detailed analysis to more fully explore and develop the concepts and refine estimates of costs to develop the options. The short list does not represent a prioritization of or a list of the District's preferred options. Fifteen of the options were surface-water options and one was a stormwater option. The District's efforts were then concentrated on conducting planning level feasibility analysis and estimating development costs for the 16 options. However, to maintain maximum flexibility throughout the water supply planning process, any of the potential 65 options identified could be developed to meet the projected demand of users. Table IVD-1 is a summary of the 16 options and Figure IVD-1 depicts the locations of the options. Additional information on each option is contained in CH2M Hill (2000). Table IVD-2 is a listing of the 65 options included in the long list and Figure IVD-2 depicts locations for these options.

The pages following the tables contain summaries of evaluations of each of the 16 options on the short list. The short list options include a rehydration plan for Starkey wellfield in the NTB region, three options that would benefit lake levels along the Lake Wales Ridge, a universal stormwater option that could be applied to new residential developments, and six variations of options on the Peace River. Several options were developed for the Peace River because it is the largest river in the planning region with significant water supply development potential within the SWUCA.

Table IVD-1. Summary of 16 (Short List) Surface Water/Storm Water Options in the Planning Region.

Project ID	Water Body	Location	Avg Annual Yield (mgd)	System Capacity	End User Group	Level of Treatment	Storage Method	Distribution Method
1	Anclote River	N of W Pasco Airport at power line easement – Starkey Wellfield	9	10	Surface hydration of wellfield	3 (filtration)	Natural storage in water table	Land application
2	Josephine Creek	At Lake Istokpoga, Highlands County	3	4	Lake level enhancement	1 (potable)	None	Aquifer
3	Upper Peace River	At Clear Springs south of Bartow	10	130	Aquifer recharge, industrial use	Potable with wetland and sand filtration	Phosphate clay settling area	Aquifer
4	Manatee River	At County reservoir (Lake Manatee)	3	50	Public supply	1 (at existing WTP)	Reservoir, ASR	Pipelines
5	Myakka River	Near I-75 in Sarasota County	15	120	Public supply	1 (potable.)	Reservoir, ASR	Pipelines
6a	Little Manatee River	At FPL facility – Lake Parrish	14	123	Agricultural irrigation,	3 (filtration)	Lake Parrish	Pipelines
6b	Little Manatee River	At FPL facility – Lake Parrish	14	123	Agricultural irrigation, Ind. use	1 (potable)	Lake Parrish, ASR	Aquifer
7a	Cow Pen Slough	At I-75 in Sarasota County	4	32	Salinity barrier, Non-potable uses	3 (filtration, disinfection)	Surface reservoir, ASR	Aquifer, pipelines
7b	Cow Pen Slough	At I-75 in Sarasota County	4	32	Public supply	1 (potable)	Surface reservoir, ASR	Aquifer, pipelines
8a	Peace River	At PRMRWSA facility, DeSoto County and Tatum Sawgrass, Manatee County	40	500	Agricultural irrigation, Aquifer recharge	1 (potable)	Reservoir, ASR	Aquifer, pipelines
8b	Peace River		40	500	Agricultural irrigation, Aquifer recharge	3 (filtration)	Reservoir, ASR	Aquifer
8c	Peace River		40	500	Agricultural irrigation, Aquifer recharge	3 (filtration)	Reservoir, ASR	Pipelines
8d	Peace River (split diversions)	At PRMRWSA facility, DeSoto County, and near Zolfo Springs, Hardee County	10 (PRMRWSA) 30 (Zolfo Spr.)	125 390	Public Supply, Agricultural irrigation, Aquifer Recharge	1 (at WTP) 1 (potable)	Reservoir, ASR	Aquifer
8e	Peace River (split diversion)		10 (PRMRWSA) 30 (Zolfo Spr.)	125 390	Public Supply, Agricultural Irrigation, Aquifer Recharge	1 (at existing WTP) 3 (filtration)	Reservoir, ASR	Pipelines
9	Shell Creek	At Shell Creek Reservoir, Charlotte County	10	40	Public Supply, Agricultural Irrigation	3 (filtration, disinfection)	Existing Reservoir, ASR	Pipelines
10	Urban stormwater supply for non-potable use. Develop methods for new developments to capture and use on-site stormwater. Review site plans of recent urban development, show how on-site supply could be used to reduce off-site water demands and enhance surrounding hydrologic system through recharge and rehydration.							

Treatment Level Descriptions Level 1 – Treatment to full potable standards, using conventional technology. Level 2 – Treatment to near potable standards, using the Actiflo process. Actiflo uses rapid sand filters and requires a smaller footprint for treatment facilities. In those situations where a partial treatment is needed, Actiflo can be used at higher flow rates than would occur to produce water meeting all potable standards. Thus, Actiflo will produce a high quality water that can be adjusted to meet minimum treatment requirements for various aquifers. Level 3 – Level 3 is a minimum pre-treatment for ASR in non-potable or brackish aquifers. Level 3 treatment usually includes filtration, and in some cases disinfection. Alternative Treatment – Supply Option no. 3 incorporates alternative treatment including wetland filtration and sand filters for initial treatment of raw water.

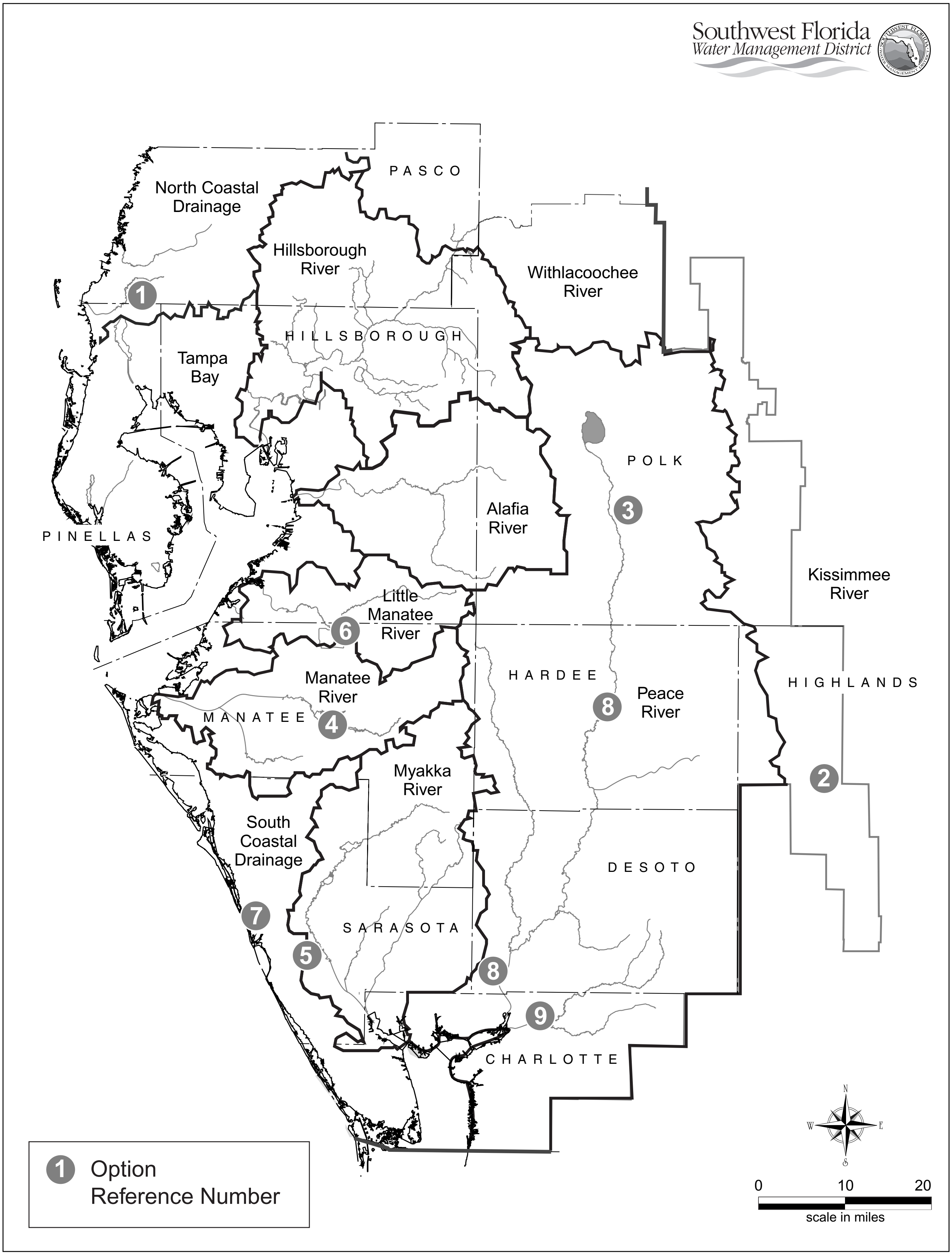


Figure IVD-1. Location of 16 (Short List) Surface Water/Storm Water Options in the Planning Region.

Table IVD-2. Summary of 65 (Long List) Surface Water/Storm Water Options.

Map No.	Water Body	User Group	Avg Annual Yield (mgd)	Intake Capacity (mgd)	Capital Cost (k$/mgd)	Unit Cost ($/kgal)	Level of Treatment	Storage Method	Distribution Method
Pasco County									
1	Anclote River	Ag, Rec	2.8	10	9,338	3.14	2	ASR	Supplement existing reuse system
2	Anclote River	PS, Env	2.8	10	440	0.15	3	None	Aquifer recharge or direct piping to impacted wetlands on Starkey wellfield
3	Anclote River	PS, Env	2.8	10	5,393	3.01	1	ASR	Aquifer recharge or direct piping to impacted wetlands on Starkey wellfield
S1	Pithlachascotee River	PS, Env	0.5	4.3	22,605	3.10	2	ASR	Piped to Starkey or N. Pasco wellfields to rehydrate wetlands - increase wellfield yields
S5	Cypress Creek	PS	4.3	26	8,004	2.28	2	Off-stream reservoir	Aquifer Recharge
S6	Zephyr Creek	Rec	0.2	2	17,705	2.43	2	stormwater detention & ASR	Piped to reuse line for golf course irrigation
Pinellas County									
S3	Lake Seminole	Urban reuse	1	9	3,708	0.42	1	Off-stream, ASR	Distributed to reuse system
S2	Lake Tarpon	Urban reuse	3.7	37	17,650	2.42	2	ASR	Distributed to reuse system, or salinity barrier, or potable use
Hillsborough County									
12	Alafia River	Ag, Ind, PS	3.4	232	3,660	10.23	3	ASR	Pipelines to Cargill or Hill. Co. Reuse

Table IVD-2. Summary of 65 (Long List) Surface Water/Storm Water Options.

Map No.	Water Body	User Group	Avg Annual Yield (mgd)	Intake Capacity (mgd)	Capital Cost (k$/mgd)	Unit Cost ($/kgal)	Level of Treatment	Storage Method	Distribution Method
13	Alafia River	Env	3.4	232	11,277	39.56	2	ASR	Pumped into river to maintain low flows
14	Alafia River	PS, Ag	3.4	232	4,079	13.19	3	None	Piped to Tampa Bay Water WTP or new reservoir
15	Alafia River	PS, Ag	3.4	232	1,165	35.09	3	ASR	Piped under Tampa Bay to Pinellas County for Public Supply
16	Alafia River	PS, Env	3.4	232	11,724	39.45	2	ASR	Sent to ASR wells along a pipeline. Use aquifer for conveyance for Brandon wellfield
16	Alafia River	PS	3.4	232	8,164	32.24	1	None	Treat water at withdrawal site to potable standards & send to Tampa Bay Water for public supply
S8	S. Prong of Alafia River	Ag, Ind	3.4	74	755	2.68	3	Phosphate settling pits, ASR	Injected into non-potable aquifer for aquifer recharge
S7	Bullfrog Creek	PS, Ind, Ag	2.4	25	8,765	2.23	3	Off-stream reservoir, ASR	Piped to adjacent urban, industrial, or agricultural users
S4	Channel A	Urban Reuse	1	9	4,776	1.93	3	Off-stream reservoir, ASR	Piped to Hillsborough County's reuse system
5	Hillsborough River	PS, Urban reuse, & Env	<1	95	48,031	16.10	3	ASR	Recovered for City of Tampa public supply or for low flow maintenance below dam
6	Hillsborough River	PS, Env	<1	163	93,725	29.82	3	None	Piped to Lower Hillsborough River Detention Area for wellfield hydration

Table IVD-2. Summary of 65 (Long List) Surface Water/Storm Water Options.

Map No.	Water Body	User Group	Avg Annual Yield (mgd)	Intake Capacity (mgd)	Capital Cost (k$/mgd)	Unit Cost ($/kgal)	Level of Treatment	Storage Method	Distribution Method
7	Hillsborough River	PS	<1	95	76,888	45.36	1	ASR	Distributed to public supply system
9	Tampa Bypass Canal	PS	<1	16	11,858	4.00	3	ASR	Piped to Tampa Bay Water WTP for potable treatment
10	Tampa Bypass Canal	PS	<1	16	6,721	4.76	1	None	Piped to Tampa Bay Water WTP for potable treatment
11	Tampa Bypass Canal	PS	<1	16	3,430	10.50	3	ASR	Aquifer recharge at inland location
Polk County									
S15	Peace Creek Canal	Ag, PS, Ind	8.5	84	6,646	1.86	2	off-stream reservoir, AR	Aquifer conveyance to agricultural, public supply, & industrial ground-water users
S14	IMC Clay Settling Ponds (stormwater)	Ag, PS, Ind	3	10	2,808	0.73	3	clay settling ponds, AR	Aquifer conveyance to agricultural, public supply, & industrial ground-water users
S11	Upper Peace River	Ag, PS, Ind	10	130	5,577	2.90	1	clay settling ponds, AR	Aquifer conveyance to agricultural, public supply, & industrial ground-water users
S13	Upper Saddle Creek	Ag, PS, Ind	2.9	29	13,500	2.55	1	clay settling ponds, AR	Aquifer conveyance to agricultural, public supply, & industrial ground-water users
Highlands County									

Table IVD-2. Summary of 65 (Long List) Surface Water/Storm Water Options.

Map No.	Water Body	User Group	Avg Annual Yield (mgd)	Intake Capacity (mgd)	Capital Cost (k$/mgd)	Unit Cost ($/kgal)	Level of Treatment	Storage Method	Distribution Method
27	Josephine Creek	Ag, PS, Ind	3.0	4	3,991	1.63	1	AR	Aquifer conveyance to agricultural, public supply, & industrial ground-water users
Hardee County									
40	Charlie Creek	Ag	12	66	11,911	3.39	2	AR	Aquifer conveyance to agricultural ground-water users
40	Charlie Creek	Ag	12	66	3,279	0.96	3	off-stream reservoir	Piped to adjacent agricultural users
40	Charlie Creek	Ag	12	66	3,376	0.93	2	off-stream reservoir, AR	Aquifer conveyance to agricultural ground-water users
19	Upper Horse Creek	Ag, PS, Ind	1.4	8.3	1,450	1.95	2	off-stream reservoir, AR	Aquifer conveyance to agricultural, public supply, & industrial ground-water users
Manatee County									
23	Braden River	PS	2.3	12	3,478	1.52	3	ASR	Distributed to City of Bradenton’s public supply system
24	Braden River	Ag	2.3	12	3,476	1.27	3	ASR	Distributed to reclaimed water system
25	Braden River	PS	2.3	12	1,405	2.56	1	ASR	Distributed to City of Bradenton’s public supply system

Table IVD-2. Summary of 65 (Long List) Surface Water/Storm Water Options.

Map No.	Water Body	User Group	Avg Annual Yield (mgd)	Intake Capacity (mgd)	Capital Cost (k$/mgd)	Unit Cost ($/kgal)	Level of Treatment	Storage Method	Distribution Method
S20	Flatford Swamp	All	8	34	2,897	1.89	2	AR	Aquifer conveyance to agricultural ground-water users
S20	Tatum Sawgrass area-Upper Myakka River	Ag	8.4	57	10,197	3.10	1	off-stream reservoir, AR	aquifer conveyance to agricultural ground-water users
S16	Frog Creek (stormwater)	PS	1	34	1,257	5.32	1	off-stream reservoir, ASR	Distributed to PRMRWSA public supply system
S17	Frog Creek (stormwater)	Ag, Urban reuse	1	34	994	4.21	3	off-stream reservoir, ASR	Distributed to MARS system
S19	Gamble Creek	Ag, Urban reuse	3.9	39	721	1.88	2	off-stream reservoir, ASR	Distributed to MARS system
17	Little Manatee River	Ag	14	123	2,335	0.81	3	off-stream reservoir	Distributed to MARS system
18	Little Manatee River	Ag, Urban reuse	14	123	3,600	1.30	1	off-stream reservoir, AR	Distributed to MARS system or aquifer conveyance to agricultural ground-water users
20	Manatee River	Ag	2.9	50	1,691	3.97	1	AR	aquifer conveyance to agricultural ground-water users
21	Manatee River	Ag, Env	2.9	50	1,694	3.11	1	ASR	aquifer conveyance to agricultural ground-water users or baseflow maintenance
22	Manatee River	PS	2.9	50	1,170	0.51	1	ASR	Distributed to PRMRWSA public supply system

Table IVD-2. Summary of 65 (Long List) Surface Water/Storm Water Options.

Map No.	Water Body	User Group	Avg Annual Yield (mgd)	Intake Capacity (mgd)	Capital Cost (k$/mgd)	Unit Cost ($/kgal)	Level of Treatment	Storage Method	Distribution Method
22	Manatee River	PS	2.9	50	5,724	2.61	1	off-stream reservoir	Distributed to PRMRWSA public supply system
Sarasota County									
S18	Celery Fields (stormwater)	Urban reuse	2	22	15,082	2.07	2	off-stream reservoir, ASR	Distributed to reclaimed water system
26	Cow Pen Slough	Urban reuse	4.4	32	3,387	1.04	3	ASR	Distributed to reclaimed water system
27	Cow Pen Slough	PS	4.4	32	6,076	1.98	1	off-stream reservoir, ASR	Distributed to Sarasota County's public supply system
28	Myakka River	Ag	15	120	5,739	2.56	2	off-stream reservoir, AR	aquifer conveyance to agricultural ground-water users
29	Myakka River	PS	15	120	4,460	2.28	3	off-stream reservoir	Distributed to PRMRWSA public supply system
31	Myakkahatchee Creek	PS	1.3	15	9,028	2.51	3	ASR	Distributed to PRMRWSA public supply system
32	Myakkahatchee Creek	PS	1.3	15	15,352	4.32	1	ASR	Distributed to PRMRWSA public supply system
DeSoto County									
39	Joshua Creek	Ag	3.8	26	15,262	4.34	2	AR	Aquifer conveyance to agricultural ground-water users
39	Joshua Creek	Ag	3.8	26	6,820	1.98	3	off-stream reservoir	Piped to Joshua Water Control District

Table IVD-2. Summary of 65 (Long List) Surface Water/Storm Water Options.

Map No.	Water Body	User Group	Avg Annual Yield (mgd)	Intake Capacity (mgd)	Capital Cost (k$/mgd)	Unit Cost ($/kgal)	Level of Treatment	Storage Method	Distribution Method
39	Joshua Creek	Ag	3.8	26	6,264	1.69	2	off-stream reservoir, AR	Aquifer conveyance to agricultural ground-water users
33	Peace River	PS	40	500	10,134	3.67	3	ASR	Distributed to PRMRWSA public supply system
34	Peace River	PS	40	500	19,233	5.66	2	ASR	Distributed to PRMRWSA public supply system
35	Peace River	PS	40	500	5,744	1.96	1	off-stream reservoir, ASR	Distributed to PRMRWSA public supply system
38	Prairie Creek	Ag	12	92	15,872	4.57	2	AR	aquifer conveyance to agricultural ground-water users
38	Prairie Creek	Ag	12	92	4,004	4.57	3	AR	aquifer conveyance to agricultural ground-water users
38	Prairie Creek	Ag	12	92	4,352	1.20	3	off-stream reservoir, AR	aquifer conveyance to agricultural ground-water users
Charlotte County									
36	Shell Creek	PS	10	40	4,880	1.77	3	ASR	Distributed to City of Punta Gorda's public supply system
36	Shell Creek	Ag	10	40	7,475	2.22	2	AR	aquifer conveyance to agricultural ground-water users
37	Shell Creek	PS	10	40	12,720	3.98	1	ASR	Distributed to City of Punta Gorda's public supply system

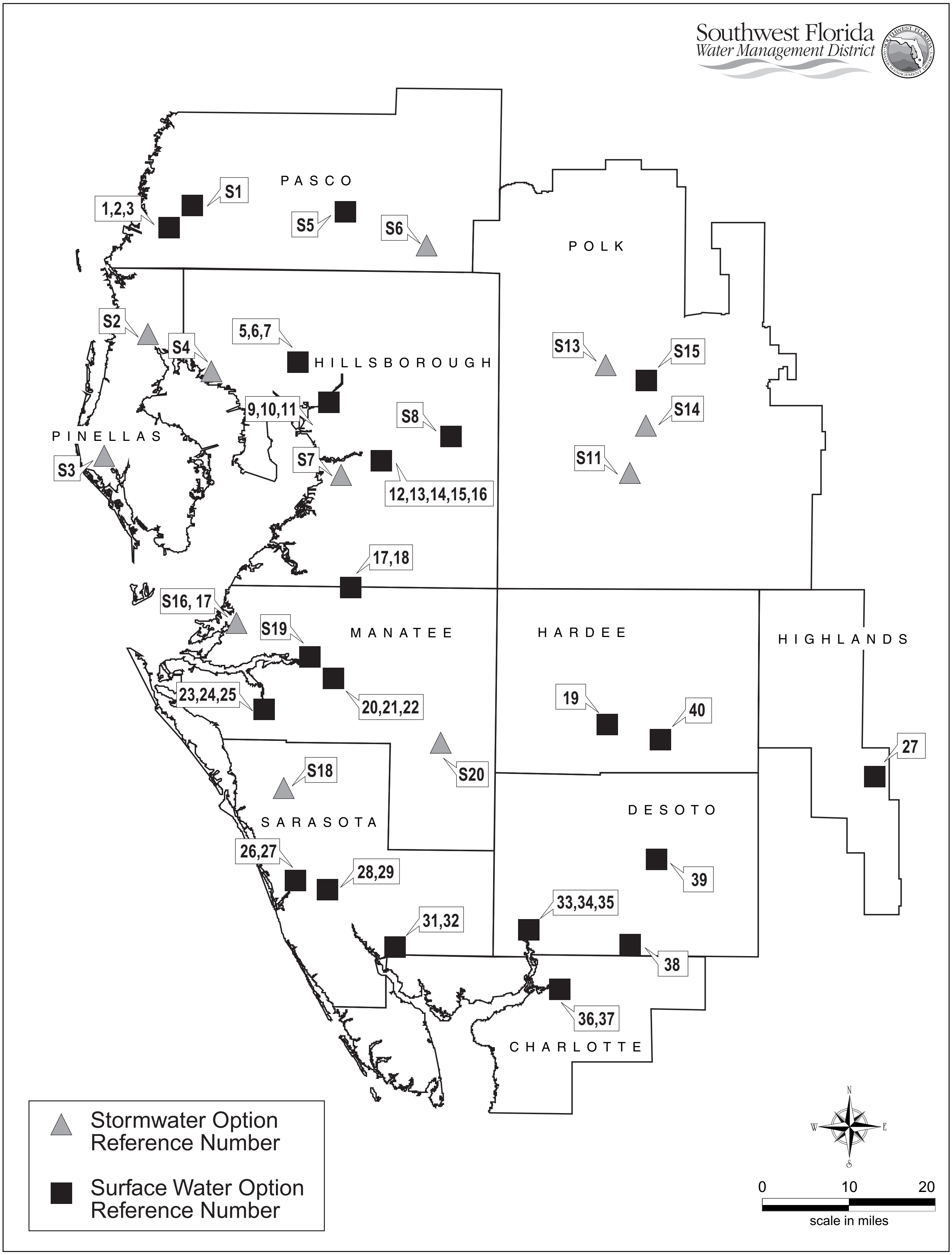


Figure IVD-2. Locations of 65 (Long List) Surface Water/Storm Water Options in the Planning Region.

Each option includes a surface-water diversion structure, water treatment alternatives, distribution system, storage options and costs. In general, water diversions will occur during periods of high flow and for relatively short periods, therefore, suitable storage mechanisms must be identified to hold water during wet times of the year for later use in the dry season. To that end, off-stream surface-water reservoirs and ASR wells are vital to develop this source of supply. In some cases, a combination of the two storage options are employed.

1.0 Anclote River Wellfield Hydration

The purpose of this option is to rehydrate stressed wetlands on the Starkey Wellfield property with water from the Anclote River. This would allow the wellfield to produce more water at rates that, without the rehydration, would further stress wetlands. This option could produce an additional nine mgd of ground water for public supply purposes above the anticipated cutback in 2020.

The majority of diversions from the Anclote River would likely occur during the wet season. The water would receive primary treatment to remove solids. It would then be pumped north along a power line easement to pipelines generally running along the divide between the Anclote and Pithlachascotee River watersheds. Water would be released at seven key locations along slightly higher topographic features. This would allow water to recharge the water table and provide seepage into numerous wetlands that have been impacted by ground-water withdrawals. Previous modeling from SDI (1995) has shown that the water table would not decline if six inches of additional recharge could be added to the surficial aquifer over the entire wellfield when the level of pumping from the facility was 15 mgd. Application of 1.8 mgd of water annually over the western 4,000 acres would be equivalent to six inches of additional recharge. The NTB recovery plan envisions wellfield withdrawals to be reduced to 6 mgd by the year 2010 without supplemental hydration.

Potential Quantity of Water Available (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
9	$3,970,000	$444,000	$0.15

Issues:

- Anclote River diversions could be increased to 2.8 mgd using the P85 and 10 percent of daily flow if additional hydration is necessary for the wellfield.
- Additional research on the effects of rehydration of wetlands should be initiated prior to implementation.

2.0 Josephine Creek - Aquifer Recharge

This option could potentially provide aquifer recharge to increase potentiometric levels in the Upper Floridan aquifer in the Lake Wales Ridge area. Numerous lakes in the Lake Wales Ridge area have chronically low levels due to ground-water withdrawals from the Upper Floridan aquifer. Water would be diverted from the west shore of Lake Istokpoga where Josephine Creek enters the lake. The water would be withdrawn using the P85 minimum flow and 10 percent of daily flow criteria. Water would be treated to potable standards and recharged to help offset ground-water withdrawals further to the north that would augment stressed lakes.

An annual average yield of three mgd would be attainable from a proposed four mgd intake structure assuming withdrawals could occur over a ten-month period. Lake Istokpoga is located within the South Florida Water Management District (SFWMD), so there is the potential for interdistrict transfer of water. Coordination and approval from the SFWMD would be necessary to develop this option.

Potential Quantity of Water Available (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
3	$11,970,000	$3,991,000	$1.63

Issues:

- Interdistrict transfer of water would require approval and coordination with SFWMD.
- If regulatory constraints on quality of source water are reduced to filtration and disinfection, costs could be reduced considerably.
- Additional research on the effects of using ground water to augment lake levels may be necessary.

3.0 Upper Peace River - Aquifer Recharge and Industrial Supply

This option involves storing excess flows from the upper Peace River in the Upper Floridan aquifer to be used to offset future agricultural or industrial (power plant) ground-water uses in the area. A 1,500-acre partially filled clay setting area, located at the Clear Springs Mine four miles south of Bartow, could be used as an off-stream reservoir with a capacity of 20,000 acre-feet. Water would be diverted from the Peace River during high flow periods. The water would then be pumped into existing created wetlands for treatment to remove solids and allowed to flow into the clay settling basin. A treatment plant constructed adjacent to the reservoir would treat water to potable standards for aquifer recharge.

An annual average yield of 10 mgd may be available for diversion from the Peace River with a maximum diversion of 130 mgd. Water would be pumped approximately 3,000 feet from the River into wetlands. Two, five mgd Avon Park aquifer recharge wells would be installed to recharge the Upper Floridan aquifer.

Potential Quantity of Water Available (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
10	$55,770,000	$5,577,000	$2.90

Issues:

- Berms around the clay settling area would require upgrading for surface-water storage.
- The feasibility of using clay settling areas as reservoirs would need to be evaluated.
- Successful completion of this option will demonstrate a use for clay settling areas on other phosphate mining lands
- Potential impacts of surface water withdrawals on the Paynes Creek State Historic Site need to be considered.
- Future withdrawals can not interfere with the downstream existing legal uses.

4.0 Manatee River - Public and Agricultural Supply - Maintenance of Minimum Flows

The purpose of this option is to utilize the existing surface reservoir and treatment capacity more efficiently to divert, treat, and store a greater portion of wet season flows while maintaining the downstream minimum flow during the dry season. In order to more efficiently use Manatee County's existing reservoir (Lake Manatee), the 10 percent withdrawal criteria was modified for this option. This was to demonstrate the effect of different withdrawal criteria on the water supply potential of proposed options. Using the P85 minimum flow and 10 percent diversion guidelines, there is little or no additional water that could be diverted from the Manatee River. However, if the diversion criteria were modified to allow diversions of 20 percent when flows were above the median flow of the river, the annual average water supply potential can be increased to 2.9 mgd. This water could be utilized for public supply or agricultural use via aquifer recharge. The Manatee River option is the only water supply option where the 10 percent diversion guideline was modified.

The increase in allowable diversions from the river could enhance the water supply potential of the Manatee River/Lake Manatee Reservoir. In exchange for the higher diversion rates (20 percent when above the median flow) from the reservoir, approximately 10 percent of the increase in total storage volume would be allocated to maintain base flow below the dam during dry periods (or when appropriate). Under this scenario, if flow below the dam is augmented 60 days per year, natural downstream base flow would be supplemented by 6 cfs (4 mgd) during this low flow period.

This option would use the existing intake and treatment facilities on Lake Manatee. It would require a change in the reservoir operating schedule so that a greater portion of storage capacity would occur in the Upper Floridan aquifer beneath the reservoir and treatment plant. The water diverted from the reservoir would be treated to potable standards and stored at a rate of 30 mgd. Ten additional wells (two mgd each) installed into the aquifer would be necessary to bring existing ASR capacity up to 30 mgd. The site is in the Most Impacted Area of the ETB WUCA and increasing recharge to the Upper Floridan aquifer at this site would benefit the regional system by reducing the potential for saltwater intrusion.

Potential Quantity of Water Available (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
2.9	$3,520,000	$1,170,000	$0.51

Issues:

- Prior to implementation, simulation modeling needs to be conducted that incorporates existing reservoir storage in a flow routing model.
- The operating costs would be the marginal cost to operate the system at a higher diversion and treatment rate during off-peak periods. It was assumed that the cost would be $0.40/kgal for the increased diversion and treatment plus $200,000 per year to operate the ASR system.
- Reduced regulatory constraints on quality of source water could reduce costs. The reduced level of treatment would allow injected water to be stored in the brackish Avon Park Formation.
- Potential impacts of surface water withdrawals on the Lake Manatee State Recreation Area need to be considered.

5.0 Myakka River - Public Supply

This option could potentially provide additional public water supply for the coastal regions of Sarasota County. Water would be diverted from the Myakka River near the I-75 crossing during high flow periods. The water withdrawn from the river would be stored in an off-stream impoundment near the diversion site. Treatment would consist of filtration and disinfection and the treated water could be stored in the brackish Avon Park Formation using four ASR wells, each with a capacity of five mgd. The water would be recovered during the dry season and treated to potable standards to supplement public supply. Finished water would be piped to an existing connection point which is a 42-inch main along Laurel Road.

An average annual yield of 19 mgd could potentially be developed with extremely large intake structures. However, for planning purposes, the practical annual average yield was estimated at 15 mgd. A 480-acre borrow pit currently exists 0.5 miles west of the river. Assuming a 10-foot deep pool, the reservoir could provide 4,000 acre-feet of storage volume. This existing reservoir could potentially be expanded to 1,500 acres.

Potential Quantity of Water Available (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
15	$66,900,000	$4,460,000	$2.28

Issues:

- A 1,500-acre reservoir consisting of 33,000 feet of 10-foot high berms would be required.
- The River's Wild and Scenic designation and Outstanding Florida Water Status needs to be considered when planning for water withdrawals from the river.
- Studies may need to be conducted to evaluate the use of water derived from ASR for appropriate augmentation of river flows to enhance the water supply potential of the river.
- The Blackburn Canal and diversions from the Flatford Swamp must be considered when calculating available quantities for diversion. Flood waters currently being diverted from the river via Blackburn Canal could be redirected to provide water supply for the region.

6.0 Little Manatee River - Agricultural Supply

This option involves using existing storage capacity for a power plant cooling pond (Lake Parrish Reservoir) to facilitate aquifer recharge or distribution of water to agricultural users. It includes the supplemental use of reclaimed water from Manatee County for cooling make-up water purposes, thereby freeing up a portion of water stored in the cooling pond for regional water supply. Because the option is located at the center of the MIA of the Eastern Tampa Bay WUCA, recharging the Upper Floridan aquifer in this area would be extremely beneficial to help offset historic potentiometric surface declines and reduce the potential for saltwater intrusion.

The cooling pond is 4,000 acres in size when the water level is at an elevation of 70 ft. NGVD. To ensure adequate surface area for evaporative cooling, pool elevations are currently maintained in a narrow operating range of 66 to 66.5 ft. NGVD. An opportunity exists to determine an acceptable reservoir operating range to generate seasonal storage volume for aquifer recharge or piped distribution to agricultural users. Average annual quantities of approximately 4.5 mgd could be generated for aquifer recharge if the reservoir is operated between elevations of 67.5 ft. NGVD in summer and 65.0 ft. NGVD in winter (equivalent to about 5,000 acre-feet of storage).

To ensure that the power plant has adequate water for cooling purposes, it is assumed that Manatee County can provide an annual average of 10 mgd of reclaimed water. This represents about 40 percent of the plant's cooling water needs at full plant capacity. If the reclaimed water is provided, another 10 mgd annual average of surface water from currently permitted diversions from the Little Manatee River could be included for aquifer recharge or piped distribution to agricultural users. Thus, with a change in the reservoir operating schedule and the addition of reclaimed water for industrial supply, the total yield for aquifer recharge would approach an annual average of 14 mgd.

The aquifer recharge option would involve treating the cooling pond water to potable standards and injecting it into the Suwannee Limestone through seven recharge wells. This would require construction of a treatment plant on-site. The distribution to agriculture option involves pumping and piping the water from the reservoir with minor treatment for filtration to nearby agricultural users that are adjacent to the power plant property. The Manatee County Agricultural Reuse System (MARS) may require augmentation with other sources to supply the flows necessary for this option to achieve its full potential (also see reclaimed water project number 24).

Aquifer Recharge Option:

Potential Quantity of Water Available (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
14	$50,410,000	$3,600,000	$1.30

Piped Distribution Option:

Potential Quantity of Water Available (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
14	$32,690,000	$2,335,000	$0.81

Issues:

- Thermodynamic calculations would need to be completed to determine whether reliable power plant cooling can occur under the revised reservoir operation schedule.
- This option would require approval and coordination with the power plant.
- If regulatory constraints on quality of source water for injection are reduced to filtration and disinfection, the costs could be reduced considerably. The reduced level of treatment would allow injected water to be stored in the brackish Avon Park Formation.
- As proposed, this option would require the exchange of reclaimed water to use for industrial purposes (power plant cooling water) for surface water that can be treated to drinking water quality and injected into the Upper Floridan aquifer.
- Currently there is a federal requirement that limits facilities at the existing power plant site to be those that are required for power generation and does not allow commercial or other activities to occur. This requirement will need to be addressed prior to moving forward on this option to take advantage of the opportunities and advantages this site provides for regional water supply development.
- Potential impacts of surface water withdrawals on the Little Manatee River State Park need to be considered.

7.0 Cow Pen Slough - Irrigation Supply/Public Supply

This option involves the creation of an off-stream reservoir from an existing borrow pit to store flows diverted from Cow Pen Slough. An average annual quantity of 4.4 mgd could potentially be developed. Cow Pen Slough is a large coastal stream (90 square mile drainage area) that flows into Dona Bay near Venice. The stream has been extensively re-channelized and improved for drainage. These modifications have increased runoff and led to downstream flooding and other imbalances in the estuarine system. By capturing some of the high flows, these adverse occurrences could be alleviated.

A 500 mg (1,535 acre-feet) off-stream reservoir would be created from an existing borrow pit. Flows from the slough would be diverted and stored in the reservoir. The water would be treated with filtration and chlorination near the reservoir and either sent directly to a reclaimed water system or stored underground for later recovery and distribution to a reclaimed water system. The planned interconnect with the reclaimed water system is located within one-half mile from the reservoir site.

Another option involves treating the water to potable standards from a newly constructed treatment plant and either directly piping the water to Sarasota County Utilities Department or storing and recovering the treated water underground through ASR wells with delivery to Sarasota County during peak demand periods. In either scenario, whether distributing the water to the reclaimed water system or for public supply purposes, three ASR wells (2 to 3 mgd capacity each) would be installed into either the Avon Park Formation (reclaimed water option) or the Suwannee Limestone (public supply option).

Reclaimed Water Option:

Potential Quantity of Water Available (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
4.4	$15,240,000	$3,387,000	$1.04

Public supply Option:

Potential Quantity of Water Available (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
4.4	$27,340,000	$6,076,000	$1.98

Issues:

- The borrow pit would require upgrade of berms to retain water for a 500 mg reservoir.
- Additional flow data/modeling will be necessary to confirm anticipated withdrawals.
- The designation of Dona Bay as an Outstanding Florida Water needs to be considered as future water supply projects from Cow Pen Slough are evaluated.

8.0 Peace River

The Peace River is the most prominent drainage feature in the SWUCA, draining portions of Polk, Hardee, DeSoto, and Charlotte counties. It has the highest flow of all the rivers in the planning region with a mean annual flow of 760 mgd (1,176 cfs). Because of the dispersed nature of water withdrawals in the SWUCA and the large potential for future water supply from the river, several options were identified that could address water needs throughout the region. Based on the withdrawal criteria established for rivers in the RWSP there is an annual average of 40 mgd potentially available for future water supply development above the 32 mgd currently permitted to the PR/MRWSA. Each of the options is based on the annual average water demands for the PR/MRWSA being supplied first before additional water is diverted from the river.

Consistent with the District's water use permitting rules, all future withdrawals upstream of the PR/MRWSA would need to demonstrate that they do not interfere with the Authority's existing legal use of the Peace River. Based on their water use permit, the maximum amount of water the Authority can deliver to its customers is 32.7 mgd on annual average basis and 38.1 mgd on a maximum monthly basis. The Authority however, is able to withdraw 10 percent of the total flow of the river up to a maximum of 90 mgd when the flow, as measured at the Arcadia stream gauge, is above 130 cfs (84 mgd) for the purpose of maximizing storage in its onsite reservoir and/or ASR system. Though there is additional water supply potential from the Peace River, based on the assumed withdrawal criteria, future water users will need to work with the PR/MRWSA to ensure that the legal existing use is protected.

8.1 Peace River Option A. PR/MRWSA Site/Tatum Sawgrass

The following three alternatives are options that were developed to capture up to an annual average of 40 mgd of water from the river in the vicinity of the PR/MRWSA plant for users throughout the region.

8.1.1 Peace River Option A - Alternative 1

This option could provide an annual average of up to 40 mgd for agricultural use or public supply. An intake structure with a maximum capacity of 500 mgd would be constructed adjacent to the existing intake structure at the PR/MRWSA facility. The high capacity would be necessary to maximize withdrawals during the river's high-flow periods, which typically occur during the wet season. Surface-water storage could be provided by a new off-stream reservoir with 20,000 acre-feet of storage capacity (surface area of 1,000 acres) and a new water treatment plant could be constructed with a maximum capacity of 65 mgd. Both the reservoir and the treatment plant would be located in the vicinity of the PR/MRWSA plant.

Up to a maximum of 50 mgd of river water would be treated to potable standards at the new treatment plant and conveyed approximately 20 miles via a 54-inch pipeline to the Tatum Sawgrass area in southeast Manatee County. At that location, the water would be injected into 14 Upper Floridan aquifer recharge wells at seven sites. Each site would have one, five-mgd ASR well constructed into the Avon Park Formation and one, two-mgd well constructed into the Suwannee Limestone. Investigation of the effects of recharging the aquifer at this location demonstrated an increase in potentiometric levels extending over a large portion of the SWUCA and encompassing much of the ETB MIA. Water recharged into the aquifer as part of this option could be accessed by agricultural and other users in the region.

During periods when the treatment plant would be operating at full capacity (65 mgd), there could be an additional 15 mgd that would be available for ASR at the reservoir at the PR/MRWSA facility. This storage could be achieved through the use of ASR wells at eight new sites. Water stored in the aquifer could be retrieved and used for public supply or transported to Tatum Sawgrass for aquifer recharge during periods of low river flow or when storage in the reservoir is unavailable.

Potential Quantity of Water Available (MGD)	**Capital Cost**	**Cost per MGD**	**Cost per 1,000 Gallons**
40	$230,000,000	$5,740,000	$1.96

Issues: None

8.1.2 Peace River Option A - Alternative 2

This option is similar to Peace River Option A, Alternative 1, except that treatment of water prior to ASR would not meet all drinking water standards. The treatment would, however, be sufficient to prevent well plugging. The option could be developed to provide an annual average of up to 40 mgd for use throughout the region. An intake structure with a maximum capacity of 500 mgd would be constructed adjacent to the existing intake structure at the PR/MRWSA facility. The high capacity would be necessary to maximize withdrawals during periods of high river flows. Surface-water storage would be provided by a new off-stream reservoir with 10,000 acre-feet of storage (surface area of 1,000 acres). A new water treatment plant would also be constructed with a maximum capacity of 100 mgd. Treatment would consist of pressure sand filtration and water leaving the plant would not meet all potable water standards. Both the reservoir and the treatment plant would be located in the vicinity of the PR/MRWSA plant.

When available, a maximum of 50 mgd of water from the treatment plant would be conveyed approximately 20 miles to the northwest via a 54-inch pipeline to the Tatum Sawgrass area in southeast Manatee County. The water would be injected into the Upper Floridan aquifer using 14 ASR wells at seven sites to help maintain regional aquifer levels. Each site would have one, five-mgd ASR well constructed into the Avon Park Formation and one, two-mgd well constructed into the Suwannee Limestone. Investigation of the effects of recharging the aquifer at this location demonstrated an increase in potentiometric levels extending over a large portion of the SWUCA and encompassing much of the ETB most impacted area. Water recharged into the aquifer as part of this option could be accessed by agricultural and other users in the region.

When water is available from the treatment plant at rates between 50 mgd and 100 mgd, a maximum of 50 mgd would be available to be stored at the PR/MRWSA plant. Storage could occur via 10 ASR wells constructed into the Avon Park Formation at the new reservoir. Water stored at the plant would be available for public supply or would be conveyed to the Tatum Sawgrass area during periods of low river flows and reservoir storage.

Potential Quantity of Water Available (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
40	$163,000,000	$4,080,000	$1.49

Issues:

- There is currently little experience with injecting partially treated (raw) river water into the Upper Floridan aquifer. Permitting issues could affect the success of this option.

8.1.3 Peace River Option A - Alternative 3

This option is similar to Peace River Option A, Alternative 2, except that there is no ASR component and water would be distributed to agricultural users in the vicinity of Tatum Sawgrass via pipelines. This option would provide an annual average of up to 40 mgd. An intake structure with a maximum capacity of 500 mgd would be constructed adjacent to the existing intake structure at the PR/MRWSA facility. The high capacity would be necessary to maximize withdrawals during the river's high-flow periods. Surface-water storage would be provided by an off-stream reservoir with 20,000 acre-feet of storage (surface area of 1,000 acres). A new water treatment plant would also be constructed with a maximum capacity of 50 mgd, however, the treatment (pressure sand filtration) would not meet all potable water standards. Treatment would be sufficient to prevent plugging of drip irrigation systems. Both the reservoir and the treatment plant would be located in the vicinity of the PR/MRWSA plant.

A maximum of 50 mgd of water from the treatment plant would be conveyed about 15 miles northwest via a 54-inch pipeline to the Tatum Sawgrass area in southeast Manatee County. The pipeline would terminate about five miles east of Tatum Sawgrass in the approximate center of the area to be served. In this area, there are about 30 agricultural water users permitted on the order of a few to several mgd. Distribution to individual users would be via a network of smaller diameter pipelines.

Potential Quantity of Water Available (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
40	$135,000,000	$3,400,000	$1.34

Issues:

- Lack of ASR reduces the reliability of this option to supply water demands.
- Water developed for this option could be underutilized if permittees stop farming on either a temporary or permanent basis.

8.2 Peace River Option B - Peace River Site/Zolfo Springs

The next two options are similar to the previously described options in that they would supply an annual average of up to 40 mgd from the Peace River. They differ, however, in that they propose to develop up to 30 mgd upstream of the river near Zolfo Springs in Hardee County and the remaining 10 mgd would be withdrawn at the existing PR/MRWSA site.

8.2.1 Peace River Option B - Alternative 1

This option proposes to develop an annual average of 30 mgd for aquifer recharge near Zolfo Springs in Hardee County and an annual average of 10 mgd for public supply use at the PR/MRWSA plant. The first part of this alternative would divert flow from the Peace River near Zolfo Springs at a maximum rate of 390 mgd. Surface-water storage would be provided about one mile from the river by a new off-stream reservoir with 10,000 acre-feet of storage (surface area of 500 acres). A new water treatment plant would be constructed with a maximum capacity of 35 mgd. Water from the reservoir would be treated to drinking water standards and injected into 10 ASR wells constructed into the Upper Floridan aquifer at five sites near the reservoir (one, five-mgd well in the Avon Park Formation and one, two-mgd well in the Suwannee Formation). Users throughout the region could access this water through wells.

For the second part of this alternative, an additional annual average of 10 mgd would be diverted from the river at the PR/MRWSA site at a maximum rate of 130 mgd. Surface-water storage would be achieved through expansion of the existing off-stream reservoir from 2,000 acre-feet to 7,000 acre-feet. Treatment facilities would be expanded from 18 mgd (currently being constructed) to a maximum capacity of 30 mgd. ASR facilities would be expanded from the currently planned 21 mgd to 30 mgd. Eight ASR wells would be constructed into the Suwannee Limestone at eight sites. One site would also have one well constructed into the Tampa Limestone. Water could be made available to public supply users through the PR/MRWSA's current distribution system.

Potential Quantity of Water Available (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
40	$165,000,000	$4,100,000	$1.72

Issues: None

8.2.2 Peace River Option B - Alternative 2

This alternative is similar to Peace River Option B, Alternative 1, in that an annual average of up to 30 mgd would be produced from the river near Zolfo Springs in Hardee County and an annual average of 10 mgd would be produced from the river at the PR/MRWSA plant. The major difference between these alternatives is that water withdrawn from the river near Zolfo Springs would be stored in a reservoir for direct distribution to users in the area. Flow would be diverted from the river at a maximum rate of 390 mgd. Surface-water storage would be provided about one mile from the river by a new off-stream reservoir with 10,000 acre-feet of storage (surface area of 500 acres). A new water treatment plant would be constructed with a maximum capacity of 35 mgd. Water treated at the plant would not meet all potable water standards but would be designed primarily to remove suspended solids. Water would be distributed to agricultural users within about six miles of the reservoir via pipelines.

The second part of this alternative is the same as described for alternative 1. That is, an annual average of 10 mgd would be diverted from the river at the PR/MRWSA site at a maximum rate of 130 mgd. Surface-water storage would be achieved by expanding the existing off-stream reservoir from 2,000 acre-feet to 7,000 acre-feet. Treatment facilities would be expanded from 18 mgd (currently being constructed) to a maximum capacity of 30 mgd. ASR facilities would be expanded from the currently planned 21 mgd to 30 mgd. Eight ASR wells would be constructed into the Suwannee Limestone at eight sites. One site would also have one well constructed into the Tampa Limestone. Water could be made available through the PR/MRWSA's current distribution system.

Potential Quantity of Water Available (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
40	$163,000,000	$4,100,000	$1.74

Issues:

- Lack of ASR at the Zolfo Springs reservoir reduces the reliability of this option to supply water demands.

9.0 Shell Creek Public Supply

This option proposes aquifer storage of high flows from Shell Creek and recovery of an annual average of 10 mgd for public supply. Shell Creek is currently impounded in a small 1,000 acre-feet in-stream reservoir for the City of Punta Gorda's water supply. The City's water demand is expected to rise from the current annual average of 4 mgd to 12 mgd by 2020. This option would significantly expand the current public supply system by enlarging the intake structure to a maximum capacity of 40 mgd to capture high flows. The water treatment plant would be expanded to a maximum capacity of 14 mgd and water would receive primary treatment (disinfection and filtration) prior to injection into the brackish Avon Park Formation at the site. Nine, five-mgd Avon Park ASR wells would be constructed for storage and recovery beneath the existing reservoir. Water would be recovered and treated to potable standards prior to distribution for public supply.

Potential Quantity of Water Available (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
10	$48,800,000	$4,880,000	$1.77

Issues:

- An interconnect with the PR/MRWSA distribution system would greatly enhance system flexibility.
- Additional research on the proposed effects of the increased diversions on the saltwater wedge in the creek is needed.
- Additional testing of the Avon Park Formation is necessary for ASR to be considered in this deeper zone.
- Increasing chloride levels in the Shell Creek reservoir need to be investigated.

10.0 Stormwater - Onsite Water Supply

This option outlines an approach whereby stormwater runoff from urban stormwater facilities is collected during the wet season and stored in ASR wells for irrigation during the dry season. Individual developments, new or existing, would be identified as potential candidates for project implementation based on geographical location, size, site topography, and configuration of the drainage network. The option is based on a hypothetical development on 1,500 acres that consists of 1,850 low/medium family residential lots and a 200 acre golf course. A 20 million gallon storage facility was assumed to be constructed to collect approximately 50 percent of the total runoff volume during the wet season. Additional storage would be provided by two ASR wells constructed into the Suwannee Formation. Water treatment would include filtration and disinfection. Cost estimates also include trunk lines and spray irrigation systems at individual homes.

Potential Quantity of Water Available (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
0.3	$3,300,000	$9,990,000	$4.12

Issues:

- This option may not be feasible on its own due to the high cost of installing the irrigation network.
- Feasibility of this option would improve if designed as part of a reclaimed irrigation system.

Section 2. Reclaimed Water Options

In developing reclaimed water options, the District solicited input from utilities, local governments, and public interest groups. As a result, 180 potential options were conceptualized (PBS&J, 2000). The list of 180 reclaimed water options was narrowed to a short list of 25 options. The short list contains options that are representative samples of the different types of options included on the long list. Options on the short list were submitted to more detailed analysis to more fully explore and develop the concepts and refine estimates of costs to develop the options. The short list does not represent a prioritization of or a list of the District's preferred options. Ten types of reclaimed water options were identified:

- Augmentation with Other Sources: Involves the introduction of another source (stormwater, surface water, ground water) into the reclaimed water system to expand the available supply.
- Aquifer Storage and Recovery: Involves the injection of reclaimed water into an aquifer during times of excess supply and the recovery of that same water for use during high demand.
- Efficiency: Involves the study of ways utilities can maximize the efficiency and offset potential of reclaimed water systems to conserve more water (includes rate structures, telemetry control, watering restrictions, metering and others).
- Interconnect: Involves the interconnection of two or more reclaimed water systems to enhance the supply and allow for a better utilization of the resource.
- Rehydration/Recharge: Involves the introduction of reclaimed water to enhance surficial and or Floridan aquifer levels.
- Saltwater Intrusion Barrier: Involves the injection of reclaimed water into an aquifer along the coast to create a salinity barrier.
- Storage: Involves traditional reclaimed water storage including ground storage tanks, and pond storage.
- Streamflow Augmentation: Involves the introduction of reclaimed water downstream of an existing or potential potable water withdrawal point as a replacement flow to enable more efficient utilization of the surface-water supply.
- System Expansion: Involves the expansion of a reclaimed water system to serve more customers.
- Transmission: Involves the construction of large reclaimed water mains to serve more customers.

The short list of 25 reclaimed water options with preliminary offsets and costs is included as Table IVD-3. Figure IVD-3 is a location map of the short list reclaimed water options. The long list of 180 reclaimed water options is included as Table IVD-4. A comprehensive description of reclaimed water and reclaimed water options in the region can be found in the Task 1&2 Report, and the Task 3&4 Report on *Reclaimed Water: Water Resource and Water Supply Development* (PBS&J, 2000). The following pages contain summaries of the consultant evaluations of the 25 short list options. At the end of the title for each reclaimed water option at the top of the page is a reference number that corresponds to the option's designated number in the PBS&J reports.

Table IVD-3. Summary of 25 (Short List) Reclaimed Water Options in the Planning Region.

Option	PBSJ Ref No.	List of 25 Reclaimed Water Options (Short List)	County	Offset	Type	Cost (Mill$)
1	1	Largo/Clearwater Pasco Interconnect/Rehydration ASR	Pasco	1.8	Rehy.	4.31
2	3+4	Pinellas County-St. Petersburg Storage/Interconnect	Pinellas	10	Stor./Inter.	11.05
3	8	Horizontal Well Reclaimed System Augmentation	Hills.	1.2	Aug.	16.67
4	10	Tampa/C. Hillsborough Interconnect	Hills.	18	Inter.	13.09
5	11	Downstream Augmentation of Hillsborough River	Hills.	10	Stream	20.27
6	12	Downstream Augmentation of Alafia River	Hills.	7	Stream	11.69
7	13	S. Hillsborough ASR Wells/Recharge/Saltwater Intrusion Barrier	Hills.	20	ASR/RCh/SWB	14.01
8	15	Sarasota Co. Interconnect	Sarasota	4.8	Inter.	10.55
9	16	Sarasota Co. ASR Wells	Sarasota	5.6	ASR	8.45
10	17	Lakeland/Polk Interconnect	Polk	1.2	Inter.	5.38
11	22	Natural Treatment/Aquifer Recharge	Hardee/Polk	1	Rech.	5.97
12	51	Lakeland Reclaimed Water-Fl Power	Polk	6	Trans.	9.73
13	53	Lakeland Electric Storage Facility	Polk	0.33	Stor.	8.68
14	54	Lakeland Cleveland Heights Golf	Polk	0.38	Trans.	1.62
15	56	Celery Fields Reuse Augmentation	Sarasota	1.5	Aug.	4.84
16	57	Manatee River Downstream Augmentation	Manatee	3.2	Stream	2.67
17	58	Longboat Key/Manatee Co./Sarasota Interconnect	Manatee	1.5	Inter.	8.43
18	60	US 41 Industrial Corridor Transmission	Hills.	10	Trans.	7.79
19	62	Pinellas County Efficiency Study	Pinellas	10	Eff.	0.1
20	68	IMC/Mars Storage - Augmentation	Manatee	9	Stor./Aug.	20.99
21	70	Polk Co. Reuse Efficiency Study	Polk	5	Eff.	0.1
22	75	Lakeland Wetland Reuse-Industrial	Polk	2	Trans.	3.23
23	78	Optimization and Efficiency Study in Coastal SWUCA	Sarasota	26	Eff.	0.1
24	136	MARS System Expansion to Lake Parrish	Manatee	4.8	Sys. Exp.	4.64
25	180	Rotonda-Long Marsh Golf Transmission	Charlotte	0.3	Trans.	0.46
Total				**119.61**		**173.39**

* Total offset doesn’t include efficiency Proj Nos 19, 21, & 23. Some options are contingent upon others. See Table IVB-4 for total potential offset in the Central & Southern Region.

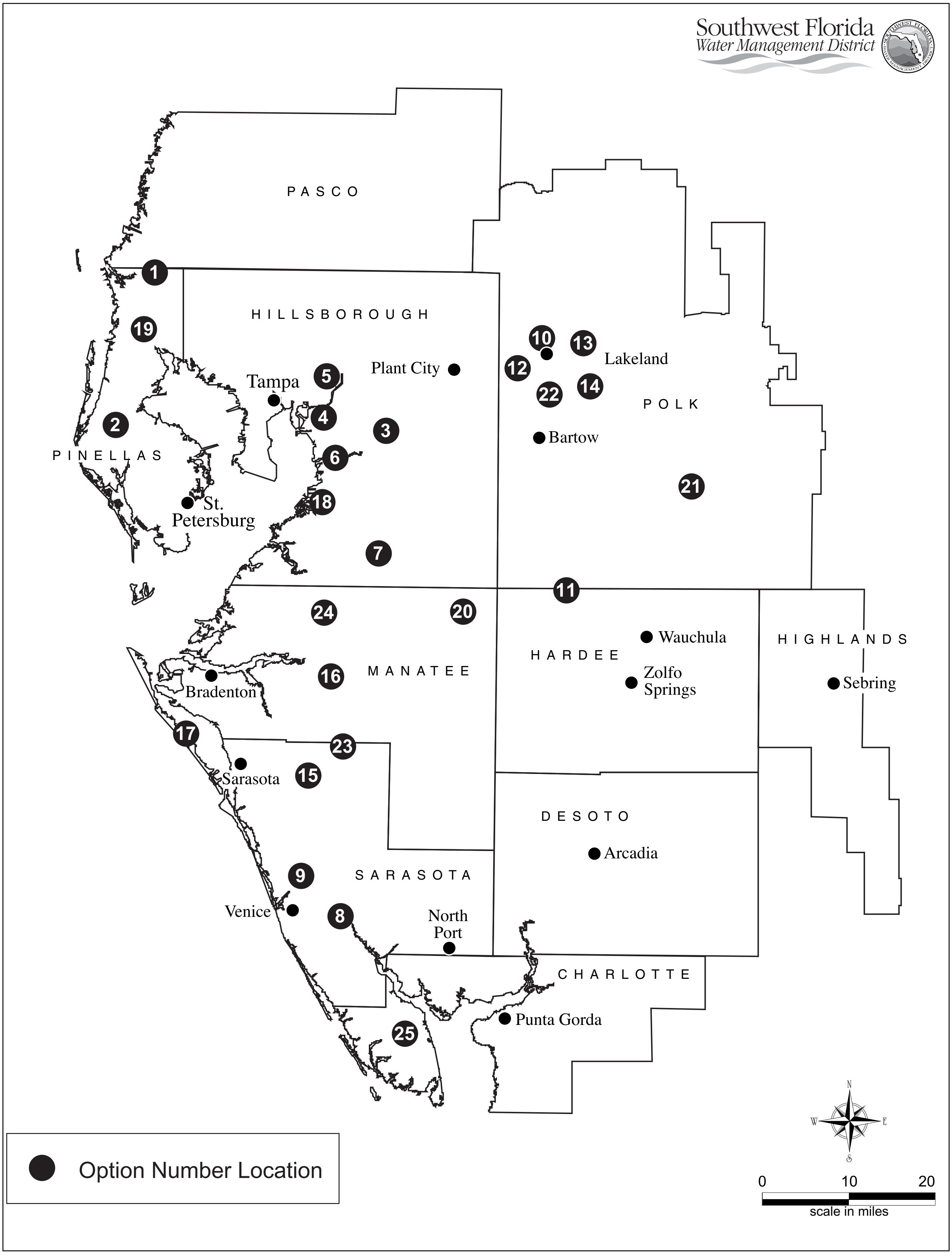


Figure IVD-3. Location of 25 (Short List) Reclaimed Water Options in the Planning Region.

Table IVD-4. Summary of 180 (Long List) Reclaimed Water Options in the Planning Region.

PBS&J #	Project Names	County	Description	MGD Supply Annualized	MGD Offset Annualized	Prelim Cap. Cost	Prelim Cost per 1000 gal
71	Howard F. Curren Direct Inject.	Hills.	Recharge	30	30	21,300,000	$0.17
2	N. Hills./Pasco Intercon.	Hills./Pasco	Intercon.	1.5	1.1	2,070,000	$0.46
34	N.W. Hills. ASR Wells	Hills.	ASR	1.1	0.82	2,000,000	$0.59
13	S. Hills. ASR Wells/Recharge/Saltwater Intru. Bar.	Hills.	ASR, Rech., SWB	20	20	14,007,000	$0.17
8	Horizontal Well Reclaimed Syst. Aug.	Hills.	Aug.	2	1.2	16,672,110	$3.31
33	N.W. Hills. Wetland Aug.	Hills.	Aug.	1	0.75	220,000	$0.07
175	Tampa Water Resource Recovery Project	Hills.	Indirect Potable	25	25	100,000,000	$0.97
6	S. Hills./C. Hills. Intercon.	Hills.	Intercon.	4	4	7,250,000	$0.44
7	C. Hills./Temple Terrace Intercon.	Hills.	Intercon.	1	1	1,380,000	$0.34
9	C. Hills./Plant City Intercon.	Hills.	Intercon.	1.5	1.5	2,070,000	$0.34
10	Tampa/C. Hills. Intercon.	Hills.	Intercon.	30	18	13,095,675	$0.24
176	Tampa/Curren Natural Treatment/Recharge	Hills.	Recharge	25	25	25,000,000	$0.24
40	Plant City Varn Road Trans.	Hills.	Rehyd./Wetland	1.5	1.5	657,000	$0.11
11	Downstream Augmentation of Hills. River	Hills.	Streamflow	10	10	20,141,950	$0.51
12	Downstream Augmentation of Alafia River	Hills.	Streamflow	7	7	11,696,000	$0.40
125	Reuse Expan. in Hills. Co.- Cent. Co. Sys. 2005-2010	Hills.	Sys. Expan.	2	1.2	2,760,000	$0.56
126	Reuse Expan. in Hills. Co.- Cent. Co. Sys. 2010-2020	Hills.	Sys. Expan.	4.1	2.46	5,658,000	$0.56
127	Reuse Expan. in Hills. Co.- NW Co. Sys. 2005-2010	Hills.	Sys. Expan.	1.8	1.08	2,484,000	$0.56
128	Reuse Expan. in Hills. Co.- NW Co. Sys. 2010-2020	Hills.	Sys. Expan.	1.7	1.02	2,346,000	$0.56
129	Reuse Expan. in Hills. Co.- S. Co. Sys. 2005-2010	Hills.	Sys. Expan.	0.7	0.42	966,000	$0.56
130	Reuse Expan. in Hills. Co.- S. Co. Sys. 2010-2020	Hills.	Sys. Expan.	0.3	0.18	414,000	$0.56
131	Reuse Expan. in Plant City WWTP 2005-2010	Hills.	Sys. Expan.	0.8	0.48	1,104,000	$0.56
132	Reuse Expan. in Plant City WWTP 2010-2020	Hills.	Sys. Expan.	1.6	0.96	2,208,000	$0.56
134	Reuse Expan. in Tampa/Curran WWTP 2005-2010	Hills.	Sys. Expan.	3	1.8	4,140,000	$0.56
135	Reuse Expan. in Tampa/Curran WWTP 2010-2020	Hills.	Sys. Expan.	6	3.6	8,280,000	$0.56
35	N.W. Hills. Telemetry	Hills.	Sys./SCADA	1	0.6	500,000	$0.20
36	N.W. Hills. Trans. I	Hills.	Trans.	1	0.6	1,035,000	$0.42
37	N.W. Hills. Trans. II	Hills.	Trans.	1	0.6	980,000	$0.40
38	N.W. Hills. Trans. III	Hills.	Trans.	1	0.6	3,850,000	$1.56
39	S.C. Hills. Trans.	Hills.	Trans.	8	8	7,616,000	$0.23
41	Plant City Walden Lakes	Hills.	Trans.	1	0.4	695,000	$0.42
42	Plant City Hardee Trans.	Hills.	Trans.	0.35	0.35	508,000	$0.35
43	Plant City Trans. I	Hills.	Trans.	3	3	1,895,000	$0.15
60	US 41 Industrial Corridor Trans.	Hills.	Trans.	10	10	7,787,950	$0.18
64	S. Tampa Area Reuse	Hills.	Trans.	5	2	6,900,000	$0.84
77	Pasco Co. Reuse Efficiency Study	Pasco	Efficiency	5	3	50,000	$0.00
25	Handcart Road Storage/Aug.	Pasco	Storage/Augment.	1	0.6	3,632,000	$1.47
105	Reuse Expan. in Pasco Co./N.P. R. Sys. 2005-2010	Pasco	Sys. Expan.	2.2	1.32	3,036,000	$0.56
106	Reuse Expan. in Pasco Co./N. P. R. Sys. 2010-2020	Pasco	Sys. Expan.	4.4	2.64	6,072,000	$0.56

Table IVD-4. Summary of 180 (Long List) Reclaimed Water Options in the Planning Region.

PBS&J #	Project Names	County	Description	MGD Supply Annualized	MGD Offset Annualized	Prelim Cap. Cost	Prelim Cost per 1000 gal
107	Reuse Expan. in Dade City WWTP 2005-2010	Pasco	Sys. Expan.	0.1	0.06	138,000	$0.56
108	Reuse Expan. in Dade City WWTP 2010-2020	Pasco	Sys. Expan.	0.4	0.24	552,000	$0.56
109	Reuse Expan. in Seven Springs WWTP 2005-2010	Pasco	Sys. Expan.	0.6	0.36	828,000	$0.56
110	Reuse Expan. in Seven Springs WWTP 2010-2020	Pasco	Sys. Expan.	0.6	0.36	828,000	$0.56
111	Reuse Expan. in Zephyrhills WWTP 2005-2010	Pasco	Sys. Expan.	0.1	0.06	138,000	$0.56
112	Reuse Expan. in Zephyrhills WWTP 2010-2020	Pasco	Sys. Expan.	0.3	0.18	414,000	$0.56
23	Starkey Reclaimed Water Main	Pasco	Trans.	1	0.75	600,000	$0.19
24	New River Intercon.	Pasco	Trans.	1	0.75	124,000	$0.04
1	Largo/Clearwater/Pasco Intercon./Restoration	Pin./Pasco	Intercon./Rehyd.	3	1.8	4,310,000	$0.54
4	Pinellas ASR Wells	Pinellas	ASR	4	2.6	12,200,000	$1.14
72	St. Petersburg Reclaimed ASR	Pinellas	ASR	5	3.25	14,300,000	$1.07
73	Largo Reclaimed ASR	Pinellas	ASR	0.5	0.325	1,700,000	$1.27
5	Tarpon Canal Reclaimed Syst. Aug.	Pinellas	Aug.	1	0.4	2,750,000	$1.67
74	St. Petersburg Reward Project	Pinellas	Aug.	2	0.8	450,000	$0.14
62	Pinellas Co. Reclaimed Efficiency	Pinellas	Efficiency		10	100,000	$0.00
177	W.-Cent. Reclaimed Water Rate Study	Pinellas	Efficiency	5	3	100,000	$0.01
3	Pinellas Co./St. Petersburg Storage-Intercon.	Pinellas	Storage/Intercon.	17	10	11,050,000	$0.28
26	N. Pinellas Co. Storage	Pinellas	Storage	0	0	3,150,000	
27	S. Pinellas Co. Storage	Pinellas	Storage	0	0	3,150,000	
30	Largo Distribution Design	Pinellas	Sys. Design	0	0	410,000	
28	Dunedin Reclaimed	Pinellas	Sys. Expan.	2	0.8	4,450,000	$1.35
113	Reuse Expan. in Pinellas Co. Sys. 2005-2010	Pinellas	Sys. Expan.	2.2	1.32	3,036,000	$0.56
114	Reuse Expan. in Pinellas Co. Sys. 2010-2020	Pinellas	Sys. Expan.	3.6	2.16	4,968,000	$0.56
115	Reuse Expan. in Clearwater East Sys. 2005-2010	Pinellas	Sys. Expan.	1.5	0.9	2,070,000	$0.56
116	Reuse Expan. in Clearwater East Sys. 2010-2020	Pinellas	Sys. Expan.	1.7	1.02	2,346,000	$0.56
117	Reuse Expan. in St. Petersburg Sys. 2005-2010	Pinellas	Sys. Expan.	0	0	0	
118	Reuse Expan. in St. Petersburg Sys. 2010-2020	Pinellas	Sys. Expan.	0	0	0	
119	Reuse Expan. in Belleair WWTP2005-2010	Pinellas	Sys. Expan.	0	0	0	
120	Reuse Expan. in Belleair WWTP 2010-2020	Pinellas	Sys. Expan.	0	0	0	
121	Reuse Expan. in Dunedin WWTP 2005-2010	Pinellas	Sys. Expan.	0.2	0.12	276,000	$0.56
122	Reuse Expan. in Dunedin WWTP 2010-2020	Pinellas	Sys. Expan.	0	0	0	
123	Reuse Expan. in Largo WWTP 2005-2010	Pinellas	Sys. Expan.	3	1.8	4,140,000	$0.56
124	Reuse Expan. in Largo WWTP 2010-2020	Pinellas	Sys. Expan.	3	1.8	4,140,000	$0.56
31	Pinellas Park Reclaimed	Pinellas	Trans.	2	0.8	3,870,000	$1.18
29	Clearwater Reclaimed	Pinellas	Trans./Storage	2.7	1	7,400,000	$1.80
32	St. Pete Reclaimed	Pinellas	Trans./Storage	0.5	0.2	5,350,000	$6.51
18	Punta Gorda Saltwater Bar.	Charlotte	Saltwater Bar.	4	3	3,100,000	$0.25
162	Reuse Expan. in Charlotte Co. East WWTP 2005-2010	Charlotte	Sys. Expan.	0	0	0	
163	Reuse Expan. in Charlotte Co. East WWTP2010-2020	Charlotte	Sys. Expan.	0	0	0	

Table IVD-4. Summary of 180 (Long List) Reclaimed Water Options in the Planning Region.

PBS&J #	Project Names	County	Description	MGD Supply Annualized	MGD Offset Annualized	Prelim Cap. Cost	Prelim Cost per 1000 gal
164	Reuse Expan. in Charlotte Co. S. WWTP 2005-2010	Charlotte	Sys. Expan.	0	0	0	
165	Reuse Expan. in Charlotte Co. S. WWTP 2010-2020	Charlotte	Sys. Expan.	0	0	0	
166	Reuse Expan. in Charlotte Co. W. WWTP 2005-2010	Charlotte	Sys. Expan.	0	0	0	
167	Reuse Expan. in Charlotte Co. W. WWTP 2010-2020	Charlotte	Sys. Expan.	0	0	0	
168	Reuse Expan. in Punta Gorda WWTP 2005-2010	Charlotte	Sys. Expan.	1.1	0.66	1,518,000	$0.56
169	Reuse Expan. in Punta Gorda WWTP 2010-2020	Charlotte	Sys. Expan.	2.6	1.56	3,588,000	$0.56
170	Reuse Expan. in Englewood WWTP 2005-2010	Charlotte	Sys. Expan.	0.7	0.42	966,000	$0.56
171	Reuse Expan. in Englewood WWTP 2010-2020	Charlotte	Sys. Expan.	1.4	0.84	1,932,000	$0.56
180	Rotonda Long Marsh Golf	Charlotte	Trans.	0.4	0.3	461,680	$0.35
160	Reuse Expan. in Arcadia WWTP 2005-2010	DeSoto	Sys. Expan.	0	0	0	
161	Reuse Expan. in Arcadia WWTP 2010-2020	DeSoto	Sys. Expan.	0	0	0	
20	Arcadia Ag. Reuse Expan.	DeSoto	Sys./Ag. Reuse	1	0.75	1,380,000	$0.45
14	S. Hills./MARS Intercon.	Hills/Manatee	Intercon.	5	3.75	6,900,000	$0.45
50	Manatee Co. ASR Wells	Manatee	ASR	0.75	0.56	1,800,000	$0.78
69	Tailwater Recovery/Reuse	Manatee	Aug.	0	0	0	
179	S.ern Reclaimed Water Rate Study	Manatee	Efficiency	5	3	100,000	$0.01
58	Longboat Key/Manatee Co./Sarasota Intercon.	Manatee	Intercon.	2	1.5	8,434,650	$1.36
65	Bradenton/Mars Intercon.	Manatee	Intercon.	3	2.25	25,000	$0.00
66	Palmetto/Mars Intercon.	Manatee	Intercon.	1	0.75	1,500,000	$0.49
67	Frog Creek Mars Storage	Manatee	Storage	1	0.75	3,500,000	$1.14
68	IMC/Mars Augmentation	Manatee	Storage/Augment.	15	9	20,996,000	$0.62
57	Manatee River Downstream Aug.	Manatee	Streamflow	3.2	3.2	2,668,000	$0.19
136	MARS to Lake Parrish	Manatee	Sys. Expan.	8	4.8	4,643,770	$0.22
137	Reuse Expan. in Manatee Co. Sys. 2010-2020	Manatee	Sys. Expan.	4.1	2.46	5,658,000	$0.56
138	Reuse Expan. in Bradenton WWTP 2005-2010	Manatee	Sys. Expan.	0.4	0.24	552,000	$0.56
139	Reuse Expan. in Bradenton WWTP 2010-2020	Manatee	Sys. Expan.	0.4	0.24	552,000	$0.56
140	Reuse Expan. in Palmetto WWTP 2005-2010	Manatee	Sys. Expan.	0.1	0.06	138,000	$0.56
141	Reuse Expan. in Palmetto WWTP 2010-2020	Manatee	Sys. Expan.	0.1	0.06	138,000	$0.56
49	Bradenton Reuse	Manatee	Trans.	3	3	6,270,000	$0.51
16	Sarasota Regional ASR System	Sarasota	ASR	5.6	5.6	8,454,950	$0.41
56	Celery Fields Reuse Aug.	Sarasota	Aug.	2.5	1.5	4,835,750	$0.89
63	Sarasota Co. Reclaimed Reg. Study	Sarasota	Efficiency	5	3	100,000	$0.01
15	Sarasota Co. Intercon.	Sarasota	Intercon.	8	4.8	10,551,650	$0.50
55	Sarasota, FGUA Intercon.	Sarasota	Intercon.	2.5	1	1,080,000	$0.26
59	Mars/Sarasota Co. Intercon.	Sarasota	Intercon.	1	0.75	1,380,000	$0.45
76	Sarasota Co. / Siesta Key Intercon.	Sarasota	Intercon.	1.6	0.64	3,000,000	$1.14
61	Flatford Swamp Reuse	Sarasota	Recharge/Reuse	10	7.5	13,800,000	$0.45
144	Reuse Expan. in Sarasota N. Co. Sys. 2005-2010	Sarasota	Sys. Expan.	3.6	2.16	4,968,000	$0.56
145	Reuse Expan. in Sarasota N. Co. Sys. 2010-2020	Sarasota	Sys. Expan.	7	4.2	9,660,000	$0.56

Table IVD-4. Summary of 180 (Long List) Reclaimed Water Options in the Planning Region.

PBS&J #	Project Names	County	Description	MGD Supply Annualized	MGD Offset Annualized	Prelim Cap. Cost	Prelim Cost per 1000 gal
146	Reuse Expan. in Sarasota S. Co. Sys. 2005-2010	Sarasota	Sys. Expan.	0.7	0.42	966,000	$0.56
147	Reuse Expan. in Sarasota S. Co. Sys. 2010-2020	Sarasota	Sys. Expan.	1	0.6	1,380,000	$0.56
148	Reuse Expan. in City of Venice Sys. 2005-2010	Sarasota	Sys. Expan.	2	1.2	2,760,000	$0.56
149	Reuse Expan. in City of Venice Sys. 2010-2020	Sarasota	Sys. Expan.	0	0	0	
150	Reuse Expan. in N. Port WWTP 2005-2010	Sarasota	Sys. Expan.	0.1	0.06	138,000	$0.56
151	Reuse Expan. in N. Port WWTP 2010-2020	Sarasota	Sys. Expan.	3	1.8	4,140,000	$0.56
152	Reuse Expan. in City of Sarasota WWTP 2005-2010	Sarasota	Sys. Expan.	0	0	0	
153	Reuse Expan. in City of Sarasota WWTP 2010-2020	Sarasota	Sys. Expan.	0	0	0	
154	Reuse Expan. Siesta Key WWTP 2005-2010	Sarasota	Sys. Expan.	0	0	0	
155	Reuse Expan. Siesta Key WWTP 2010-2020	Sarasota	Sys. Expan.	0	0	0	
156	Reuse Expan. Gulfgate WWTP 2005-2010	Sarasota	Sys. Expan.	0	0	0	
157	Reuse Expan. Gulfgate WWTP 2010-2020	Sarasota	Sys. Expan.	0	0	0	
158	Reuse Expan. S.gate WWTP 2005-2010	Sarasota	Sys. Expan.	0	0	0	
159	Reuse Expan. S.gate WWTP 2010-2020	Sarasota	Sys. Expan.	0	0	0	
44	Englewood Boca Royale Trans.	Sarasota	Trans.	1	0.75	667,000	$0.22
45	Englewood Residential Trans.	Sarasota	Trans.	1	0.4	900,000	$0.55
46	Englewood Pump Station	Sarasota	Trans.	1	0.4	600,000	$0.37
47	N. Port Sumter Boulevard Trans.	Sarasota	Trans.	1	0.4	870,000	$0.53
48	N. Port Price Boulevard Trans.	Sarasota	Trans.	1	0.4	360,000	$0.22
78	Optimization and Efficiency Study in Coastal SWUCA	Various	Efficiency		26	100,000	$0.00
142	Reuse Expan. in Wauchula WWTP 2005-2010	Hardee	Sys. Expan.	0	0	0	
143	Reuse Expan. in Wauchula WWTP 2010-2020	Hardee	Sys. Expan.	0	0	0	
19	Wauchula Industrial Reuse	Hardee	Sys./Industrial Reuse	1	1	1,380,000	$0.34
174	Highlands Co. Reuse Regionalization	Highlands	Intercon.		0	0	
172	Reuse Expan. in Sebring WWTP 2005-2010	Highlands	Sys. Expan.	0	0	0	
173	Reuse Expan. in Sebring WWTP 2010-2020	Highlands	Sys. Expan.	0	0	0	
21	Sebring Reuse	Highlands	Sys./Ag. Reuse	1	0.75	1,380,000	$0.45
52	Winter Haven Plant III Reuse	Polk	Ag. Reuse	3	2.25	11,750,000	$1.27
75	Lakeland Wetland-Hwy 60 Industrial Reuse	Polk	Trans.	2	2	3,233,000	$0.59
70	Polk Co. Reuse Efficiency Study	Polk	Efficiency		5	100,000	$0.00
178	East-Cent. Reclaimed Water Rate Study	Polk	Efficiency	5	3		$0.00
17	Lakeland/Polk Intercon.	Polk	Intercon.	2	1.2	5,381,240	$1.02
53	Lakeland Electric Storage Facility	Polk	Storage	0.3	0.3	8,676,307	$5.92
51	Lakeland Wetland-Power	Polk	Trans.	6	6	9,734,836	$0.38
79	Reuse Expan. in Polk Cent. Regional WWTP 2005-2010	Polk	Sys. Expan.	0.35	0.21	483,000	$0.56
80	Reuse Expan. in Polk Cent. Regional WWTP 2010-2020	Polk	Sys. Expan.	2.3	1.38	3,174,000	$0.56
81	Reuse Expan. in Polk NE Regional WWTP 2005-2010	Polk	Sys. Expan.	1	0.6	1,380,000	$0.56
82	Reuse Expan. in Polk NE Regional WWTP 2010-2020	Polk	Sys. Expan.	3.4	2.04	4,692,000	$0.56
83	Reuse Expan. in Polk NW Regional WWTP 2005-2010	Polk	Sys. Expan.	3	1.8	4,140,000	$0.56

Table IVD-4. Summary of 180 (Long List) Reclaimed Water Options in the Planning Region.

PBS&J #	Project Names	County	Description	MGD Supply Annualized	MGD Offset Annualized	Prelim Cap. Cost	Prelim Cost per 1000 gal
84	Reuse Expan. in Polk NW Regional WWTP 2010-2020	Polk	Sys. Expan.	2	1.2	2,760,000	$0.56
85	Reuse Expan. in Polk SW Regional WWTP 2005-2010	Polk	Sys. Expan.	2	1.2	2,760,000	$0.56
86	Reuse Expan. in Polk SW Regional WWTP 2010-2020	Polk	Sys. Expan.	0	0	0	
87	Reuse Expan. in Bartow WWTP 2005-2010	Polk	Sys. Expan.	0.7	0.42	966,000	$0.56
88	Reuse Expan. in Bartow WWTP 2010-2020	Polk	Sys. Expan.	1.2	0.72	1,656,000	$0.56
89	Reuse Expan. in Fort Meade WWTP 2005-2010	Polk	Sys. Expan.	0	0		
90	Reuse Expan. in Fort Meade WWTP 2010-2020	Polk	Sys. Expan.	0	0	0	
91	Reuse Expan. in Cypress Wood WWTP 2005-2010	Polk	Sys. Expan.	0	0	0	
92	Reuse Expan. in Cypress Wood WWTP 2010-2020	Polk	Sys. Expan.	0	0	0	
93	Reuse Expan. in Haines City WWTP 2005-2010	Polk	Sys. Expan.	0.7	0.42	966,000	$0.56
94	Reuse Expan. in Haines City WWTP 2010-2020	Polk	Sys. Expan.	0.47	0.282	648,600	$0.56
95	Reuse Expan. in Lake Wales WWTP 2005-2010	Polk	Sys. Expan.	0.5	0.3	690,000	$0.56
96	Reuse Expan. in Lake Wales WWTP 2010-2020	Polk	Sys. Expan.	0.5	0.3	690,000	$0.56
97	Reuse Expan. in Winter Haven #2 WWTP 2005-2010	Polk	Sys. Expan.	0.3	0.18	414,000	$0.56
98	Reuse Expan. in Winter Haven #2 WWTP 2010-2020	Polk	Sys. Expan.	0.5	0.3	690,000	$0.56
99	Reuse Expan. in Winter Haven #3 WWTP 2005-2010	Polk	Sys. Expan.	0.5	0.3	690,000	$0.56
100	Reuse Expan. in Winter Haven #3 WWTP 2010-2020	Polk	Sys. Expan.	1	0.6	1,380,000	$0.56
101	Reuse Expan. in Auburndale Sys. WWTP 2005-2010	Polk	Sys. Expan.	0.25	0.15	345,000	$0.56
102	Reuse Expan. in Auburndale Sys. WWTP 2010-2020	Polk	Sys. Expan.	0.5	0.3	690,000	$0.56
103	Reuse Expan. in Lakeland Sys. WWTP 2005-2010	Polk	Sys. Expan.	1	0.6	1,380,000	$0.56
104	Reuse Expan. in Lakeland Sys. WWTP 2010-2020	Polk	Sys. Expan.	6	3.6	8,280,000	$0.56
54	Lakeland Cleveland Heights Golf	Polk	Trans.	0.5	0.38	1,616,750	$2.22
22	Natural Treatment/ Aquifer Recharge	Polk/ Hardee	Recharge	1	1	5,965,590	$2.03

Italics denotes SWFWMD estimations, highlighted denotes projects studied in PBS&J Task 3&4 Report (PBS&J 2000)
Not all projects have estimated costs
MGD Offset = (if estimated) Annualized Supply x 75% Ag,R/A. 100% I/C,PG. 60% All. 40% PS/lrr
ASR Costs = (if estimated) Annualized Supply x 4 x $700,000 + $300,000
Total Cost = (if estimated) = Annualized Supply x $1.38/Gallon

1.0 Largo/Clearwater/Pasco Interconnect/Restoration/ASR (PBS&J, 2000 #1)

This option proposes to interconnect existing reclaimed water systems into an integrated regional reclaimed water system to increase the reliability and efficiency of reclaimed water reuse. The cities of Largo and Clearwater, and Pasco County Utilities have reclaimed water systems with significant supply and demand variations. By interconnecting these three reclaimed water systems, excess reclaimed water during wet weather periods and supply deficits during dry weather periods could be better managed. Wet weather discharges could be minimized which would result in more effective utilization. Water could also be diverted to wetlands in northwest Hillsborough County, and south-central Pasco County for restoration. Since wetlands are not generally in need of water during wet weather periods, this interconnect would be more effectively and reliably utilized if seasonal storage (e.g., reclaimed water ASR) were available. This would allow excess water to be stored during wet weather conditions for restoration of wetlands during dry weather or to meet peak demand. Future interconnects to either Hillsborough County's reclaimed water system or the City of St. Petersburg's reclaimed water system could be considered to provide this storage since these utilities have already obtained well construction permits for their initial reclaimed water ASR wells. Alternatively, the City of Largo could consider developing its own reclaimed water ASR program to maximize the potential of this interconnect. Future interconnects or ASR programs are not considered part of this option.

The concept involves an interconnect from the City of Largo to the East WWTP; an estimated two miles of approximately 16-inch diameter reclaimed water transmission piping along a pipeline corridor near US19 south of SR60. From the Northeast WWTP, near McMullen Booth Road and SR580, another estimated three miles of approximately 16-inch diameter reclaimed water transmission line would be installed north to the vicinity of East Lake Road and SR54, to interconnect Pasco County Utilities to the other two reclaimed water systems. Small diameter pipelines would be installed leading to existing wetlands or other feasible restoration locations.

This option is expected to provide an estimated three mgd additional reclaimed water annually, offsetting an estimated 1.8 mgd of potable water use in the tri-county area of Pinellas, Pasco, and Hillsborough counties.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
3 (1.8*)	$4,310,000	$2,390,000	$0.54

* - Beneficial offset (see Table IVD-4 footnotes)

Issues:

- Permitting and siting of ASR wells may prove to be a multi-year task based upon past experiences with other reclaimed water ASR wells within the District. In addition, all local permitting requirements would have to be met.
- Project acceptability may be an issue due to the proximity of potential wetland restoration sites and public supply wells.

2.0 Pinellas County – St. Petersburg Storage/Interconnect (PBS&J, 2000 #3)

The City of St. Petersburg's wastewater system relies on reclaimed water reuse as their primary disposal method. Reclaimed water is distributed to its customers through an extensive network of distribution pipes. The transmission system consists of a 76-mile looped system connecting the City's four water reclamation facilities. These four facilities treat an average of 48 mgd and have 25 million gallons of storage capacity. Excess supply is disposed of in 10 deep injection wells.

The majority of reclaimed water in the City is used for lawn irrigation. In recent years, demand for reclaimed water in the dry season exceeds supplies. Over the next 10 years significant shortages in supplies during the dry season are expected to occur in seven of those years. Yet on an annual basis only about 60 percent of the total volume of reclaimed water is reused. The City's consultant has concluded that the City does not have enough long-term storage and that almost 40 percent of the reclaimed water is discharged to the injection wells during the wet weather months when demand for irrigation water is low.

Pinellas County is expanding their reclaimed water system into the barrier island communities. This system could benefit greatly from access to seasonal storage capacity. Studies have shown ASR to be an efficient method of providing long-term storage. The areas near the City's Northwest Water Reclamation and the adjacent Walter Fuller Park are potential ASR sites.

The Pinellas County transmission pipeline serving the beach communities runs along Belcher Road (71st Street) passes near the location of the Northwest WRF. An interconnection at this location is a practical way for both utilities to utilize the ASR system and to more efficiently utilize their reclaimed water resources.

Initially two ASR test wells would be constructed at two different sites and an additional eight ASR wells would be constructed later to provide 10 to 12 mgd of storage capacity.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
17 (10*)	$11,050,000	$1,110,000	$0.28

* - Beneficial offset

Issues: none

3.0 Horizontal Well Reclaimed System Augmentation (PBS&J, 2000 #8)

The purpose of this option is to develop a source of water to augment Hillsborough County's reclaimed water system during the dry season. The County currently cannot meet demand for reclaimed water during peak demand periods. During the wet season, water would be withdrawn from the surficial aquifer through a series of horizontal wells and stored in ASR wells for recovery in the dry season. Depending on the local hydrology, it may also be feasible to augment the reclaimed water system during the dry season.

The option conceptually would provide up to eight mgd during periods when ground-water levels are highest. Monitoring wells would be used as part of an automated control and telemetry system that would turn the wells on when levels reached a pre-set high level and off at a pre-set low level. Withdrawal would occur through a minimum of 16 wells with a capacity of 0.5 mgd each. These wells would discharge into the South Hillsborough County ASR/Recharge/Salt water Intrusion Barrier system. Two wells would be sited, designed, permitted and constructed as an initial demonstration phase. After two years of testing, this option could be implemented and 14 additional production wells would be designed and constructed.

The wells could be located at various locations in the vicinity of reclaimed water transmission pipelines, ASR wells, or distribution lines of at least eight inches in diameter. This option could work in conjunction with the South Hillsborough ASR Wells/Recharge/Saltwater Intrusion Barrier System.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
2 (1.2*)	$16,670,000	$13,890,000	$3.31

* - Beneficial offset

Issues:

- Potential environmental impacts due to the lowering of the surficial aquifer by the horizontal well system withdrawals.

4.0 City of Tampa/ East Hillsborough County Interconnect (PBS&J, 2000 #10)

The City of Tampa's Howard F. Curren Advanced Wastewater Treatment Facility (HFCAWTF) discharges 50 to 60 mgd into Tampa Bay. While the City has plans to use about 10 percent of this flow for their South Tampa Area Reuse (STAR) Project, the balance can be made available for beneficial reuse. For this to be a viable option, a water agreement between the City and the County and/or other users would be necessary to establish the amounts sold and the cost of the resource.

A pumping station located on the Curren site is required to move the reclaimed water from the City's AWT facility eastward across or under McKay Bay. The pipeline would proceed along Causeway Blvd. to a point of interconnection with Hillsborough County's reclaimed water system near Causeway Blvd. and 78th.

The purpose of the interconnect is to supply reclaimed water for the following systems and options:

- Hillsborough County's Reclaimed Water System
- South Hillsborough ASR Wells/Recharge/Saltwater Intrusion Barrier System
- US 41 Industrial Corridor Transmission Pipeline
- Downstream Augmentation of the Alafia River

The pump station and pipeline will have a capacity of 30 mgd.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
30 (18*)	$13,090,000	$730,000	$0.24

* - Beneficial offset

Issues:

- The use of reclaimed water for augmentation of river flows will require consideration of the effects of nutrient loading on downstream water quality.

5.0 Downstream Flow Augmentation of Hillsborough River at the City Dam (PBS&J, 2000 #11)

The purpose of the option is to augment the downstream flow of the Hillsborough River with highly treated reclaimed water, to enable more potable water supply above the dam. Large amounts of water are withdrawn from the Hillsborough River, upstream of the dam, and treated at the City of Tampa's water treatment plant. During the dry season the amounts withdrawn can exceed the flow of the Hillsborough River, thereby resulting in little or no flow over the dam. This option would pump highly treated reclaimed water from the HFCAWTF to a point just downstream of the dam, which would allow for an increased downstream flow. HFCAWTF currently discharges about 60 mgd into Tampa Bay. While the City has plans to use about 10 percent of this flow for their STAR Project, as much as 30 mgd has been suggested for downstream augmentation of the Hillsborough River. The option may assist in the establishment of a yet-to-be-defined fishery immediately downstream of the Hillsborough River Dam.

A large pumping station is required to move the reclaimed water from the HFCAWTF north to the downstream side of the dam. The pipeline would head north within a corridor bounded by 15th and 30th Streets to a diffuser located downstream of the dam. The pump station and pipeline will have a capacity of 30 mgd.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
10 (10*)	$20,140,000	$2,010,000	$0.51

* - Beneficial offset

Issues:

- The use of reclaimed water for augmentation of river flows will require consideration of the effects of nutrient loading on downstream water quality.

6.0 Downstream Augmentation of the Alafia River (PBS&J, 2000 #12)

The purpose of this option is to provide additional potable water for coastal regions of the Tampa Bay Area. Tampa Bay Water has received permits to divert surface water from the Alafia River during high flow periods.

Reclaimed water could be piped immediately downstream of the surface-water diversion structure located at Bell Shoals Road to augment flows in the lower Alafia River during low-flows periods. A peak reclaimed water discharge rate of 20 mgd has been identified for this option. Reclaimed water volumes of this magnitude are only available from the HFCAWTF. Twenty mgd represents approximately 30 percent of the total available flow from this facility. A connection from the HFCAWTF (City of Tampa/East Hillsborough County Interconnect Option) is therefore assumed to be a precursor for selection of this option.

The Alafia River surface-water withdrawal point is located at Bell Shoals Road. A conceptual downstream replacement location to discharge reclaimed water would be at the location where Boyette Road intersects Bell Creek. This location would require approximately seven miles of 42-inch diameter reclaimed water pipeline in roughly an east-west alignment along Boyette Road and Gibsonton Road to provide a reclaimed water interconnect to the south/central Hillsborough County reclaimed water system near US 41 south of the Alafia River. This option is contingent on options 10 and 60.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
7 (7*)	$11,690,000	$1,670,000	$0.40

* - Beneficial offset

Issues:

- The use of reclaimed water for augmentation of river flows will require consideration of the effects of nutrient loading on downstream water quality.
- Permit modifications would be necessary.

7.0 South Hills. ASR Wells/Recharge/Saltwater Intrusion Barrier System (PBS&J, 2000 #13)

The purpose of this option is to provide reclaimed water storage, ground-water recharge and a saltwater intrusion barrier along the eastern shore of Tampa Bay in Hillsborough County. Reclaimed water would be injected into the Upper Floridan aquifer from the Valrico, Falkenburg, and South County WWTPs. In addition, should the County and City of Tampa reach an agreement, additional reclaimed water may be available for ASR.

Injection will occur during the wet season when demand for reclaimed water is low. Excess water could be recharged into the aquifer using a total of approximately 20 ASR wells. The County is investigating the subsurface seasonal storage of surplus reclaimed water for recovery during periods of decreased supply and/or increased demand to supplement its South and Central reclaimed system.

The County has identified areas with high potable water use for non-potable applications in the central Hillsborough reclaimed water service area. Demand is projected to be approximately 19 mgd by the year 2020. An additional 7 mgd demand has been identified in the south Hillsborough portion of the reclaimed water service area.

Use of reclaimed water will allow potable water savings and ground-water pumping offsets. From the projected 26 mgd of reclaimed water demand, a ground-water offset of approximately 20 mgd is expected to be realized with implementation of the County's plan. Option phases will include: 1) construction of initial ASR wells in the Big Bend and Alafia River areas, 2) ASR expansion, 3) interconnection of pipelines, and 4) construction of conveyance facilities from wet-weather sources.

Phase I involves construction and testing of ASR wells at two sites, the existing South County Dechlorination Facility (the existing surface-water outfall) in the Big Bend area, and in the Alafia River area in the vicinity of Cargill Park. Phase II would involve expansion of the ASR system to 15, one mgd reclaimed water ASR wells in the vicinity of the initial two sites. During Phase III, an ASR expansion to 20 mgd (approximately 20 ASR wells total) is planned among the three sites. This option is contingent on City of Tampa/East Hillsborough County Interconnect and US 41 Industrial Corridor Transmission Pipeline Options.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
20 (20*)	$14,010,000	$700,000	$0.17

* - Beneficial offset

Issues: none

8.0 Sarasota County Interconnect (PBS&J, 2000 #15)

An important component of an integrated regional reuse system is the interconnection of the major reclaimed water systems within the region. The Sarasota County interconnect is proposed to provide integration by connecting the reuse systems of Sarasota County, Siesta Key, Florida Cities Utilities, Englewood Water District and the cities of Sarasota, Venice and North Port. These connections will allow the transfer of reclaimed water between all utilities, and provide access to storage through the combined utilization of the ASR systems being planned, permitted and/or constructed by the Englewood Water District, the City of Sarasota and Sarasota County.

Phase I of the option will interconnect Florida Cities' Gulfgate AWT plant with the County's reuse system at the Central County Water Reclamation Facility (WRF) and Florida Cities' Southgate AWT plant with the City of Sarasota reuse transmission pipeline. A 12 inch pipeline will be constructed from the Southgate AWT plant west to the city limits on Tuttle Avenue where a connection will be made to the City's existing 12 inch reclaimed water main. A 16 inch pipeline will be constructed from the Gulf Gate AWT plant southeast to the Central County Water Reclamation Facility where a connection will be made to the County's reclaimed water system. Both facilities now discharge to surface waters. By reusing this water for irrigation nearly three mgd of ground-water and potable water irrigation will be offset.

Phase II of the option will interconnect Sarasota County's north and south reclaimed water systems. Sarasota County is planning a reclaimed water transmission pipeline from the City of Venice's WWTP south along Jacaranda Blvd. to the Venice Gardens WRF. The interconnect could be made by extending this pipeline north to tie into the County's north reclaimed water system on Clark Road. The alignment would follow the route proposed in the County's 1994 reuse master plan. About 10.5 miles of transmission pipeline are required.

Other related options are contributing to the realization of a fully integrated system. The City of Sarasota and Sarasota County systems are to be interconnected next year under a separate existing project. Also, Phase I of the proposed Sarasota Regional ASR System Option (see next page) includes a connection between Siesta Key and the City of Sarasota. Future phases of this Sarasota County Interconnect option will include connections to the cities of Venice, North Port and Englewood.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
8 (4.8*)	$10,550,000	$2,190,000	$0.50

* - Beneficial offset

Issues: none

9.0 Sarasota Regional ASR System Phase I (PBS&J, 2000 #16)

The District is participating in the funding of Sarasota County's existing north and south ASR options through cooperative funding agreements. The north and south County ASR options provide the foundation for development of a regional, reclaimed water ASR system to provide storage for all the reclaimed water systems in Sarasota County. Phase I of the proposed option will include the construction of additional ASR capacity to handle reclaimed water generated by the City of Sarasota and Siesta Key Utilities. It will also include a pipeline to connect the proposed Siesta Key Utilities ASR wells to the City of Sarasota reuse system.

Other components to make this an integrated, regional system are planned. A reclaimed water interconnect between Sarasota County and the City of Sarasota is planned and funded. An interconnect between the two Florida Cities AWT plants and the Sarasota County reclaimed water system is being considered in the Sarasota County Interconnect Option. Future expansions of the ASR system will incorporate the reclaimed water systems owned by the cities of Venice and North Port and the Englewood Water District.

For this option, two ASR test wells could be designed, permitted and constructed; one in the City of Sarasota and one on Siesta Key. Upon completion of the test period, these wells will be converted to production ASR wells and four additional ASR production wells will be constructed to handle the reclaimed water volume available for storage. The pipeline connecting Siesta Key's system to the County reuse system will be constructed concurrent with the additional production wells.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
5.6 (5.6*)	$8,450,000	$1,510,000	$0.41

* - Beneficial offset

Issues: none

10.0 City of Lakeland/Polk County Interconnect (PBS&J, 2000 #17)

The District recently funded a reclaimed water transmission main to serve Polk County's Southwest reclaimed water service area. This pipeline is currently under construction. Based on the projected reuse demand, the County may not have sufficient reclaimed water to meet the needs of this area. An interconnection between the City of Lakeland and Polk County for both Northwest and Southwest reclaimed water service areas is proposed to supply water to augment the County's supply from City of Lakeland's surpluses. The supplemental supply is assumed to be 1.0 mgd for each service area.

The Northwest interconnect would include a 10-inch transmission main, and an in-line booster station. The existing pipe, which runs between Carl Dicks WWTF and Northside WWTF, would be tapped near the intersection of US 92 and Lake Parker Drive. A new 10-inch transmission main would run west along US 92, north along US 98, west on Duff Road. At Duff Road it would be connected to an existing 16-inch line 0.5 miles west of US 98.

The Southwest interconnect would include a 10-inch transmission main, and a high service pump station located at Carl Dicks WWTF. The 10-inch transmission main would run south along County Road 37B and connect at County Rd 540A to a 16-inch reclaimed pipeline that is currently under construction.

Effluent for the Carl Dicks and Northside WWTFs does not currently meet public access reuse standards. If the treatment is not upgraded before this option is initiated, disinfection and filtration will have to be added at both treatment plants, thereby increasing the cost of this option.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
2 (1.2*)	$5,380,000	$4,480,000	$1.02

* - Beneficial offset

Issues: none

11.0 Natural Treatment/Aquifer Recharge (PBS&J, 2000 #22)

The purpose of this option is to provide an additional water supply for agricultural use. Reclaimed water could be diverted to various Noralyn Phosphate Mine sites in Polk and Hardee counties and used for aquifer recharge year round. Water would receive further treatment through a natural treatment system that was previously a waste clay settling area. Wetland plant species would be introduced to increase reclaimed water treatment efficiency in the restored clay settling pond(s). Near the downstream or discharge end of the diversion site, primary treatment (filtration and disinfection) would be installed at the site, most likely a sand filtration system for additional polishing of the reclaimed water. The reclaimed water would then be injected into the Suwannee Limestone using two constructed recharge wells. Potable water standards would need to reliably meet at the wellhead prior to recharge. Pumps would be installed in the wells for periodic back-flushing and to provide a seasonal peaking supply for agricultural or other non-potable reuse applications.

The proposed reclaimed water supply is from the City of Wauchula's WWTP. It is assumed that the reclaimed water quality does not meet current regulatory requirements for discharge into a potable aquifer, therefore, the additional proposed wetland treatment will likely be required. The available reclaimed water supply from this source is estimated at one mgd annual average. A net Floridan aquifer recharge of approximately one mgd is expected to offset an estimated one mgd of ground-water use. If demonstrated to be feasible, additional reclaimed water supplies could be investigated and possibly used to increase total recharge at the Noralyn Mine Recharge site.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
1 (1*)	$5,970,000	$5,970,000	$2.03

* - Beneficial offset

Issues:

- Prior to full option implementation, FDEP mine reclamation regulatory issues will need to be addressed.

12.0 City of Lakeland Wetlands-Reclaimed Water for Power Plant Cooling (PBS&J, 2000 #51)

Recently Florida Power Corporation constructed a power plant in Polk County which is located approximately eight miles south of SR 60 on CR 555. Currently, this plant withdraws water from a large on-site cooling pond. Surface water and ground water are used to replace water that is lost through evaporation or seepage.

Approximately 12 miles from this power plant, the City of Lakeland operates a wetland treatment system that provides the final treatment prior to discharging their reclaimed water. A pump station and a transmission main could be constructed to deliver reclaimed water from the wetlands to the power plant for cooling water. Approximately six mgd of ground water would be offset.

The reclaimed water would be chlorinated to control algae and slime then pumped to the power plant cooling ponds via a 20-inch transmission main. The transmission main would run east along SR 60 and then south on CR 555.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
6 (6*)	$9,730,000	$1,620,000	$0.38

* - Beneficial offset

Issues: none

13.0 Lakeland Electric Surface Storage Facility (PBS&J, 2000 #53)

The proposed option consists of a reclaimed water line and an onsite storage pond to help supply Lakeland Electric with cooling/process water. The estimated quantity to be supplied to the storage pond is 0.332 mgd annualized with an offset of 0.30 mgd. Reclaimed water from the Carl Dicks WWTP would be pumped to a proposed effluent storage pond. The proposed 22.3-acre pond will be capable of storing approximately 85 million gallons of reclaimed water.

A reuse pump station at the WWTP will be upgraded and additional pumping capacity will be added at the wetland pump station. Water from the storage pond, which is not used for cooling, will flow to the Lakeland Wetland Treatment System.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
0.33 (0.3*)	$8,680,000	$26,130,000	$5.92

* - Beneficial offset

Issues: none

14.0 Lakeland – Cleveland Heights Golf (PBS&J, 2000 #54)

The purpose of the option is to provide reclaimed water for irrigation at the Cleveland Heights Golf Course. The reclaimed water would be pumped from the Carl Dicks WWTF which is located adjacent to the golf course. The option will consist of additional treatment at the WWTF to meet public access reuse standards for reclaimed water. In addition, reclaimed water transfer pumping, transmission main piping, storage ponds and high service pumping will be required.

The additional treatment required includes filtration and disinfection for a one mgd design, 0.5 mgd average daily side stream flow which is to be sent to the golf course. Storage for the reclaimed water will be provided at the golf course through the construction of additional ponds or water hazards.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
0.5 (0.38*)	$1,620,000	$4,310,000	$2.22

* - Beneficial offset

Issues: none

15.0 Sarasota County Celery Fields Reuse Augmentation (PBS&J, 2000 #56)

The Celery Field Regional Storage Facility (CFRSF) is a regional stormwater management facility on approximately 346 acres adjacent to the Main C canal of Phillippi Creek, south of Fruitville Road and east of I-75, in Sarasota County. The CFRSF was developed as a multiple use facility consisting of stormwater storage for flood control, stormwater treatment for pollution control and supplemental reuse, and constructed wetlands for stormwater treatment and mitigation. The CFRSF provides capacity to temporarily impound 1,000 acre-feet of stormwater runoff for controlled release into Phillippi Creek.

The Celery Fields Reuse Augmentation option proposes to utilize a portion of the stormwater stored in the CFRSF plus additional amounts skimmed from Phillippi Creek during high-flow periods. Consultants for Sarasota County have estimated that 10 percent to 50 percent of the wet weather flows could be withdrawn from Phillippi Creek and utilized to augment reuse supplies. The actual volumes will be determined through the water use permitting process.

This storm water will be filtered and chlorinated prior to being introduced into Sarasota County's reuse system. It will be used to augment the reclaimed system during the peak, dry season, irrigation demand. ASR wells will be utilized to store the treated storm water during wet weather for later recovery during periods of high irrigation demands.

Required components include a stormwater pump station with disc filters and chlorination, a pipeline to connect to the County's reuse distribution system and two ASR wells located in the vicinity of the CFRSF or at the County's North ASR facility site.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
2.5 (1.5*)	$4,840,000	$3,220,000	$0.89

* - Beneficial offset

Issues: none

16.0 Manatee County Manatee River Downstream Augmentation (PBS&J, 2000 #57)

Manatee County's principal source of potable water is Lake Manatee, a reservoir on the Manatee River near Waterline Road, just north of SR 64. Several studies have been conducted on the effects of the impoundment of the river on the downstream ecosystem.

A recent study (Camp, Dresser and McKee, 1995) evaluated a range of reservoir releases, or other streamflow augmentations from offsite, on the salinity profile of the river and the estuarine communities downstream. Other than direct releases from the reservoir, water sources considered for augmentation included in-stream reservoirs upstream of Lake Manatee, a pumped-storage area, and diversion of the Myakka River via the Flatford Swamp. The 1995 study considered releases or augmentation flows of 0.425, 5.0 and 10.0 cfs.

The Manatee River Downstream Augmentation option would use reclaimed water from the Manatee Agricultural Reuse System (MARS) as a freshwater source to augment river flow. The water that would have otherwise been released would be made available for potable use. The amount of water to be used for augmentation would range from 5.0 and 10.0 cfs (3.2 and 6.5 mgd) on an intermittent basis. The reclaimed water would provide the same environmental benefits to the estuary that would have been provided by releases from the reservoir.

A surface-water discharge permit for WWTP effluent would be required. The surface-water discharge permit may require a higher level of treatment than is now provided or contemplated for the County's three WWTPs. Other permits associated with the infrastructure construction (ERP, County right-of-way use permit, etc.) would also be required.

The option would include a 20-inch diameter pipeline from the MARS system to the downstream face of the Lake Manatee Dam, beginning at the Rye Road-Waterline Road intersection and following Waterline Road to the water treatment plant site and the dam; a distance of about 2.8 miles. The connection would operate from the pressure in the MARS system. The outlet end would include flow-control valve stations with metering and telemetry. No easements or subaqueous crossings would be required. The MARS may require augmentation with other sources to supply the flows necessary for this option to achieve its full potential.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
3.2 (3.2*)	$2,670,000	$830,000	$0.19

* - Beneficial offset

Issues:

- The use of reclaimed water for augmentation of river flows will require consideration of the effects of nutrient loading on downstream water quality.

17.0 Longboat Key/Manatee County/Sarasota Interconnect (PBS&J, 2000 #58)

For several years the Town of Longboat Key has expressed an interest in reclaimed water to reduce the demand on the potable water system and possibly eliminate two major ground-water pumping wells for the irrigation of two golf courses.

Two potential sources of reclaimed water for the barrier island would be from Manatee County, which receives and treats the wastewater production from the island, or the City of Sarasota. Both municipalities treat wastewater to a level that is suitable for public access reuse irrigation and both currently operate reuse systems.

The proposed interconnect would help to meet the irrigation needs for the entire island while reducing the demand on both ground-water pumping and the potable water system by a total of approximately 2.0 mgd.

Longboat Key is also interested in using this reuse pipeline interconnect as an emergency back-up to the existing sanitary sewer force main currently carrying raw sewage to Manatee County's Southeast WWTP. Should the existing sanitary force main fail, the reuse main could quickly be converted to handle the sewage.

The proposed reuse pipeline will parallel the existing sanitary sewer force main crossing Sarasota Bay. The construction of the reuse pipeline will likely be accomplished by directional drilling the subaqueous crossing of Sarasota Bay. This will minimize environmental impacts and simplify the permitting process. An easement from the state for the subaqueous crossing is likely to be required and an above ground storage tank would be constructed on Longboat Key to provide adequate diurnal storage of reclaimed water. The storage tank would also absorb the peak flow demands, while a booster pumping station would be required to service the island. The MARS may require augmentation with other sources to supply the flows necessary for this option to achieve its full potential.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
2 (1.5*)	$8,430,000	$5,620,000	$1.36

* - Beneficial offset

Issues: none

18.0 US 41 Industrial Corridor Transmission Pipeline (PBS&J, 2000 #60)

A number of potential industrial reuse customers have been identified along US 41 from Causeway Blvd. south to the TECO Energy Big Bend Power Plant. Currently, Hillsborough County does not have sufficient reclaimed water to serve these customers. Recently TECO requested two mgd of reclaimed water to operate their new sulfur dioxide air scrubbers being installed at Big Bend to improve air quality. Also, a gypsum plant along US 41 has requested reclaimed water for an industrial use. IMC-Agrico, Cargill, Nitram and TECO's Gannon power plant are also potential customers.

The Tampa/East Hillsborough Interconnect transmission pipeline is proposed to carry reclaimed water from the City of Tampa's Howard F. Curren WWTF to a terminus at Causeway Blvd. near US 41. The pipeline proposed in this option will convey water from the Hillsborough County Interconnect south along US 41 to Cargill's plant at the Alafia River. A transmission pipeline is proposed to cross the river and continue south along US 41 to a termination point in the vicinity of TECO Energy's Big Bend Power Plant.

This pipeline will also supply the South Hillsborough ASR Wells/Recharge/Saltwater Intrusion Barrier System. This ASR system will provide seasonal storage and increase the reliability of service to the industrial customers. Ten mgd of pipeline capacity will be provided for a design life of 20 years.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
10 (10*)	$7,790,000	$780,000	$0.18

* - Beneficial offset

Issues: none

19.0 Pinellas County Reclaimed Water Efficiency Study (PBS&J, 2000 #62)

A Reclaimed Water Efficiency Study of existing reuse systems in Pinellas County is needed to determine ways to maximize the efficient usage of reclaimed water and increase the benefit of offsetting the use of ground water for non-potable needs. When many of the existing reclaimed water options were developed in Pinellas County, the primary focus was maximizing effluent disposal. Water savings associated with the reuse systems were only considered to be ancillary benefits at that time. In order to encourage connection to the reclaimed water systems, incentives were offered, such as free use of the water or a nominal flat monthly charge and no restrictions on irrigation frequency. These incentives promote an inefficient overuse of the reclaimed water supply. It has been demonstrated that irrigation use can more than double when customers switch from using public potable water supplies to reclaimed water.

Because of this overuse of reclaimed water, many utilities are limited in their ability to serve irrigation water needs in their service areas with reclaimed water. By promoting and implementing methods for more efficient use of reclaimed water, utilities could potentially serve more customers and increase the ground-water offset.

This option will involve an evaluation of existing reclaimed water systems in the county, including review of current reclaimed water rate structures and other aspects of the reuse programs that might encourage non-efficient use of reclaimed water. Measures will be proposed that can maximize efficiency, making more reclaimed water available for other users. Efficiency measures that will be examined include, but are not limited to, reclaimed water conservation rate structures, addition of metering of reclaimed water usage, water use restrictions, telemetry to control reclaimed water availability, and increased education programs. Estimates will be made on the quantity of additional reclaimed water that would be available for increased reuse if the efficiency measures are implemented.

Approximately 133 mgd of reclaimed water is projected to be produced in Pinellas County by 2020. Based on current utilization rates, approximately 50 percent, or 66 mgd would be available for reuse. Using current reuse practices, if all of this wastewater is reused, only about 60 percent, or 40 mgd, would be expected to offset the use of ground water or potable water. By increasing efficiency, the offset could potentially be increased to 75 percent, resulting in an additional offset of approximately 10 mgd.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
N/A	$100,000	N/A	N/A

* - Beneficial offset

Issues: none

20.0 IMC/MARS Augmentation Option (PBS&J, 2000 #68)

For a number of years Manatee County has been planning its MARS, a program to provide reclaimed water to agricultural users to induce them to reduce their permitted ground-water withdrawals. The principal sources of supply for the MARS are the three WWTPs that serve the County. These plants are designed to provide the level of treatment needed to allow reclaimed water from the plants to be used for non-potable purposes, the largest of which is irrigation.

IMC/Agrico mines phosphate at its Four Corners Site in northeast Manatee County. County staff and IMC have been in planning discussions concerning the end of mining operations. The restoration of the property would include surface reservoirs for the storage of streamflow diverted from the South Fork of the Little Manatee River and from Long Branch. Such diversion and storage would provide a supplemental source of water for MARS, and would help the County meet its goal for the program.

The storage volume is represented by the county to be 1.0 billion gallons. This, together with the other sources of supply for MARS, is projected to directly offset 15 mgd of ground-water demand in the year 2020. This would reduce the stress on the ground-water supply and help to retard saltwater intrusion into the aquifer.

This option would provide for the diversion of surface waters to storage and to eventual use in the reclaimed water system, and would include a modification to the reuse permit to account for the additional source to the reuse system. Other permits associated with the infrastructure construction (ERP, County right-of-way use permit, etc.) will also be required.

The surface storage reservoirs will be constructed as part of the land reclamation program after mining is completed. A 10,000 gpm pumping station would be constructed near the reservoirs with a flow meter and telemetry. The station will discharge to MARS via a 36-inch pipe along SR 62 to Spencer Parrish Road just east of US 301.

Subaqueous crossings will be required at South Fork and Long Branch, assuming all three areas of the mine are included in the reservoir configuration. Easements are not expected to be required, and the County anticipates that it will acquire the property for the reservoir as part of the reclamation project.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
15 (9*)	$20,990,000	$2,330,000	$0.62

* - Beneficial offset

Issues: none

21.0 Polk County Reclaimed Water Efficiency Study (PBS&J, 2000 #70)

This option involves a Reclaimed Water Efficiency Study of existing reuse systems in Polk County to determine ways to maximize the usage of reclaimed water and increase the benefit of offsetting the use of ground water for non-potable needs. When many of the existing reclaimed water options were developed in Polk County, the primary focus was maximizing effluent disposal. Water savings associated with the reuse systems were only considered to be ancillary benefits at that time. To encourage connection to the reclaimed water systems, incentives were offered, such as free use of the water or a nominal flat monthly charge and no restrictions on irrigation frequency. These incentives promote an inefficient overuse of the reclaimed water supply. It has been demonstrated that irrigation use can more than double when customers switch from using public potable water supplies to reclaimed water.

Because of this overuse of reclaimed water, many utilities are limited in their ability to serve the non-potable irrigation water needs in their service areas with reclaimed water. By promoting and implementing methods for more efficient use of reclaimed water, utilities could potentially serve more customers and increase the ground-water offset.

This option will involve an evaluation of existing reclaimed water systems in Polk County, including review of current reclaimed water rate structures and other aspects of the reuse programs that might encourage inefficient use of reclaimed water. Measures will be proposed that can maximize efficiency, making more reclaimed water available for other users. Efficiency measures that will be examined include, but are not limited to, reclaimed water conservation rate structures, addition of metering of reclaimed water usage, water use restrictions, telemetry to control reclaimed water availability, and increased education programs. Estimates will be made on the quantity of additional reclaimed water that would be available for increased reuse if the efficiency measures are implemented.

Approximately 43 mgd of reclaimed water is projected to be produced in Polk County by 2020. Based on current utilization rates, approximately 75 percent, or 32 mgd would be available for reuse. Using current reuse practices, if all of this wastewater is reused, only about 60 percent, or 19 mgd, would be expected to offset the use of ground water or potable water. By increasing efficiency, the offset could be potentially increased to 75 percent, resulting in an additional offset of approximately 5 mgd.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 gallons
N/A	$100,000	N/A	N/A

* - Beneficial offset

Issues: none

22.0 City of Lakeland Wetlands – SR 60 Industrial Reuse (PBS&J, 2000 #75)

This option involves using reclaimed water from the City of Lakeland wetlands treatment system for industrial chemical manufacturers such as Mulberry Phosphate, Cargill, CF Industries, US Agrichem and others. These users are located within four miles of the wetlands.

The City proposed that a pump station and transmission main from the wetland treatment system be constructed to distribute the reclaimed water from the wetlands to industrial users located along the S.R. 60 corridor.

Approximately 2.0 mgd of reclaimed water would be available for industrial reuse. A 12-inch pipeline would distribute reclaimed water to the potential customers. Chlorination would be required prior to reusing the water.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 gallons
2 (2*)	$3,230,000	$1,620,000	$0.59

* - Beneficial offset

Issues: none

23.0 Reclaimed Water Utilization and Efficiency Study in Coastal SWUCA (PBS&J, 2000 #78)

This option involves a Reclaimed Water Utilization and Efficiency study of existing reuse systems in coastal areas of the SWUCA to determine ways to maximize the usage of reclaimed water and increase the benefit of offsetting the use of ground water for non-potable needs. When many of the existing reclaimed water options were developed in the SWUCA, the primary focus was maximizing effluent disposal. Water savings associated with the reuse systems were only considered to be ancillary benefits at that time. In order to encourage connection to the reclaimed water systems, incentives were offered, such as use of the water for free or a nominal flat monthly charge and no restrictions on irrigation frequency. These incentives promote an inefficient overuse of the reclaimed water supply. It has been demonstrated that irrigation use can more than double when customers switch from using public potable water supplies to reclaimed water.

Because of this overuse of reclaimed water, many utilities are limited in their ability to serve the non-potable irrigation water needs in their service areas with reclaimed water. By promoting and implementing methods for more efficient use of reclaimed water, utilities could potentially serve more customers and increase the ground-water offset. This option will involve an evaluation of existing reclaimed water systems in the coastal areas of the SWUCA, including review of seasonal storage, current reclaimed water rate structures and other aspects of the reuse programs that might encourage inefficient use of the resource. Measures will be proposed that can maximize utilization and efficiency, making more reclaimed water available for other users. Efficiency measures that will be examined include, but are not limited to, reclaimed water conservation rate structures, addition of metering of reclaimed water usage, water use restrictions, telemetry to control reclaimed water availability, and increased education programs.

Estimates will be made on the quantity of additional reclaimed water that would be available for increased reuse if the efficiency measures are implemented. Approximately 100 mgd of reclaimed water is projected to be produced in the Coastal SWUCA by 2020. Using current reuse practices, only about 50 percent, or 50 mgd, could be expected to be utilized due to seasonal demand and storage requirements. By optimizing utilization, the rate could potentially be increased to 75 percent, resulting in an additional availability of nearly 25 mgd. Current average reclaimed water efficiency rates range from 25 percent to 100 percent offset, with an approximate average of 60 percent offset. By using the current utilization rate (50 percent) and current efficiency rate (60 percent), the total reclaimed water offset in the coastal SWUCA would only be 30 mgd. However, by using the target utilization rate (75 percent) and the target efficiency rate (75 percent), the total reclaimed water offset in the Coastal SWUCA could be approximately 56 mgd.

Quantity of Water Produced (MGD)	**Capital Cost**	**Cost per MGD**	**Cost per 1,000 gallons**
N/A	$100,000	N/A	N/A

* - Beneficial offset

Issues: none

24.0 MARS System Expansion to Lake Parrish (PBS&J, 2000 #136)

The MARS is a reclaimed water system planned and developed by Manatee County Utilities to provide reclaimed water to large agricultural users to assist them in reducing their permitted ground-water withdrawals.

This option proposes to fund an expansion of the MARS. The expansion will include transmission pipelines to serve additional agricultural customers and a connection to Lake Parrish. A 36-inch pipeline will be constructed along SR 62, from the current terminus of the MARS, to Lake Parrish, an off-stream reservoir constructed as part of the Florida Power & Light Company's (FP&L) Parrish Power Plant. Water in the reservoir is used to condense the steam in the power generating units. The hot water is then recirculated through the lake to cool it. Water that evaporates is replaced by permitted withdrawals from the Little Manatee River.

The pipeline connection to Lake Parrish will allow reclaimed water to be used as cooling water and water from the Little Manatee River could then be used as a potable water supply. Currently FP&L withdraws an annual average of 7.7 mgd and they are permitted to withdraw up to 40 percent of the flow or about 34 mgd under certain conditions. By supplying eight to 10 mgd of reclaimed water, 34 mgd may be made available as a potable water supply during parts of the year. The MARS may require augmentation with other sources to supply the flows necessary for this option to achieve its full potential.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 gallons
8 (4.8*)	$4,640,000	$970,000	$0.22

* - Beneficial offset

Issues:

- TDS and chloride levels in the reclaimed water may be of concern in the plant cooling system
- Transfer of FP&L WUP

25.0 Rotonda/LongMarsh Golf Courses (PBS&J, 2000 #180)

Reclaimed water from both the Rotonda (Aqua Source) WWTP and the Englewood Water District WWTP is currently delivered to portions of the Rotunda Development. This option proposes to extend the service area to include the Long Meadow and White Marsh nine-hole golf courses in Rotonda. Pipelines will be extended eastward first to Long Meadow and then to White Marsh to provide reclaimed water for irrigation.

Englewood Water District is proceeding with the construction of an ASR test well. Pending approval of FDEP for full operation, ASR will provide wet weather storage and dry season capacity sufficient to service the needs of these additional golf courses.

The irrigation demand for each course is expected to be 200,000 gpd annual average and 300,000 gpd during the dry season.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 gallons
0.4 (0.3*)	$460,000	$1,540,000	$0.35

* - Beneficial offset

Issues: none

Section 3. Non-Agricultural Conservation

District staff and Ayres Associates, Inc., determined conservation options appropriate for implementation by public supply, domestic self-supply, recreation/aesthetic and commercial/industrial (C/I) and mining/dewatering (M/D) users. Using information gathered from water use permittees and District data, previous and ongoing water conservation efforts in the region were inventoried. Potential water conservation options that have not been implemented were identified. Options were primarily evaluated for applicability to each water use category, associated potential water savings, and cost-effectiveness. All options were considered to be applicable within each county in the planning region. Once all potential options were identified, the list was shortened to include those projects which cost less than $2.00/1000 gallons of water saved if implemented either independently or in conjunction with another program, and favorably addressed the secondary considerations described in Section 4 of Part D in Chapter IVB. The following nine water conservation measures were identified as having the best potential for water savings upon implementation in the planning region.

- Plumbing retrofit kit give-aways
- Ultra low volume (ULV) toilet rebates
- Residential water use surveys
- Water-efficient landscape and irrigation system rebates
- Industrial, commercial and institutional (ICI) water use surveys
- Large landscape water use surveys
- Rain sensor shut-off device rebates
- Water budgeting

A detailed description of all specific options are available in the final report on non-agricultural water conservation options in the planning region (Ayres, 2000). Specific projects were identified at the utility level for public supply, and at the county level for other non-agricultural water users. In addition, the report identified the costs and savings attributable to each option at the respective (utility or county) levels. The pages that follow provide a description of each option, including issues that may be related to planning or implementation. Included in each description is the average cost and potential water savings attributable to each option. It should be noted that more than one option may be implemented by any given utility or county at one time. If such options target the same type of use (two separate options which both target landscape water use, for example), it is reasonable to expect that savings may be less than indicated, as will program start-up costs. Because both savings and costs are affected similarly, the cost-effectiveness of the combined options is not greatly affected, and is considered to be valid for planning purposes. Detailed costs and savings associated with each option for each utility in the planning region, and domestic self-supply water users in each county, are contained in the consultant's report, *Development of Water Conservation Options for Non-Agricultural Water Users* (Ayres, 2000).

As mentioned previously, some readily applicable conservation options were not addressed due to the wide variance in cost per thousand gallons saved, and the site-specific nature of their implementation. Two such measures in particular which have savings potential but were not addressed as part of this plan are water conserving rate structures, and codes/ordinances which require water efficiency. Water conservation oriented rate structures provide a financial incentive to adopt water conserving technologies and habits. The typical objectives of a conservation oriented rate structure are to:

- collect as much of required utility revenues from usage related charges as is fiscally prudent from a revenue stability standpoint,
- provide financial incentives to customers to reduce waste and discretionary use,
- and keep non-discretionary use affordable.

In addition, temporary drought/emergency rate structures can be used to significantly dampen demand during severe drought conditions and water emergencies while still producing required revenues. The potential water savings of rate structure changes vary by utility service area characteristics, existing water and sewer rate levels and structures, and the rate structure and usage information provided to customers. The District provides free software and information to assist utilities in developing water conservation oriented rate structures.

Landscape codes could address a variety of issues such as the installation or maintenance of existing drought resistant vegetation, use of Xeriscape or Florida Yards and Neighborhoods principles, limitations on irrigable area, efficiency of irrigation systems, deed restrictions, and the use of rain and soil moisture sensors to override the automatic operation of irrigation systems. Unfortunately, there is little information addressing the cost per thousand gallons saved by a uniform landscape code, let alone the significant variants likely to be adopted at the local government level.

1.0 Plumbing Retrofit Kit Give-Aways

The purpose of this option is to achieve indoor water conservation through installation of plumbing retrofit kits containing equipment and instructions to retrofit high-volume plumbing fixtures. This option is appropriate for implementation in the domestic self-supply category, and multi-family and single family homes in the public supply category. Typically, retrofit kits contain easy-to-install low flow showerheads, faucet aerators, and toilet tank retrofit devices. The kits would be distributed to all single family and multi-family residences in a utility service area, for public supply customers, or within a county, for domestic self-supply water users. This option is an alternative program to residential water surveys in that it seeks to achieve a high installation rate of efficient devices for less than the cost of a survey.

The option would involve a drop-and-canvass approach where kits are left on residential doorknobs, and a follow-up visit is made to offer assistance and ascertain whether installation has occurred. The county, or the water provider, would first publicize the program through bill stuffers and news media coverage in the target area. The implementation of the option is typically administered by a professional, experienced contractor.

Costs are presented in first year planning period dollars. The cost to the administrator would be $55,000 per year including overhead while the program is being implemented. The cost to purchase and deliver the kits through a properly publicized neighborhood canvas program is estimated to be about $25 per household (Metropolitan, 1991), including about $10 for the retrofit kit and $15 for labor, including kit delivery and installation. The kit cost of $10 is considered to be average; it should be noted that by purchasing higher quality (more expensive) kit contents, device retention rates may increase, thereby increasing program effectiveness. Annual costs incurred over the program period are assumed to be in first year planning period dollars. Therefore, costs incurred beyond the first year are brought back to first year planning dollars by applying a present worth factor. The default interest rate used for the present worth analysis is eight percent.

Previous studies have shown that homes that installed kits save about 10.5 gpcd. Due to the limited useful life of toilet tank displacement devices, their contributions toward savings (1.3 gpd) were not considered, and a 20-year planning saving of 9.2 gpcd was assumed. Costs and potential savings associated with the implementation of this option in each county are summarized below.

Category	Quantity of Water Conserved (GPD)	Cost per 1,000 Gallons
Public Supply	7,100,000	$0.22
Domestic Self-Supply	970,000	$0.29

Issues: none

2.0 Ultra Low Volume (ULV) Toilet Rebates

The ULV toilet rebate option is designed to offer rebates as an incentive for customers to replace their high water-volume toilets with ULV models which use less water. ULV toilets use about 1.6 gallons per flush (gpf), as apposed to older, less efficient models using 3.5 - 7.0 gpf, depending on their age. This option is considered to be most effective if implemented in two categories: (1) public supply, including single- and multi-family residential customers, as well as non-residential customers; and (2) domestic self-supply, involving single-family residences only. It was assumed that an average of 1.4 rebates would be issued per single-family program participant, 1.3 rebates would be issued per multi-family program participant, and 4.2 for the nonresidential category. It is assumed a utility would administer the program for public supply customers, and a county agency for water users not associated with a public supply system.

The most common approach in existing programs for the implementation of the ULV toilet rebates option, has been the reservation system. This involves the reservation of a rebate by eligible customers/water users, who then have 30 days to purchase and install the toilet(s) of their choosing. Once installed, the customer sends original receipts for the toilet purchase to the program administrator, and a rebate check or utility billing credit is issued. As with most conservation options, the county, or the water provider, would first publicize the program through bill stuffers and news media coverage in the target area. This option is typically administered by a professional, experienced contractor.

Costs include research and development, training, and rebates. Research and development costs, depending upon the number of rebates offered, were assumed to be between $30,000 (< 10,000 rebates) and $70,000 (> 25,000 rebates). Training costs, based on the same range of rebates, were assumed to be between $2,000 and $6,000. For the RWSP, it was assumed that the rebate offered would be $165 per toilet. Annual costs incurred over the program period are assumed to be in first year planning period dollars. Therefore, costs incurred beyond the first year are brought back to first year planning dollars by applying a present worth factor. The default interest rate used for the present worth analysis is eight percent.

It was assumed that implementation of the ULV toilet rebate option would begin in 2000. The table below summarizes the costs and potential savings associated with the implementation of this option in each county.

Category	Quantity of Water Conserved (GPD)	Cost per 1,000 Gallons
Public Supply	18,340,000	$0.86
Domestic Self-Supply	1,910,000	$0.70

Issues: none

3.0 Residential Water Use Surveys

The purpose of this option is to offer residents an indoor/outdoor water use survey to provide information related to how water is being used, and ways it may be used more efficiently. The option includes free-of-charge services and items: the survey, water conservation literature, and water-conserving items such as low-flow showerheads, faucet aerators, and optimum watering schedule information and tips. The survey would be advertised in the areas of high customer water use. This option is most effective for single-family domestic self-supply water users.

As part of this option, the indoor survey would include an inspection of plumbing devices to determine if more-efficient fixtures can be used. Surveyors would provide and replace, where local guidelines allow, high water use showerheads and faucet components with low-volume models. Leaking toilets and other fixtures would be noted, and repair encouraged. The outdoor survey includes an inspection of irrigation system components. Information that could be used to improve irrigation water use, including a customized lawn irrigation schedule, would be provided.

The following assumptions affecting costs and savings were made relative to the implementation:

- Follow-up surveys would be conducted every five years to ensure continued savings
- Water savings from residential water use surveys would continue for 20 years
- Each surveyor could conduct and write up results for about five surveys per week
- Multi-family surveys take longer depending on the size of the complex
- To complete the initial surveys within a five-year period, the counties/utilities would hire sufficient surveyors to survey one-fifth of the participating homes each year

The amount of each survey was estimated to be $160. Research and development costs vary depending upon the number of surveys conducted, and are estimated to be between $15,000 (< 10,000 surveys) and $50,000 (> 25,000 surveys). Based on the same numbers of accounts, training is estimated to cost between $2,000 and $6,000.

Estimated water savings related to each survey are estimated to be 22 gallons per day (gpd) for single-family, and 25.6 gpd for multi-family homes. The table below summarizes the costs and potential savings associated with providing surveys to all eligible domestic self-supply water users in each county. This measure was designed to be completed every five years.

Category	Quantity of Water Conserved (GPD)	Cost per 1,000 Gallons
Domestic Self-Supply	970,000	$1.80

Issues: none

4.0 Water Efficient Landscape and Irrigation System Rebates (WEIS)

This option is designed to reduce peak water demand by improving outdoor irrigation efficiency. The WEIS rebate is applicable to all accounts/water-use permittees that use in-ground sprinkler systems for landscape irrigation. It is considered to be most effective when implemented in the public supply and domestic self-supply categories of water use. It is assumed that public utilities or county agencies would implement this option. A rebate would be provided as an incentive to repair, modify and/or replace high water-use landscape and irrigation systems by:

- Installing multiple program controllers
- Installing innovative irrigation technology
- Maintaining separate irrigation zones for turf and landscape plant areas
- Maintaining sprays and rotors in separate zones
- Replacing sprinkler heads that have unmatched precipitation rates
- Installing automatic rain shut-off devices

Eligibility of each participant for rebates would be determined during an initial site audit to evaluate each irrigation system's design, operating condition, and current overall efficiency. Data collected from the irrigation audit would be used by customers to identify improvements, by the program administrator in evaluating the rebate program and to develop a base irrigation schedule to be used by each participant.

The amount of each survey/rebate was estimated to be $655. Research and development costs vary depending upon the number of surveys conducted, and are estimated to be between $10,000 (< 10,000 surveys) and $45,000 (> 25,000 surveys). Based on the same numbers of accounts, training is estimated to cost between $2,000 and $6,000.

Savings are limited to five years; as such, this option is designed to be repeated every five years. Savings are estimated to be equal to 22 gpd for each single-family, and 15.6 gpd for each multi-family property (Ayres, 2000). This option may be implemented concurrently with irrigation system surveys, but potential savings are considered independently for the purposes of the RWSP. Costs and potential savings associated with providing rebates to all eligible public supply and domestic self-supply water users in each county are summarized below.

Category	Quantity of Water Conserved (GPD)	Cost per 1,000 Gallons
Domestic Self-Supply	4,890,000	$0.60
Public Supply	22,120,000	$0.35

Issues: none

5.0 Industrial, Commercial and Institutional (ICI) Water Use Surveys

The purpose of this option is to provide ICI water users with a free evaluation of their water use, and specific recommendations for improving efficiency. As surveys are completed, follow-up telephone calls would be made to verify where recommendations are implemented and measure savings. It is assumed that a qualified consultant/contractor would be employed to administer the program. This option is most effective for the Industrial/Commercial (I/C) and Mining/Dewatering (M/D) category of water users. It is assumed that a county agency would take the lead in implementing the survey program.

The amount of each survey was estimated to be $3,450. Research and development costs vary depending upon the number of surveys conducted, and are estimated to be between $20,000 (< 10,000 surveys) and $50,000 (> 25,000 surveys). Training costs would not be incurred, since contractors are employed.

The option applies only to the interior water uses of the ICI water users, for which the average savings is estimated to be 2,308 gpd. Costs and potential savings associated with providing rebates to all eligible public supply and domestic self-supply water users in each county are summarized below.

Category	Quantity of Water Conserved (GPD)	Cost per 1,000 Gallons
I/C and M/D	138,000	$0.29

Issues: none

6.0 Large Landscape Water Use Surveys

This option is designed to reduce peak demand by improving outdoor irrigation efficiency of water users with landscapes larger than one acre. The option applies to exterior water use in three categories: (1) the nonresidential sub-category of the public supply category; (2) the I/C and M/D category, and (3) the recreational/aesthetic category. To improve the landscape water efficiency, different types of technical support and incentives would be offered, depending on whether the account/permittee has a dedicated landscape meter or a mixed-use meter. These types of support and incentives are detailed in Appendix IVC-3.

Landscape water use surveys would be offered to accounts with significant seasonal water use. Potential participants would be identified based on the savings potential, and existing overall system efficiency. Such surveys would include a landscape water use evaluation, installation of meters, training in water-efficient landscape maintenance, and financial incentives for improving system efficiency. In addition, voluntary landscape water budgets may be applied, where possible. It is expected that the participants would pay for implementing survey findings, including minor irrigation systems repairs, and incur the labor cost to reset irrigation controls periodically. It is assumed that trained surveyors and technicians would be employed to administer the program. Follow-up surveys would be provided once every five years.

The cost of the option increases with the area surveys. For the purposes of the RWSP, the amount of each survey was estimated to be $800. Research and development costs vary depending upon the number of surveys conducted, and are estimated to be between $15,000 (< 50 surveys) and $45,000 (> 100 surveys). Based on the same numbers of accounts, training is estimated to cost between $2,000 and $6,000.

The average savings for this option is estimated to be 428 gpd for each large, non-residential landscape implementing all identified water conservation measures. The costs and potential savings associated with administering a program, including associated incentives, for all eligible water users in each county are summarized below.

Category	Quantity of Water Conserved (GPD)	Cost per 1,000 Gallons
I/C and M/D	28,000	$1.66
Recreation/Aesthetic	1,330,000	$0.14
Public Supply	880,000	$0.73

Issues: none

7.0 Rain Sensor Shut-off Device Rebates

The purpose of the rain sensor option is to reduce water used by automatic irrigation systems by eliminating irrigation during significant rain events. The is most effective in the public supply, domestic self-supply, and recreational/aesthetic categories. The option would be implemented by offering rebates to encourage the purchase and installation of the rain sensors. Inspection to determine proper installation is recommended. It is assumed the program would be administered by a consultant/contractor.

The amount of each rebate was estimated to be $65. Research and development costs vary depending upon the number of rebates offered, and are estimated to be between $10,000 (< 1,000 surveys) and $45,000 (> 3,500 surveys). Based on the same numbers of accounts, training is estimated to cost between $2,000 and $6,000.

The average savings for this option is estimated to be 103 gallons per device per day, based on a program implemented in Hernando County in 1997. Costs and potential savings associated with providing rebates to all eligible public supply, domestic self-supply, and recreation/aesthetic water users in each county are summarized below.

Category	Quantity of Water Conserved (GPD)	Cost per 1,000 Gallons
Domestic Self-Supply	3,820,000	$0.20
Recreation/Aesthetic	560,000	$0.46
Public Supply	11,630,000	$0.22

Issues: none

8.0 Water Budgeting

The concept of the water budgeting option is to require water associated with irrigation to remain within an annual budget. Based on a landscape and irrigation survey, a water budget is assigned to customers in a utility service area, or water users within a municipal jurisdiction. This option represents the only mandatory option evaluated and recommended, and would require a utility (using the billing system, for example) or a local government (using meters and law enforcement, for example) to monitor and enforce the budgets. Budgeting allows the water user to irrigate for landscape irrigation needs, based on plant material, soil, climate, weather patterns, and other critical decision factors. It provides an alternative to the two-day per week irrigation schedule enforced over most of the planning region. For the purposes of the RWSP, this option requires water users to adhere to the IFAS irrigation water schedule, which recommends 46 or less irrigation events per year. A total of 104 irrigation days per year are currently allowed based on watering restrictions.

The cost of $11 per public supply customer, or non-public supply permittee, is based on the monitoring and enforcement of water budgets. Research and development costs vary depending on the number of permittees/customers, and are estimated to be between $30,000 (< 1,000) and $70,000 (> 2,500). Based on the same numbers of accounts, training is estimated to cost between $2,000 and $6,000.

The average savings for this option is estimated to be 78 gpd for single-family homes, 192 gpd for multi-family properties, and 578 gpd for non-residential properties. The table below summarizes the costs and potential savings associated with providing rebates to all eligible public supply and non-public supply water users in the region.

Category	**Quantity of Water Conserved (GPD)**	**Cost per 1,000 Gallons**
Public Supply	16,410,000	$0.16
Non-public Supply	4,220,000	$0.29

Issues: None.

Section 4. Agricultural Conservation

1.0 Description of Conservation Options

Project consultants led by HSW Engineering, Inc. (HSW) identified the following conservation options that potentially could be employed by agriculturists to help extend supplies of water over the next 20 years. For each of these options, potential water savings and associated costs were estimated:

- Conversion to more water-conserving irrigation systems
- On-farm decision support systems (irrigation scheduling programs)
- Tensiometers
- Shallow water table observation ("monitor") wells
- Automatic pump controls
- Variable rate pumping
- Water flow meters
- Laser leveling
- Seepage interception/horizontal wells
- Tailwater recovery

Each above identified conservation option is briefly discussed below.

1.1 Conversion to more water-conserving irrigation systems

Generally speaking, a grower might consider the following elements in a determination of whether to convert to a more water-conserving irrigation system:

- Assessment of suitability of water quality and quantity
- Evaluation of soil profiles and depth
- Assessment of labor and operator skill
- Evaluation of energy requirements
- Analysis of hydraulic capacity to determine fertigation feasibility (fertigation refers to the application of crop fertilizers in aqueous solution by the use of an irrigation system)
- Estimation of costs and analysis of economic feasibility

Irrigation system conversion may require the following equipment:

- Filtration systems
- Mains, submains, manifolds, and lateral pipelines
- Flexible polyethylene pipe
- Microsprinklers
- Control valves
- Pressure regulators
- Flow meters and pressure gauges
- Flush valves

- Center pivots
- Irrigation controller and automatic valves (optional)
- Chemical injection equipment (optional)
- Backflow prevention equipment (in conjunction with chemical injection system)

For this study, project consultants evaluated the following potential irrigation system conversion scenarios:

- Semi-closed seepage to drip
- Semi-closed seepage to fully-enclosed seepage
- Overhead sprinkler to line source emitters (spaghetti tube)
- Overhead sprinkler to drip
- Semi-closed seepage to center pivot

1.1.1 Conversion from Semi-Closed Seepage to Drip

The conversion of a semi-closed seepage irrigation system to a drip system is similar in cost to installing a drip system from scratch. In some cases, it may be possible to retrofit parts of the existing main and/or lateral pipelines. However, growers typically install an entirely new system independent of existing facilities. The cost per acre to install a drip irrigation system varies depending on plant spacing requirements. Crops evaluated for this conversion scenario were tomatoes, cucumbers, melons, and other vegetables/row crops.

1.1.2 Conversion from Semi-Closed Seepage to Fully-Enclosed Seepage

A semi-closed seepage irrigation system can be retrofitted to a fully-enclosed seepage system at a cost that is about 25 percent lower than the cost of installing a fully-enclosed system from scratch. The basic physical requirements are the same; however, pumping requirements may change because less pressure is needed for a fully-enclosed seepage system. Crops evaluated for this conversion scenario were tomatoes, cucumbers, other vegetables/row crops, melons, and field nurseries. Although it is recognized that some field nurseries might opt instead to convert to a drip system, a fully-enclosed system was selected for purposes of this analysis because a number of larger field nurseries currently utilize semi-closed seepage technology.

1.1.3 Conversion from Sprinkler to Line Source Emitters (Spaghetti Tube)

Conversion from sprinklers to spaghetti tubes was evaluated for container nurseries. This irrigation system conversion is quite costly and requires significant planning and design due to the diversity of container nursery operations. Nurseries cultivate a variety of plant sizes in many different sized containers. As such, some nurseries will require emitters with a variety of different delivery rates. Injector mechanisms will be needed for liquid fertilizer applications. Pump and motor modifications also may be necessary.

1.1.4 Conversion from Sprinkler to Drip

The conversion of a sprinkler irrigation system to a drip system involves activities similar to the installation of an entirely new drip system. The savings resulting from reusing laterals and mains is not usually considered to be worth the effort of design modifications. Drip systems typically require much less velocity than a sprinkler system; therefore, a water pump design modification would most likely be necessary. After the drip system is installed, growers typically leave the sprinkler system in place for crop establishment and cold protection. This conversion scenario was considered for other vegetables/row crops.

1.1.5 Conversion from Semi-Closed Seepage to Center Pivot Sprinkler

This conversion scenario was considered for sod production. Project consultants' research also indicates that lateral move sprinklers could be used if a field were long and rectangular. Center pivot systems are preferable for more square fields; at the end of each line there is a special extender gun to irrigate the corners of the field. The estimated cost of a center pivot system is slightly less than a lateral move system.

1.2 On-Farm Decision Support Systems (Irrigation Scheduling Programs)

Decision support systems generally consist of a personal computer, modem and/or wireless transmitters, weather station, and data translators. Along with the electronic hardware, an optimization plan is included upon system installation. The system is used to schedule irrigation on a real-time basis, using weather and soil environment data as inputs. The system is typically coupled to an automated pump/valve control system to optimize irrigation scheduling. These systems are expensive but can result in labor savings as well as more efficient use of water.

1.3 Tensiometers

Tensiometers are devices for measuring the tension (*i.e.*, negative pressure) under which water is held in the soil matrix and provide an indirect measurement of the water content of a specific soil type. Tensiometers can be equipped with magnetic self-monitoring devices which can be connected to a pump controller to automatically start an irrigation event when a predetermined critical soil tension threshold is reached. Tensiometers require regular maintenance in the field.

1.4 Shallow Water Table Observation ("Monitor") Wells

The efficiency of all types of seepage irrigation systems which rely on the maintenance of an artificially high water table can be enhanced by closely monitoring the water table elevation. Maintaining a water table no higher than is necessary for the current stage of crop development reduces water use by minimizing tailwater losses. An inexpensive device has been developed for monitoring water table elevation which consists solely of PVC pipe and fittings. Irrigation managers can read the device easily and make appropriate adjustments to their irrigation schedule. Results of one study in the SJRWMD (McSweeney, 1997) indicated that by irrigating only when the monitor well gauge showed a need, irrigation quantities were reduced by about 35 percent on test farms. Since it is not known what effect different site conditions in the SWFWMD might have on these results, no specific statements of transferability are made in the RWSP.

1.5 Automatic Pump Controls

Among other things, the efficiency of an irrigation system is limited by the abilities and time resources of the operator. Investments in water table and soil moisture monitoring must be translated into appropriate adjustments in irrigation system run time in order to reduce water use. Mechanical, electrical, and computerized devices which start and stop pumps as well as open and close valves can greatly enhance an operator's irrigation scheduling. The operator can focus on a more suitable amount of water to be applied by making adjustments, as necessary, to pump run time and/or zone irrigation duration if the pump supplies more than one field.

1.6 Variable Rate Pumping

Mechanical, electrical, and/or computerized devices which vary the pumping rate to match both crop needs and soil infiltration rates can have water savings potential for seepage-type irrigation systems. When variable rate pumping is being used as a water conservation tool, the design might require the installation of a larger horsepower motor than typically would be used. Computerized controls are required in the form of a variable frequency driver (VFD). The VFD is an electrical controlling device that operates similar to a dimmer switch. For very large farms, additional costs may result from building a structure to house the controls and installing the air conditioning that would be required for certain controls.

1.7 Water Flow Meters

Well head water flow meters currently in use, which are associated with permitted agricultural water users, provide producers with the ability to monitor water use for comparison with other growers or with published application rate recommendations. By installing flow meters at individual or multiple fields, growers can develop a knowledge of water utilization with respect to specific crop maturity, soils, and field configurations. Water use monitoring also aids in the detection of leaks or obstructions in the irrigation system. Over time, growers can develop application rate benchmarks which should be incorporated with other data for determining optimal irrigation scheduling for specific crops on specific fields. In essence, flow meters allow growers to measure their real water use.

1.8 Laser Leveling

Laser leveling is a process by which a farm production field is brought to a consistent grade and evenness. Laser leveling is useful for evening out random high and low areas in the field thereby providing a consistent depth to a raised or perched water table. Thus, the water table need not be raised any higher than necessary and it is easier to maintain uniform soil moisture throughout the field. In addition, laser leveling can decrease the amount of runoff.

1.9 Seepage Interception/Horizontal Wells

This method involves the interception of subsurface water so that it can be reused for irrigation. This option is appropriate for more porous soils. Irrigation managers using this practice would need to employ a monitoring system to optimize management decisions. This is important because the frequent use of horizontal wells could increase the risk of lowering the water table below the capillary fringe area. Therefore, farms using seepage interception use other conservation tools such as monitor wells and a comprehensive decision support system for managing the entire operation.

1.10 Tailwater Recovery/Rainwater Harvesting Systems

The recovery and reuse of tailwater from irrigation and/or rainfall runoff provides a promising method for water conservation where overhead sprinkler and seepage irrigation systems are used. In such systems, irrigation tailwater and/or rainwater is collected at the low end of the field in tailwater ditches or perforated drain lines and is conveyed by gravity to a sump or storage pond to be pumped for reuse in a production area. For the RWSP, the term ‘tailwater recovery’ is used in conjunction with overhead sprinkler and seepage irrigation systems; the term ‘rainwater harvesting’ is used in conjunction with other irrigation systems.

1.11 Other Options for Future Research

During the preparation of the RWSP, the potential conservation options listed below also were considered. Although the following options have been deferred from further consideration in this edition, additional research will be devoted to these options for possible consideration in future RWSPs.

1.11.1 Implanted Reservoir Tillage

To reduce runoff and improve water distribution, implanted reservoir tillage (inter row tillage) is used with center pivot and lateral move sprinkler irrigation systems in the western United States. Implanted reservoirs are made by inserting a wedge-shaped device into the soil that creates a depression behind the device and a dam ahead of the device. Elongated depressions are created across the drainage furrow that act as dikes for retaining water and preventing runoff. This practice is considered to have potential for reducing runoff during bed preparation periods when seepage irrigation systems are used. However, due to a lack of available data relative to the use of this technique in Florida-specific site applications, this option was deferred from further consideration for the RWSP.

1.11.2 Pervious Mulch

Pervious mulch is a natural (*e.g.*, straw or celluloid) or synthetic material spread or placed on the ground surface that allows the infiltration of water but reduces weed infestation and evaporative losses. Some concerns exist regarding the ability of this type of mulch to hold fertilizers and fumigants in the bedded area. However, due to a lack of available data relative to the use of this technique in Florida-specific site applications, this option was deferred from further consideration for the RWSP.

1.11.3 Containerized Transplants

Some strawberry growers have begun to investigate the desirability of using containerized transplants rather than bare root plantings in the crop establishment phase of strawberry cultivation. If this practice should prove to be successful in regular field-scale operations, it is possible that the amount of water necessary for strawberry crop establishment may be reduced. Inasmuch as the testing of this practice is still in the experimental stages, it was deferred from further consideration for the RWSP.

2.0 Introduction to Model Farm Case Studies

To estimate the costs that might be incurred by a 'typical' agricultural operation to implement one or more of the identified conservation options, project consultants developed 20 'model' farms that are typical of a variety of different agricultural operations in the planning region. Commodities included in the model farm studies were citrus (flatwoods and ridge: model farms 1,2), tomatoes (model farms 3,4,5), field nurseries (model farms 6,7), container nurseries (model farm 8), sod (model farms 9,10), other vegetables/row crops (model farms 11,12,13), watermelons (model farms 14,15,16), cucumbers (model farms 17,18,19), and strawberries (model farm 20).

Each model farm case study is discussed individually in the following pages. Estimated water savings at year 2020 for each model farm are based on an assumption of a 75 percent participation rate by growers. Estimated water savings are for a 5-in-10 (average annual) rainfall year and are expressed in mgd. Cost figures represent a combination of annualized capital costs and annual operation and maintenance costs.

Detailed presentations of model farm design parameters and assumptions applicable to cost estimation methodologies are included in Appendix IVD-4.

Model Farm 1

This case study was developed for flatwoods citrus production. The primary irrigation system was assumed to be microjet. Applicable conservation options consist of the implementation of BMPs, including on-farm decision support systems, tensiometers, flow meters, and a rainwater harvesting system.

Estimated water savings: mgd	Annualized cost per planted acre:	Average cost per thousand gallons saved:
8.17	$68.11	$3.32

Issues: none

Model Farm 2

This case study was developed for ridge citrus production. The primary irrigation system was assumed to be microjet. Applicable conservation options consist of the implementation of BMPs, including on-farm decision support systems, tensiometers, and flow meters (i.e, similar to Model Farm 1, excluding a rainwater harvesting system).

Estimated water savings: mgd	Annualized cost per planted acre:	Average cost per thousand gallons saved:
7.92	$35.11	$1.33

Issues: none

Model Farm 3

This case study was developed for tomato production on Myakka soils. The primary irrigation system was assumed to be semi-closed seepage. Applicable conservation options consist of the implementation of BMPs, including on-farm decision support systems, automatic pump control, flow meters, a tailwater recovery system, laser leveling, variable rate pumping, and monitor wells.

Estimated water savings: mgd	Annualized cost per planted acre:	Average cost per thousand gallons saved:
3.59	$138.10	$1.05

Issues: none

Model Farm 4

This case study was developed for spring or fall tomato production on Myakka soils. The primary irrigation system was assumed to be semi-closed seepage. Applicable conservation options consist of the installation of a drip irrigation system and the implementation of BMPs, including on-farm decision support systems, laser leveling, tensiometers, and flow meters.

Estimated water savings: mgd	Annualized cost per planted acre:	Average cost per thousand gallons saved:
5.38	$383.47	$1.93

Issues: none

Model Farm 5

This case study was developed for tomato production on Myakka soils. The primary irrigation system was assumed to be semi-closed seepage. Applicable conservation options consist of the installation of a fully-enclosed seepage system and the implementation of BMPs, including on-farm decision support systems, flow meters, a rainwater harvesting system, laser leveling, and monitor wells.

Estimated water savings: mgd	Annualized cost per planted acre:	Average cost per thousand gallons saved:
5.02	$328.03	$1.77

Issues: none

Model Farm 6

This case study was developed for field nurseries. The primary irrigation system was assumed to be semi-closed seepage. Applicable conservation options consist of the implementation of BMPs, including on-farm decision support systems, automatic pump control, flow meters, a tailwater recovery system, laser leveling, variable rate pumping, and monitor wells.

Estimated water savings: mgd	Annualized cost per planted acre:	Average cost per thousand gallons saved:
1.50	$336.74	$1.15

Issues: none

Model Farm 7

This case study was developed for field nurseries. The primary irrigation system was assumed to be semi-closed seepage. Applicable conservation options consist of the installation of a fully-enclosed seepage irrigation system and the implementation of BMPs, including on-farm decision support systems, flow meters, a rainwater harvesting system, monitor wells, and laser leveling.

Estimated water savings: mgd	Annualized cost per planted acre:	Average cost per thousand gallons saved:
2.10	$526.67	$1.29

Issues: none

Model Farm 8

This case study was developed for container nurseries. The primary irrigation system was assumed to be fixed overhead sprinkler. Applicable conservation options consist of the installation of a microirrigation (spaghetti tube/line source emitter) system and the implementation of BMPs, including on-farm decision support systems, tensiometers, and flow meters.

Estimated water savings: mgd	Annualized cost per planted acre:	Average cost per thousand gallons saved:
0.03	$1,693.25	$5.52

Issues:

- The design of a water conservation model for container nursery operations is difficult due to the large number of individual containerized plants which require irrigation.
- Discussions with industry representatives indicate that some small-container operations may cultivate as many as 80,000 containerized plants per acre, thereby rendering it impractical to run the necessary microirrigation system "drip" lines to each individual plant. Further discussions with industry representatives indicate that spaghetti tube/line source emitter irrigation systems can be applied (although at considerable cost) to operations or portions thereof where the container sizes are 15 gallons or larger. Therefore, this model farm is applicable to approximately 20 percent of the container nursery acreage in the planning region (*i.e.*, where container sizes are 15 gallons or larger). The District is cooperating in ongoing research efforts to ascertain whether additional water savings can be achieved by container nursery operations.

Model Farm 9

This case study was developed for sod production. The primary irrigation system was assumed to be semi-closed seepage. Applicable conservation options consist of the implementation of BMPs, including on-farm decision support systems, flow meters, automatic pump control, a tailwater recovery system, laser leveling, variable rate pumping, and monitor wells.

Estimated water savings: mgd	Annualized cost per planted acre:	Average cost per thousand gallons saved:
6.16	$138.10	$0.89

Issues: none

Model Farm 10

This case study was developed for sod production. The primary irrigation system was assumed to be semi-closed seepage. Applicable conservation options consist of the installation of a center pivot irrigation system and the implementation of BMPs, including on-farm decision support systems, flow meters, and laser leveling.

Estimated water savings: mgd	Annualized cost per planted acre:	Average cost per thousand gallons saved:
9.74	$98.65	$0.40

Issues:

- Additional research is ongoing to ensure that all applicable capital and operating costs associated with conversion to a center pivot irrigation system have been captured appropriately.

Model Farm 11

This case study was developed for production of other vegetables and row crops. The primary irrigation system was assumed to be semi-closed seepage. Applicable conservation options consist of the implementation of BMPs, including on-farm decision support systems, flow meters, automatic pump control, a tailwater recovery system, laser leveling, variable rate pumping, and monitor wells.

Estimated water savings: mgd	Annualized cost per planted acre:	Average cost per thousand gallons saved:
1.66	$138.10	$1.54

Issues: none

Model Farm 12

This case study was developed for other vegetables and row crops. The primary irrigation system was assumed to be semi-closed seepage. Conservation options consist of the installation of a fully-enclosed seepage irrigation system and the implementation of BMPs, including on-farm decision support systems, monitor wells, flow meters, a rainwater harvesting system, and laser leveling.

Estimated water savings: mgd	Annualized cost per planted acre:	Average cost per thousand gallons saved:
2.32	$328.03	$2.61

Issues: none

Model Farm 13

This case study was developed for production of other vegetables and row crops. The primary irrigation system was assumed to be a sprinkler system. Applicable conservation options consist of the installation of a drip irrigation system and the implementation of BMPs, including on-farm decision support systems, tensiometers, and flow meters.

Estimated water savings: mgd	Annualized cost per planted acre:	Average cost per thousand gallons saved:
0.58	$227.31	$1.55

Issues: none

Model Farm 14

This case study was developed for melon production. The primary irrigation system was assumed to be semi-closed seepage. Applicable conservation options consist of the implementation of BMPs, including on-farm decision support systems, automatic pump control, flow meters, a tailwater recovery system, laser leveling, variable rate pumping, and monitor wells.

Estimated water savings: mgd	Annualized cost per planted acre:	Average cost per thousand gallons saved:
1.22	$138.10	$1.20

Issues: none

Model Farm 15

This case study was developed for melon production. The primary irrigation system was assumed to be semi-closed seepage. Applicable conservation options consist of the installation of a fully-enclosed seepage irrigation system and the implementation of BMPs, including on-farm decision support systems, flow meters, monitor wells, a rainwater harvesting system, and laser leveling.

Estimated water savings: mgd	Annualized cost per planted acre:	Average cost per thousand gallons saved:
1.70	$328.03	$2.03

Issues: none

Model Farm 16

This case study was developed for melon production. The primary irrigation system was assumed to be semi-closed seepage. Applicable conservation options consist of the installation of a drip irrigation system and the implementation of BMPs, including on-farm decision support systems, tensiometers, and flow meters.

Estimated water savings: mgd	Annualized cost per planted acre:	Average cost per thousand gallons saved:
1.82	$336.76	$1.94

Issues: none

Model Farm 17

This case study was developed for cucumber production. The primary irrigation system was assumed to be semi-closed seepage. Applicable conservation options consist of the implementation of BMPs, including on-farm decision support systems, automatic pump control, flow meters, a tailwater recovery system, laser leveling, variable rate pumping, and monitor wells.

Estimated water savings: mgd	Annualized cost per planted acre:	Average cost per thousand gallons saved:
0.85	$138.10	$1.63

Issues: none

Model Farm 18

This case study was developed for cucumber production. The primary irrigation system was assumed to be semi-closed seepage. Applicable conservation options consist of the installation of a fully-enclosed seepage irrigation system and the implementation of BMPs, including on-farm decision support systems, monitor wells, flow meters, a rainwater harvesting system, and laser leveling.

Estimated water savings: mgd	Annualized cost per planted acre:	Average cost per thousand gallons saved:
1.19	$328.03	$2.77

Issues: none

Model Farm 19

This case study was developed for cucumber production. The primary irrigation system was assumed to be semi-closed seepage. Applicable conservation options consist of the installation of a drip irrigation system and the implementation of BMPs, including on-farm decision support systems, tensiometers, flow meters, and laser leveling.

Estimated water savings: mgd	Annualized cost per planted acre:	Average cost per thousand gallons saved:
1.27	$293.49	$2.31

Issues: none

Model Farm 20

This case study was developed for strawberry production. The primary irrigation system was assumed to be drip. Applicable conservation options consist of the implementation of BMPs, including on-farm decision support systems, tensiometers, and flow meters.

Estimated water savings: mgd	Annualized cost per planted acre:	Average cost per thousand gallons saved:
2.53	$196.45	$1.27

Issues: none

3.0 Cost Considerations

It is important to describe some of the difficulties encountered in attempting to estimate the costs of water savings in the various model farm scenarios. While it is possible to estimate the costs of individual BMPs or irrigation system installations, there is a lack of field research documenting the effectiveness (i.e., the amount of water savings) associated with individual conservation options. Therefore, it is necessary to group together the conservation options applicable to a given model farm scenario, aggregate the cost estimates, and then attempt to allocate those costs over the estimated difference in water use between that of a typical farm operation and the assumed "optimum" operation with the best possible combination of irrigation equipment and management skills. Thus, the costs of water savings shown are derived from the implementation of combinations of options; lack of option-specific water savings data precludes cost effectiveness evaluations of individual options.

It is difficult to determine what effect this limitation may have on the estimated cost of water savings in each of the individual model farm case studies. However, inasmuch as a concerted effort was made to identify and incorporate all potential options that theoretically might be applicable in each case, there is a greater likelihood that any errors in estimated costs per thousand gallons saved would be errors of overstatement rather than errors of understatement.

It also should be noted that there are a number of benefits associated with the implementation of agricultural water conservation options in addition to a reduction in water use. Again, the lack of available data on field scale operations is a problem in evaluating the potential of each benefit in the context of model farm case study scenarios. However, it is important at least to present a qualitative discussion of potential benefits and to state that to the extent that these benefits can be realized, there would be a mitigating effect to some degree on the costs associated with water conservation.

Project consultants and District staff identified the following benefits from the implementation of conservation options that were not readily quantifiable for the specific model farm case studies: labor cost savings associated with adding BMPs, yield improvements, fertigation, disease control, and other benefits associated with microirrigation. Several relevant studies provided the following information:

- The use of fertigation through a microirrigation system has been shown to result in improved yields of Ruby Red grapefruit over those obtained using conventional dry fertilizer methods (Florida Citrus Mutual, 1994).
- Drip irrigation helps to reduce foliar disease incidence compared to overhead sprinkler systems. Since the plant foliage stays drier, it is less susceptible to disease outbreaks and there may be an associated reduction in the need for fungicides (Hochmuth and Clark, 1991).
- Drip systems can allow the use of more saline water for irrigation without harming crops (Hochmuth and Clark, 1991).
- Drip systems allow the prescription application of nutrients during the season in amounts that the crop needs at particular times. This capability has the potential to reduce the amounts of fertilizer applied. This potentially could lead to a decrease in fertilizer costs and a reduction in leaching. (Hochmuth and Clark, 1991; Woods, 1988).

Finally, the cultural practice of double cropping cannot be ignored. Generally speaking, double cropping involves the practice of sequentially growing different seasonal crops on the same beds and plastic. The extent to which this practice is employed in the District is unknown at this time. Preliminary investigations indicate that it might be occurring to a limited extent in the Palmetto-Ruskin production region; Food and Resource Economics Department researchers at the University of Florida Institute of Food and Agricultural Sciences typically compile production cost information for a limited number of double crop budgets (Smith and Taylor, 1999). Previous District-sponsored research indicated the potential for savings in production costs that might be achievable by double cropping (Stanley et al, 1989).

As stated previously in Chapter IVA of this report, irrigation quantities for all seasonal crops grown on plastic mulch include quantities for crop establishment; this assumption is consistent with reporting in the District's 1998 WSA and is made out of an abundance of caution from a water user's perspective. As elements of the RWSP are implemented, additional research will be devoted to the potential water conservation benefits of double cropping. To the extent that double cropping may be practiced in the District, it has the potential dual benefit of providing for possible reductions in the amount of water required for crop establishment and possibly allowing the fixed costs associated with the implementation of conservation options to be spread over a greater amount of potential water conservation, thereby reducing the costs per thousand gallons saved.

Section 5. Brackish Ground Water

Brackish ground water is a viable source of water in the planning region, especially in the coastal areas. However, care needs to be taken in developing this resource to avoid exacerbating existing resource problems. The identification of brackish ground-water desalination sites was based on review of currently planned or proposed options and an assessment of potential brackish ground-water resources in the region. In the NTB area, Tampa Bay Water has proposed to construct two brackish ground-water sites with the potential to supply up to five mgd of potable water each. Since the original proposal, however, the City of Clearwater negotiated to take over development of the planned facility associated with the City's well field. The City of Oldsmar, in cooperation with the District, conducted a feasibility analysis of brackish ground-water desalination. Results of the analysis indicate a supply of up to four mgd could be developed. To demonstrate the costs associated with developing this resource in the southern portion of the planning region, a potential site was identified in Charlotte County.

Though not evaluated in this report, the concept of using an "inverted" salinity barrier or creating a low pressure trough to stabilize movement of the interface, while developing a water supply, was proposed to be investigated. The idea is to create an area of low pressure along the coast using ground-water withdrawals. Water in the aquifer would move toward the area of low pressure and be intercepted by the wells. Landward movement of the interface could be stabilized while developing a brackish ground water supply. If movement of the interface can be stabilized and managed this way, it may be possible to allow increased withdrawals to occur in interior portions of the basin. One of the primary concerns with this approach is the effect on regional saltwater intrusion that may result. This concept will be investigated in more detail for future updates of the RWSP.

1.0 Tampa Bay Water Brackish Ground-Water Options

The following are descriptions of two brackish ground-water desalination sites originally proposed to be developed by Tampa Bay Water in Pinellas County. Development of the "Clearwater C-2" site was recently initiated by the City of Clearwater. Technical feasibility and cost analyses for these sites have been prepared. Each site consists of a brackish ground-water wellfield, RO treatment plant, associated piping for conveyance from the wellfield to the treatment plant, and disposal of the waste concentrate.

1.1 Clearwater "C-2"

This site is located in Pinellas County and is referred to as the Clearwater "C-2" site (Missimer, 2000). The site is proposed to be located on 5.7 acres within Air Park Property and is owned by the City of Clearwater. The location of this site is favorable due to its proximity to a two million gallon water storage facility and booster pump station owned by Pinellas County. Approximately 6.25 mgd of brackish ground-water will be withdrawn from 12 Upper Floridan aquifer wells in a proposed linear wellfield in Northern Pinellas County. The wells will individually pump an average of about 0.5 mgd. Water from the wellfield will be treated using RO to produce five mgd of potable supply. For the RWSP, it was assumed that concentrate disposal would be by deep well injection using two new wells.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
5	$15,910,000	$3,182,000	$1.79

Issues:

- Product water from the RO facility will need to be adjusted to ensure compatibility with the regional distribution system

1.2 Pinellas Park "P-3A"

This site is located in Pinellas Park, in Pinellas County, and is referred to as the "P-3A" site (Missimer, 2000). This site is proposed to be located on 3.2 acres of privately owned land in a business park. The location of this site is favorable due to its proximity to a two million gallon water storage tank owned by Pinellas Park and because the storage tank is a connection point to the regional distribution system. Approximately 6.25 mgd of brackish ground-water will be withdrawn from 12 Upper Floridan aquifer wells in a proposed linear wellfield in Central Pinellas County. The wells will individually pump an average of about 0.5 mgd. Water from the wellfield will be treated using RO to produce five mgd of potable supply (Missimer, 2000). For this plan, it was assumed that concentrate disposal would be by deep well injection using two new wells.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
5	$15,058,600	$3,011,700	$1.74

Issues:

- Product water from the RO facility will need to be adjusted to ensure compatibility with the regional distribution system

2.0 City of Oldsmar

The City of Oldsmar, in cooperation with the District, conducted a feasibility study of brackish ground water at their wastewater treatment plant (Boyle Engineering, 1998). The City has proposed constructing brackish ground-water withdrawal and treatment facilities to supply up to two mgd of potable water for the City. This system would replace the potable water supply currently purchased from Pinellas County and the City of St. Petersburg. The proposed facility would incorporate a storage tank, high service pumping station, chlorination equipment, and distribution systems now owned and operated by the City of Oldsmar (Curran, 1998). The waste concentrate is proposed to be discharged to the surface waters of Safety Harbor (a Class III water). This would require a 6,000 foot 10 inch diameter pipeline. Possible degassification and pH adjustment of the concentrate are included in the design to adjust potential low dissolved oxygen and hydrogen sulfate levels (Curran, 1998). Although the City has expressed interest in expanding this plant to 4 mgd in the future, the initial design and costs presented here were based on supplying 2 mgd.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
2	$8,719,800	$4,359,900	$2.02

Issues:

- Product water from the RO facility will need to be adjusted to ensure compatibility with the regional distribution system
- Although it is possible to discharge the waste concentrate into Old Tampa Bay, or Safety Harbor, this area is an aquatic preserve and water quality concerns exist due to shallow water depths and poor flushing.

3.0 Charlotte County Conceptual Site

A one mgd brackish ground-water desalination option in Charlotte County was evaluated to demonstrate the cost of developing this source in the southern portion of the planning region. Costs associated with this site may be generally applicable to regional brackish ground-water sites from southern Sarasota to central Charlotte counties. In this region, depth to brackish ground water is generally greater than in the NTB region.

The Charlotte County conceptual site is located in the vicinity of Charlotte Beach. This area has experienced extensive land/lot development over the past two decades and could potentially experience a large rate of growth in a short period of time. Depending on the availability of supplies from the Peace River system and Rotunda West Utilities (from expansion), a new brackish ground-water desalination facility could be constructed to meet the additional needs.

The proposed one mgd facility would incorporate a brackish ground-water wellfield, an RO desalination treatment system, storage tank(s), high service pumping station, stabilization system, and a deep injection well for waste concentrate. Brackish ground-water resources are generally in the middle and lower intermediate aquifer, which is encountered at depths between 200 and 600 feet below land surface (bls). Additional quantities could be developed from the Upper Floridan Aquifer, at depths ranging from 700 to 900 feet bls, depending on water quality and production needs. Brackish desalination facilities in this region generally blend product water with fresh ground water from the surficial aquifer. The following estimated costs are associated with the development of a one to two mgd brackish ground-water desalination facility and associated systems. Actual costs may change due to actual resource water quality, ability to blend product with a freshwater resource, technical advancements in the desalination industry, transmission distances, and type of waste concentrate disposal system.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
1	$5,750,000*	5,750,000	$2.38

*Cost estimations were derived from cost estimation information found on the following literature; (Curtis), (Law Engineering, SJ97-SP3), (SJRWMD, 1998A), (SJRWMD, 1998B)

Issues:

- Product water from the RO facility will need to be adjusted to ensure compatibility with the distribution system.

Section 6. Seawater Desalination

Four options were evaluated for development of seawater desalination facilities. These options are considered viable sources to help meet 2020 demands (Water Resource Associates, 2000). Though seawater is in abundant supply in the planning region, the total yield from the options developed for this plan was limited to 75 mgd. Factors affecting the amount of seawater that can be developed include cost and permitability. In general, permitability refers to the ability to safely dispose of the waste concentrate generated from the desalination process. Locations of the four options are shown in Figure IVD-4.

Investigation of potential seawater desalination options included identifying industrial dischargers for potential co-location with future desalination plants. Much of the near-shore area in the planning region has been designated as either Outstanding Florida Waters (OFW) or aquatic preserves. For this reason, it was important and preferable to find potential sites that did not have either of these designations. Other criteria for identifying potential locations were access to existing public supply infrastructure and the existence of nearby water demand (SWFWMD, 2000).

A desalination facility developed at any of the four sites would be required to address the two major environmental permitting issues; the intake of water directly from the Gulf or a bay which usually results in loss of marine species as a result of impingement and entrainment and, the production and disposal of waste concentrate (also called brine, or reject).

As noted in Part A of this chapter, standardized cost criteria were developed and applied to all options which enabled a comparison of costs among the options (Hazen and Sawyer, 1999). For this reason, the costs presented for the seawater desalination options will differ from the currently contracted price for construction of Tampa Bay Water’s 25 mgd desalination facility at the TECO’s Big Bend site on Tampa Bay. Factors contributing to the contracted price of $2.08 per 1,000 gallons for the Big Bend plant include a tax exempt interest rate of 5.2 % and a service life of 31.5 years, compared to an interest rate of 7.1 % and service life of 20 years for options evaluated for the RWSP. In addition, the contracted price was also the result of a competitive negotiation process to bring the first seawater desalination facility to the area. Other standardized costs included a power cost for desalination plants of $1.68 per 1,000 gallons, and engineering, administration, and contingencies calculated at 15 percent, 10 percent, and 20 percent, respectively. Detailed feasibility assessments of each of the four sites are included in the following pages.

Figure IVD-4. Location of Sites for Potential Seawater Desalination Plants.

1.0 Anclote Power Plant

This option would develop 25 mgd of potable water for use in Tampa Bay Water's distribution system. A seawater desalination plant would be co-located with the Anclote Power Plant, which is owned and operated by Florida Power Corporation and located in southwestern Pasco County. This site has been the subject of previous seawater desalination evaluations for Tampa Bay Water and offers several advantages such as an existing source of pre-filtered cooling water for the power plant that can be used as intake water and a source of water for dilution of a discharge concentrate stream. A 9.7 mile pipeline would be constructed to deliver water from the plant to the S.K. Keller pumping station for blending and further transmission to customers.

A seawater desalination plant at this site would use the intake and discharge canals of the power plant, which would substantially reduce the potential for environmental problems generally associated with intake and discharge structures. The waste concentrate from the seawater desalination process would be diluted with 450 mgd to 2,900 mgd of cooling water from the power plant. Use of existing infrastructure would allow the option to modify the existing FDEP-Industrial Wastewater discharge permit or establish a new FDEP-Industrial Wastewater discharge permit for the desalination process. Additionally, the plant would be located within Class 3 waters of the State and outside of the Pinellas County Aquatic Preserve OFW, which would facilitate discharge permitting.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
25	$85,887,000	$3,057,000	$3.05

Issues:

- Additional research on the effects of discharging waste concentrate at this site would be required by the FDEP for the NPDES permit application, prior to implementation. Though the waters receiving the waste discharge are Class 3 waters, an Outstanding Florida Waters body and an aquatic preserve exist nearby.
- Product water from the RO facility will need to be adjusted to ensure compatibility with the regional distribution system

2.0 Big Bend Power Plant

This option would expand Tampa Bay Water's currently planned desalination plant at Tampa Electric Company's Big Bend Power Station located on Tampa Bay in southern Hillsborough County. Currently, the developer S and W Water, LLC, is in the process of obtaining permits and constructing a 25 mgd desalination plant at this site for Tampa Bay Water. This option involves the expansion of the plant by 10 mgd, from the currently planned 25 mgd. As designed, the desalination plant is expandable to 35 mgd.

Expansion of the Big Bend Site would require a modification to the FDEP Industrial Wastewater Facility Permit in order to accommodate the additional concentrate discharge. If research conducted by the District and FDEP is confirmed by the blending design employed by the S&W Water facility, there will be adequate cooling water available (1.4 billion gallons per day) to blend with the additional concentrate to meet discharge standards. If the discharge from the 25 mgd facility does not violate discharge permit conditions and environmental monitoring programs show no indications of adverse impacts, a modification for an increased discharge quantity could be obtained. In addition, the use of existing intake and discharge structures for this expansion should also lessen environmental impacts and expedite the permitting process.

Projected costs for this expansion are based on the actual capital costs ($18,400,000) submitted as part of the Best and Final Offer (BAFO) by S & W Water in their bid to build the Big Bend plant. Standardized criteria for estimating the cost to construct water supply options identified in this plan were then used to estimate costs for this option.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
10	$27,933,000	$2,793,00	$2.69

Issues:

- The effects of increasing the amount of waste concentrate from the Big Bend facility would require additional investigation.
- Product water from the RO facility will need to be adjusted to ensure compatibility with the regional distribution system

3.0 Port Manatee

This option would develop 20 mgd of potable water at the Port Manatee site in northwestern Manatee County, on Tampa Bay. The site was chosen because of its industrial nature and proximity to a deep water channel which could be used for intake and discharge facilities. Its location in Class 3 waters outside aquatic preserves or OFWs may improve the potential for obtaining a permitted discharge at the site. Both intake and discharge structures would be located in the vicinity of the existing dredged channel to Port Manatee. The proximity of this site to the mouth of Tampa Bay may be advantageous with respect to disposal of concentrate from the plant. The large volumes of water entering and leaving the bay during a normal tidal cycle would provide an excellent source for dilution and a mechanism for mixing.

This site has been identified as an industrial land use on Manatee County's map of future land use. Significant expansion of port-related and industrial facilities has been proposed for this area. Additionally, this site 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. This facility could produce an estimated 20 mgd for Manatee County, and possibly Sarasota County, through existing system interconnections. In order to properly manage the disposal of concentrate from the desalination plant, the intake would be designed to withdraw up to 100 mgd of which 40 mgd would be feed water for the desalination process. The process would result in 20 mgd of concentrate that would be diluted with up to 60 mgd of seawater (3 to 1 ratio) and discharged to the Gulf.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
20	$83,718,000	$4,186,000	$3.42

Issues:

- The facility, as evaluated, does not include co-location with an existing industrial discharger.
- Potential impacts requiring evaluation include the effects of a large scale intake of seawater from the bay and concentrate discharge to the bay. Though the waters receiving the waste discharge are Class 3 waters, an Outstanding Florida Waters body and an aquatic preserve exist nearby.
- Product water from the RO facility will need to be adjusted to ensure compatibility with the regional distribution system

4.0 Venice

This option would develop 20 mgd of potable water in the general vicinity of the Venice airport. The site was chosen because it is near areas of water demand and has access to potential intake and discharge sites in the Intracoastal Waterway (ICW) and Gulf of Mexico. The site is also located near an existing water treatment plant which is interconnected to the Sarasota County Water System and may provide a point for distribution of the product water. Because the site is also located near an existing wastewater treatment plant, opportunity may exist to access an existing permitted surface discharge site.

The proposed intake would be located in the ICW which is outside an OFW. A benefit of locating the intake in the ICW is to increase the flushing in the waterway which has exhibited poor water quality in the past. The discharge line would be located in the Gulf of Mexico. In order to properly manage the disposal of concentrate from the desalination plant, the intake would be designed to withdraw up to 100 mgd from the ICW, of which 40 mgd would be feed water for the desalination process. The process would result in 20 mgd of concentrate that would be diluted with up to 60 mgd of seawater (3 to 1 ratio) and discharged to the Gulf.

Quantity of Water Produced (MGD)	Capital Cost	Cost per MGD	Cost per 1,000 Gallons
20	$86,026,000	$4,301,000	$3.45

Issues:

- The facility, as evaluated, does not include co-location with an existing industrial discharger.
- Potential impacts requiring evaluation include the effects of a large scale intake of seawater from the ICW and concentrate discharge to the Gulf. Though the waters receiving the waste discharge are Class 3 waters, an Outstanding Florida Waters body and an aquatic preserve exist nearby.
- Product water from the RO facility will need to be adjusted to ensure compatibility with the regional distribution system

Chapter V. Water Resource Development Component

Part A. Background

Section 1. Criteria for Determining Water Resource Development Projects

This section of the RWSP addresses the legislatively required water resource development projects identified through the planning process. As mentioned in Part A of Chapter IVC, the Water Supply Development Component of this Plan, it is very difficult to categorize the numerous projects receiving District funding assistance as water supply development or water resource development projects. For the RWSP, the majority of projects funded through the Basin Boards' Cooperative Funding Program, the New Water Sources Initiative, and the Partnership Agreement have been categorized as water supply development projects.

The intent for water resource development projects is to enhance the amount of water available for water supply development. The District is primarily responsible for water resource development projects. Water resource development is defined as "*the formulation and implementation of regional water resource management strategies, including the collection and evaluation of surface water and ground-water 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 ground-water recharge augmentation; and related technical assistance to local governments and to government-owned and privately owned water utilities*" (s. 373.019(19), F.S.).

Section 2. Legislation Regarding the Role of Water Management Districts in Water Resource Development

Section 373.0831, F.S., Water resource development; water supply development, states, in part:

> "*(1) The Legislature finds that:*
> *(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.*
> *(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) It is the intent of the Legislature that:*
> *(a) Sufficient water be available for all existing and future reasonable-beneficial uses and the natural systems, and that the adverse effects of competition for water supplies be avoided.*
> *(b) Water management districts take the lead in identifying and implementing water resource development projects, and be responsible for securing necessary funding for regionally significant water resource development projects.*
> *(c) Local governments, regional water supply authorities, and government-owned and privately owned water 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.
(d) Water supply development be conducted in coordination with water management district regional water supply planning and water resource development.
(3) The water management districts shall fund and implement water resource development as defined in s. 373.019. Each governing board shall include in its annual budget the amount needed for the fiscal year to implement water resource development projects, as prioritized in its regional water supply plans."

This resource development component of the RWSP has been prepared in recognition of these legislative provisions. The following sections describe those projects which the District believes constitute water resource development and for which the District will take the lead in implementing.

Part B. Overview of Water Resource Development Projects

Section 1. Hydrologic Data Collection

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

- Quantity of Water to be Made Available: This is an effort that supports many other water supply development and management activities and no specific quantity of water that could become available as a result of the project can be estimated.
- Timetable and Costs: Continuing on an annual basis. The projected annual budget over the next five years is approximately $3 million.
- Funding Sources and Needs: Ad valorem taxes from the Governing Board and Basin Boards and matching contributions from the USGS.
- Implemented primarily by the District with the USGS. acting as contractor for a significant portion. Permittees also contribute through data collection required by water use permits.

Section 2. Regional Observation Monitoring Program (ROMP)

Project Description: This program has increased the density of the District's ground-water monitoring network since the mid-1970s by constructing additional monitor wells. The data from these monitoring sites are used to evaluate seasonal and long-term changes in ground-water levels and quality, and the interaction and connectivity between ground water and surface-water bodies. The ROMP also performs geophysical logging on existing wells to provide needed data on well construction and water quality, most of which is incorporated into the District's Geographical Information System (GIS) database. Impacts resulting from increased water demand over the past 30 years have been documented and assessed through analysis of ground-water data. These impacts directly affect the District's planning, regulatory policies and programs. For example, ground-water data are used during the permitting process to model potential impacts of new uses. This information is also used to monitor existing permittees to prevent them from significantly impacting natural systems and existing legal users. If these impacts do occur, the District can respond appropriately. Construction of new monitor wells also provides the opportunity to collect valuable technical information such as the geologic core that is recovered from various depths (e.g., lithology, water quality, and potentiometric levels). From these data, aquifers and confining units are delineated, location of the freshwater/saltwater interface is determined and water quality within aquifers is characterized. The installation of long-term ground-water monitoring sites for the next few years will continue to target the District's WUCAs. This will provide additional data for the WRAPs, well performance data for wellhead protection projects and the aquifer characteristics inventory.

- Quantity of Water to be Made Available: This is an effort that supports many other water supply development and management activities and no specific quantity of water that could become available as a result of the project can be estimated.
- Timetable and Costs: Continuing on an annual basis. The projected annual budget over the next five years is approximately $1.4 million.
- Funding Sources and Needs: Ad valorem taxes from the Governing Board and Basin Boards and occasional funding partnerships with organizations such as the Withlacoochee River Regional Water Supply Authority.
- Implemented primarily by the District.

Section 3. Quality of Water Improvement Program (QWIP)

Project Description: The QWIP was established in 1974 through Chapter 373, F.S., to restore ground-water conditions altered by well drilling activities. The QWIP's primary goal is to preserve ground- and surface-water resources through proper well abandonment. Plugging abandoned artesian wells eliminates the waste of water at the surface and the degradation of ground water from inter-aquifer contamination. Wells constructed prior to current well construction standards are often deficient in casing and expose several aquifers of varying water quality to one common wellbore. Thousands of these wells are in existence and they allow potable water supplies to be contaminated with mineralized water from deeper aquifers. Contaminated water and potable water can flow to the surface, which wastes water and can contaminate surface water.

Plugging wells involves filling the abandoned well with cement. Confinement is thus reestablished and mixing of varying water qualities and free flow is stopped. Prior to plugging an abandoned well, the well is geophysically logged to determine the proper plugging method and to provide background water quality and geologic data for inclusion in the District's database. These data are used in the WRAP studies discussed later to determine changes in water quality. The emphasis of this program is primarily in the coastal portions of the SWUCA where the aquifer is confined and flowing wells can exist. Chapter 373, F.S., requires that artesian systems, those areas where water in a well will rise naturally above the confining unit, be specifically addressed.

Historically, the QWIP has proven to be a cost-effective method to prevent waste and contamination of potable water resources, both ground and surface waters. In January 1994, the District increased QWIP funding as an incentive for property owners to comply with well plugging requirements contained in the Florida Statutes.

- Quantity of Water to be Made Available: Since its inception in 1974, the program has plugged 2,537 wells, of which 62 percent (or 1,583 wells) have been plugged since the 1994 increase in funding. This has resulted in an estimated savings of 65 to 245 mgd from wells freely flowing on the surface and between 15 to 30 mgd protected from contamination through inter-aquifer exchange.
- Timetable and Costs: Continuing on an annual basis. The projected annual budget over the next five years is approximately $500,000.
- Funding Sources and Needs: Ad valorem taxes from the Governing Board and Basin Boards.
- Implemented primarily by the District in cooperation with private well owners.

Section 4. Flood Control Projects

The District was originally created in 1961 as a flood control district. For more than half of its history, flood control has been the primary area of responsibility for the agency, and flood protection remains an important District function today. Flooding is a natural occurrence that is initiated when heavy rainfall exceeds the capacity of streams, lakes, and other natural features to absorb runoff. These large rainfall events cause normally dry areas to be inundated, becoming temporary storage areas for excess storm water. Flooding also may occur when abnormally high tides or storm surges cause seawater to rise and move inland, inundating low-lying coastal areas. Only when there are human uses in these temporary flood storage areas (i.e., floodplains or coastal lands) does flooding become a management problem.

A number of surface-water supply options discussed in Chapter IVD involve the capture of high flows from rivers during the wet season and storage of this water in the Floridan aquifer or in off-stream reservoirs for use in the dry season. In addition to the water supply benefits of these options, they may have the added benefit of reducing the magnitude of flood events.

1.0 Data Collection

Project Description: Data collection related to flood protection includes the regular assembly of information on such key indicators as rainfall, water levels and stream flows. The District's capability to assist in flood control has continued to improve during the past several years with the expansion of the District's Supervisory Control And Data Acquisition (SCADA) system. This computerized data collection system comprises the cornerstone of the District's flood data collection, through a District-wide network of more than 117 real time and near-real time water level and rainfall data collection stations. The term "real time" means that the data are available within minutes of being measured, whereas near-real time means that the data are reported within four hours of being measured.

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

The amount and detail of rainfall and stream level data now available for use by modelers has expanded significantly in recent years. In addition to the 53 real time rainfall sites, the District operates 27 near-real time rainfall sites, and 40 other recording rainfall gauges. These instruments record rainfall accumulations at least once per hour, and in many cases even more frequently. More recording rain gauges are being installed to develop a dense, Districtwide network of precipitation data.

The USGS monitors flow on all major rivers and streams in west-central Florida. During the past two years, mostly through a cooperatively funded program with the District, the USGS has instrumented 60 sites on these rivers and streams with data collection instruments that have the capability to relay data in near-real time by satellite. These data are posted on the USGS' Internet Web site, increasing accessibility for the many entities who use this information.

- Quantity of Water to be Made Available: This is an effort that supports many other water supply development and management activities and no specific quantity of water that could become available as a result of the project can be estimated.
- Timetable and Costs: Continuing on an annual basis. The annual budget for data collection activities related to flood control over the next five years is contained in the overall hydrologic data collection budget listed in Section 1 of this Chapter.
- Funding Sources and Needs: Ad valorem taxes from the Governing Board and Basin Boards and matching contributions from the USGS.
- Implemented primarily by the District with the USGS acting as contractor for a significant portion.

2.0 Remediating Existing Problems

Project Description: While much of the District's focus is on prevention, existing flood problem areas can be addressed in numerous ways. The District is working with local governments through the Flood Protection Coordination Initiative to set priorities for remedial actions to address existing problems. Such actions may include conveyance improvements, creation of flood storage, relocation of structures out of flood prone areas, or other initiatives. Much of the funding for these projects is provided through the District's Basin Boards. Projects can be funded entirely by the Basin Board or shared equally between the Basin Board and a local cooperator. Table V-1 contains flood remediation projects that the District and its Basin Boards will implement over the next five years.

- Quantity of Water to be Made Available: Most but not all of the flood remediation projects listed in Table V-1 are not designed for water supply purposes. The Blue Sink/Curiosity Creek Investigation is an example of a project that does have water supply benefits. In addition, there are a number of options listed in the RWSP that could alleviate flooding by diverting flood waters for water supply. However, until these options are chosen for implementation, it will not be possible to determine the amount of water that could be produced.
- Timetable and Costs: Continuing on an annual basis. The total budget over the next five years is $21 million.
- Funding Sources and Needs: Ad valorem taxes from the Basin Boards and matching contributions from local government cooperators.
- Implemented primarily by the District and local government cooperators.

3.0 CWM Initiative

Project Description: This program is more fully described in the Watershed Management Chapter of the District Water Management Plan. With regard to flood protection, CWM provides a comprehensive analysis of surface-water hydrology and flooding issues for each of 11 major watersheds in the District. At a broad scale, CWM analyses help to identify existing problems and potential future problem areas through use of GIS technology and local involvement, and develop cross-disciplinary solutions.

- Quantity of Water to be Made Available: This is an effort that supports many other water management activities and no specific quantity of water that could become available as a result of the project can be estimated.
- Timetable and Costs: Continuing on an annual basis. The total annual budget over the next five years is unknown at this time.
- Funding Sources and Needs: Ad valorem taxes from the Governing Board and Basin Boards.
- Implemented primarily by the District with assistance from local governments and state agencies.

4.0 Lake Levels Program/MFLs

Project Description: The District's Lake Levels Program, established in the 1970s, has provided adopted management levels for over 400 lakes throughout the District. Flood stage information from this program is used by many local governments in regulating development adjacent to lakes, as well as by the District in public flood protection education efforts. Information relative to flood protection from the Lake Levels Program is contained in the District publication, *Flood-Stage Frequency Relations for Selected Lakes.* This report, a compilation of flood level information for all lakes for which it is available, has been distributed to numerous local governments and is available from the District upon request.

Table V-1. Flood Remediation Projects in the Planning Region.

Local Cooperator	Type of Program	Funding Requested ($)				
		FY 2000	**FY 2001**	**FY 2002**	**FY 2003**	**FY 2004**
Pasco County	Flood Protection (FIRM Update)	$0	$50,000	$0	$0	$0
Pasco County	Flood Protection (SMMP Implementation)	$92,119	$463,000	$145,950	$334,000	$0
City of Madeira Beach	Watershed Management Plan	$0	$50,000	$50,000	$50,000	$50,000
City of Treasure Island	Stormwater Mgmt Area, Design & Constr.	$150,000	$0	$0	$0	$0
Town of Indian Shores	Town Hall Stormwater Management	$40,000	$0	$0	$0	$0
Town of Redington Beach	Watershed Management Plan	$40,000	$0	$0	$0	$0
City of Madeira Beach	Stormwater Improvements	$156,000	$0	$0	$0	$0
City of Clearwater	Stevenson Creek Watershed Management Plan: Data Development	$221,851	$418,750	$837,500	$418,750	$0
Pasco County	Anclote River Watershed Management Plan	$0	$145,000	$150,000	$150,000	$205,000
City of Oldsmar	Watershed Management Plan	$251,851	$0	$0	$0	$0
Hillsborough County	Carrolwood West Outfall	$144,586	$0	$0	$0	$0
Hillsborough County	Lake Estes Outfall	$57,500	$0	$0	$0	$0
Hillsborough County	Timber Land Outfall	$80,000	$0	$0	$0	$0
Hillsborough County	Stormwater Program	$0	$172,830	$169,100	$143,064	$0
Hillsborough County	Lake Egypt Stormwater P2 Project	$21,960	$19,500	$11,750	$3,750	$0
City of Tampa	Blue Sink/Curiosity Creek Investigation	$51,100	$100,000	$0	$0	$0
Totals		**$1,306,967**	**$1,419,080**	**$1,364,300**	**$1,099,564**	**$255,000**

Table V-1. Flood Remediation Projects in the Planning Region.

Local Cooperator	Type of Program	Funding Requested ($)				
		FY 2000	**FY 2001**	**FY 2002**	**FY 2003**	**FY 2004**
Pasco County	Lake Zepher Watershed	$151,108	$0	$0	$0	$0
City of Tampa	Curiosity Creek Watershed Plan	$100,000	$0	$0	$0	$0
Hillsborough County	Lake Gronto/Chapman Outfall	$75,000	$0	$0	$0	$0
Hillsborough County	Leonard Dr. Stormwater Improvements	$65,000	$0	$0	$0	$0
Hillsborough County	Lake St. Clair	$103,063	$0	$0	$0	$0
Hillsborough County	Lake Mango Outfall	$60,000	$0	$0	$0	$0
Hillsborough County	Gibsonton On the Bay Stormwater Mgmt	$0	$200,000	$0	$0	$0
Hillsborough County	Alafia River Watershed Management Plan Implementation	$0	$0	$30,000	$0	$0
Manatee County	Bowless Creek/Oneco Drain Enhancement / Stormwater Management	$0	$0	$0	$250,000	$1,200,000
Manatee County	Pearce Drain Enhancement	$0	$0	$200,000	$500,000	$1,000,000
Manatee County	Gamble Creek Enhancement	$0	$0	$200,000	$500,000	$1,000,000
Manatee County	Wares Creek Flood Protection	$350,538	$862,000	$862,000	$430,000	$0
Sarasota County	North Englewood Stormwater Mgmt. Constr.	$0	$0	$250,000	$250,000	$500,000
Sarasota County	Phillippi Creek Floodplain Restoration	$451,391	$250,000	$250,000	$1,000,000	$0
Sarasota County	Myakka River Watershed Mgt. Plan	$127,391	$375,000	$125,000	$0	$100,000
Totals		**$1,483,491**	**$1,687,000**	**$1,917,000**	**$2,930,000**	**$3,800,000**

Table V-1. Flood Remediation Projects in the Planning Region.

Local Cooperator	Type of Program	Funding Requested ($)				
		FY 2000	**FY 2001**	**FY 2002**	**FY 2003**	**FY 2004**
City of Lake Alfred	Stormwater Management Improvement	$76,461	$0	$0	$0	$0
Polk County	Saddle Creek Watershed's Stormwater Improvement	$748,841	$400,000	$0	$0	$0
Polk County	Lake Drain Floodplain Analysis	$52,339	$0	$25,000	$0	$0
Polk County	Crooked Lake: Stephenson Av. Stormwater	$39,351	$37,500	$75,000	$0	$0
Charlotte County	GPC Stormwater Management Construction	$708,558	$500,000	$500,000	$789,500	$0
Highlands County	Josephine Creek Watershed: Lake Placid Seepage	$32,829	$0	$0	$0	$0
City of Lakeland	Lake Parker Stormwater Retrofit, Construction Phase	$0	$500,000	$0	$0	$0
Highlands County / City of Sebring	Lake Jackson Stormwater Survey	$15,109	$175,000	$200,000	$50,000	$0
Totals		**$1,673,488**	**$1,612,500**	**$800,000**	**$839,500**	**$0**

Recently, the Lake Levels Program has merged with the District's MFLs Program in an effort to expand and enhance the management and protection of surface and ground-water resources. A detailed discussion of the District's MFLs program is contained in Chapter III.

- Quantity of Water to be Made Available: This is an effort that supports many other water supply development and management activities and no specific quantity of water that could become available as a result of the project can be estimated.
- Timetable and Costs: Continuing on an annual basis. The total annual budget over the next five years is $1.5 million.
- Funding Sources and Needs: Ad valorem taxes from the Governing Board and Basin Boards.
- Implemented primarily by the District.

Section 5. Hydrogeologic Investigations

1.0 USGS Hydrologic Studies

Project Description: The District has a long-term cooperative program with the USGS to collect hydrologic data and conduct regional hydrogeologic investigations. The goals of this program are to monitor for changes in the hydrologic system and improve the understanding of cause and effect relationships. Funding for this program is generally on a 50/50 cost share basis 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.

Hydrologic data collection is a large part of the cooperative program and is closely coordinated with the District's Hydrologic Data Section. The USGS provides ongoing monitoring of ground-water levels at 177 sites, surface-water flows at 82 sites, and water levels at 33 lakes within the entire District.

Regional investigations of the hydrogeology of the District are an important aspect of the cooperative program. These investigations are intended to augment work conducted by District staff and are focused on improving the understanding of cause and effect relationships and developing analytical tools to be used in resource evaluations. Over the past 25 years these investigations have included: 1) development of computer models of the regional ground-water flow systems for the SWFWMD, HR WUCA, Hardee and DeSoto counties, Cypress Creek, Cross Bar, and Morris Bridge wellfields, and the St. Petersburg ASR site, 2) detailed analysis of the hydrologic budgets for two benchmark lakes (Lucerne and Starr), 3) hydrogeologic characterization of the intermediate aquifer, and 4) hydrologic assessments of the Peace and Alafia Rivers.

In recent years, this program has included projects to determine the effects of using ground water to augment stressed lakes and investigation of factors influencing coastal spring flows. Projects currently planned for the next five years include: evaluation of the effects of using ground water for supplemental hydration of wetlands; hydrogeologic characterization of the intermediate aquifer system; use of ground-water isotopes to estimate lake seepage; statistical characterization of lake level fluctuations; and investigation of the hydrology of the Upper Hillsborough River Basin.

- Quantity of Water to be Made Available: This is an effort that supports many other water supply development and management activities and no specific quantity of water that could become available as a result of the project can be estimated.
- Timetable and Costs: Continuing on an annual basis. It is anticipated that funding for the USGS program over the next five years will be maintained at current levels; approximately $1.3 million for data collection and $800,000 for hydrogeologic investigations for a total contribution of about $2.1 million annually.
- Funding Sources and Needs: Ad valorem taxes from the Governing Board and Basin Boards and matching contributions from the USGS. and local government cooperators.
- Implemented primarily by the District and the USGS. with support from local government cooperators for some projects.

2.0 WRAPs

Project Description: In the late 1980s, the District initiated a program to conduct WRAPs to assess water availability in several regions and to support the development and establishment of MFLs. These projects are detailed assessments of regional water resources and include intensive data collection and monitoring to characterize hydrologic conditions and determine effects of water withdrawals. There are five areas in the District for which WRAPs have been initiated. The first three WRAPs were initiated in the late 1980s and early 1990s for the NTB, ETB, and HR areas (Figure I-4). These projects were initiated in response to falling lake levels, drying of wetlands, and the increased landward movement of the freshwater/saltwater interface. In the mid-1990s, a fourth WRAP was initiated that covered the southern portion of the District and encompassed both the ETB and HR WRAPs. The purpose of this WRAP is to assess the cumulative effects of all water withdrawals in the region. A fifth WRAP is being conducted for the northern portion of the District, primarily focusing on areas north of Pasco County. The data collection element for the Northern District WRAP was initiated in 1998 to provide baseline hydrologic conditions. The ETB WRAP was completed in 1993 and the NTB WRAP was completed in 1996. The Southern District WRAP and Northern District WRAPs are scheduled to be complete by 2005 and 2010, respectively. Completion of these assessments provides the technical foundation for determining water availability and can assist in the establishment of MFLs. Once the studies are completed, water resource management programs established in these areas can be modified as necessary.

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

- Quantity of Water to be Made Available: This is an effort that supports many other water supply development and management activities and no specific quantity of water that could become available as a result of the project can be estimated.
- Timetable and Costs: Continuing on an annual basis. It is anticipated that the District's support of these efforts over the next five years will be maintained close to current levels of funding; approximately $1 million annually.
- Funding Sources and Needs: Ad valorem taxes from the Governing Board and Basin Boards.
- Implemented primarily by the District.

Section 6. Summary of Water Resource Development Projects

Over the next five years, the District will allocate approximately $68.5 million for water resource development projects that will support water supply development by local governments, utilities, and regional water supply authorities. These projects are centered around the collection and analysis of data and the setting of MFLs. These activities will facilitate the determination of the amount of ground and surface water available for water supply development and the amount that must be reserved to sustain natural systems.

Chapter VI. Overview of Funding Mechanisms

Part A. Background

The need to plan and secure funding to meet future water demands is not a new concern or one that is particular to Florida. A nationwide survey of utilities conducted in 1993 indicated that 80 percent of water utilities anticipated financing capital improvements in the next five years and 32 percent of the capital improvements planned involved the development of a new source of supply (Wade Miller Associates, 1993). While many water professionals in the state are familiar and comfortable with the planning and financing of public water supply systems, the decreasing availability of traditional, lower cost water sources for self-supplied water users raises a host of possible new issues, policies and institutions to be explored.

Section 1. Statutory Responsibility for Funding

The genesis for statutorily defining the water management districts' roles in funding water resource and water supply development is found in a report prepared by the Governor's Water Supply Development and Funding Work Group (1997). Much of the statutory guidance below was developed from this report.

> Section 373.0831, F.S. describes the responsibilities of the water management districts in terms of water resource and water supply development and its funding:
>
> *(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 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.*

In accordance with the intent of the legislation and the promotion of efficient use of water, direct beneficiaries of water supply development projects should generally bear the costs of projects from which they benefit. However, affordability and equity are also valid considerations. The Governor's Water Supply Development and Funding Report also identifies numerous potential sources of funding for both water resource and water supply development.

Currently, the District funds both water resource and water supply development projects. In general, as discussed in Chapter V, the District considers its water resource development activities to include: resource data collection, analysis, and the setting of minimum flows and levels. In recent years, the District has significantly increased expenditures on water resource development projects. In terms of water supply development, the District has typically funded the development, storage and transmission of non-traditional sources of water, including reclaimed water and conservation. The following addresses potential sources of funding for water resource and water supply development activities.

Part B. Funding Mechanisms

Section 1. Water Utilities

Water supply development has been, and should remain, the primary responsibility of water utilities. It is estimated that water utilities in the planning region, both government and investor-owned, generated over $364 million in rate revenues in 1997[1]. At 2020 estimated demand and with no rate increase from 1997 rates, utility water charges could generate over $487 million annually. Water charges, however, are not dedicated solely to funding source development, but also fund other utility costs such as operation, maintenance, and administration. The revenue estimates do not include any revenues from reclaimed water sales or the portion of wastewater charges dedicated to reclaimed water system development.

There are a number of existing and innovative rate type and structure options available to fund future water supply development projects and to keep basic water needs affordable. These include capital improvement program fund charges, marginal cost pricing to fund infrastructure, and additional revenues from inclining block, seasonal surcharge, and excessive use charge rate structures to fund conservation programs. In addition, many government-owned utilities benefit from water supply system and capacity development impact fees. A state-wide survey of government-owned utilities conducted in 1993 indicated that 88 percent of the utilities surveyed assessed residential water supply impact fees. In 1997 dollars, the fees averaged $939 per residence (Black and Veatch, 1993). Other customer classes pay impact fees as well. Investor-owned utilities may also levy charges similar to an impact fee.

Section 2. Basin Boards

The District's eight Basin Boards provide significant financial assistance for conservation and alternative source programs through the Cooperative Funding Program and the Water Supply and

[1] Based on a weighted average charge of $2.36 per 1,000 gallons and 423 MGD of public supply use in 1997 and 566 MGD in 2020. Data sources: SWFWMD. *Estimated 1997 Water and Wastewater Charges in the Southwest Florida Water Management District*, June 1999 and SWFWMD. *Estimated Water Use 1997*. June 1999.

Resource Development Fund, primarily to governmental entities. However, some Basin Boards have also partnered with private entities. A good example of this is the Manasota Basin Board's agreement with Falkner Farms in Manatee County to assist in the funding of a project to offset ground-water withdrawals for agricultural irrigation with excess surface water from the Flatford Swamp.

Projects funded by the Basin Boards usually require a 50/50 cost share by a local cooperator. The Basin Boards have an additional funding mechanism known as a Basin Initiative, which, in those cases where a project is of great importance or priority to a region, the Board can increase its percentage match or in some cases provide total funding for the project. Examples of Basin Initiatives include the 1) Quality of Water Improvement Program (QWIP); an initiative to plug deteriorated, free-flowing wells that waste water and cause inter-aquifer contamination, 2) the leak detection program; an initiative to conserve water by having District staff inspect and detect leaks in Public Water System pipelines, and 3) the Agricultural Conservation Partnership Program (AgCP) explained below.

Between 1988 and 2000, a cumulative total of about $150 million has been provided by the Basin Boards and matched by local cooperators. Most of this investment has been for water supply development related projects (about 70 percent), but other projects funded include flood protection, water quality and natural systems enhancements. In recent years the cumulative annual contribution of the Basin Boards to these efforts has been approximately $20 million. In addition to the Cooperative Funding Program, Basin Boards also contribute a cumulative annual total of $10 million to New Water Sources Initiative (NWSI) projects. This program is explained in detail in Section 3 of this Chapter.

The Agricultural Conservation Partnership (AgCP) Program was developed by the District and the Manasota Basin Board as a Basin Initiative. This non-regulatory program was established in the Upper Myakka River Watershed to develop partnerships with the agricultural community and to resolve resource issues dealing with environmental impacts to the Flatford Swamp. AgCP allows the District to join with the agricultural community to conduct production-scale field demonstrations of irrigation BMPs. This local initiative will demonstrate the successful use of irrigation BMPs and help growers gain experience and confidence in their use. The Manasota Basin Board and Governing Board will reimburse AgCP participants 50 percent, up to $100,000 of each approved AgCP project.

Section 3. Governing Board

The Governing Board funds all or part of the water resource development projects discussed in the previous chapter. These include: hydrologic monitoring, regional hydrologic and hydrogeologic investigations, the ROMP and QWIP programs, flood control projects, the CWM initiative, the lake levels program, and the MFLs program.

The District Governing Board in 1994 initiated a financial incentive program known as the NWSI. NWSI was created as an effort to assist in the development of non-traditional alternatives to ground-water use. Since its inception in 1994, the Governing Board has budgeted $10 million annually, an amount matched by the affected Basin Boards, for specific projects. In most cases, the total District contribution is then matched by a local cooperator. Currently, 17 NWSI projects ranging from aquifer storage and recovery, to regional reclaimed water systems, to seawater desalination, are in various stages of development. Two examples of major NWSI projects are Tampa Bay Water's Seawater Desalination project and the Peace River/Manasota Regional Water Supply Authority's (PR/MRWSA) Peace River Option. The Seawater Desalination project involves the development of a $96 million desalination facility on Tampa Bay. The facility is designed to produce freshwater at the rate of 25 mgd, and is expandable to 35 mgd. The District is contributing 90 percent of the capital cost of the project. The Peace River Option is a project to increase the water supply available in the southern portion of the SWUCA by expanding the treatment capacity of the Peace River Facility from 12 mgd to 18 mgd, constructing 14 additional ASR wells, and constructing transmission lines to interconnect the major public water utilities in Charlotte, DeSoto, and Sarasota counties. The District will contribute up to 50 percent of the $52 million capital cost of the project.

It is projected the District will commit in excess of $240 million towards NWSI projects through FY 2007 (including $183 million for the Tampa Bay Partnership Agreement). A future challenge will be to assist all appropriate users, potentially including the agricultural sector.

The District has recently implemented a Water Supply and Resource Development Fund. The governing Board will contribute $3 million annually to this fund and this will be matched annually by $3 million contributed collectively by the Basin Boards. It is anticipated that these funds, matched by local cooperators on a 50/50 cost share basis, will be used for water supply and resource development projects.

Section 4. The Florida Forever Act

The Florida Forever Act (FFA) is a $10 billion, 10-year, statewide program that will provide the District approximately $26.25 million per year for land acquisition, environmental restoration, and water resource development. At least 50 percent of these funds must be spent on land aquisition over the life of the program leaving an annual average of approximately $13 million for environmental restoration and water resource development. A "water resource development project" is defined as a project eligible for funding pursuant to Section 259.105 (Florida Forever) that increases the amount of water available to meet the needs of natural systems and the citizens of the State by enhancing or restoring aquifer recharge, facilitating the capture and storage of excess flows in surface waters, or promoting reuse. Implementation of eligible projects under Florida Forever includes land acquisition, land and water body restoration, ASR facilities, surface-water reservoirs and other capital improvements. It does not include construction of treatment, transmission, or distribution facilities. Florida Forever bonds are authorized for issuance on July 1, 2001. Based on experience the District had with issuance of the first series of Preservation 2000 bonds, it is anticipated that funds will not be available to the District until FY 2002.

Section 5. Federal Revenues

1.0 Federal Funding for NWSI Projects

In 1994, the District began investigating the feasibility of obtaining federal matching funds for water projects funded under the District's NWSI program. The District, in cooperation with members of Florida's congressional delegation, local government and regional water supply authority sponsors, was successful in obtaining funding for five NWSI projects. Since that time, the federal initiative has grown substantially. The District was joined in its efforts by other water management districts and local governments and, through FY 2000, federal funding for alternative sources in Florida has totaled $60.6 million. Local governments and regional water supply authorities within the District have received $45.4 million.

2.0 Statewide Efforts to Obtain Federal Funding for Water Resource Development Projects

In 1999, Florida's water management districts joined with the Office of the Governor and the FDEP to expand efforts to fund the development of alternative source projects. Project criteria were developed and used to create a list of projects for which funding was sought through the congressional budget. In the FY 2000 budget, $5 million was allocated for the Tampa Bay Regional Reservoir. In the FY 2001 budget, an additional $15 million was secured.

In 2001, the State of Florida and the water management districts have expanded the list of projects in order to seek all available resources to develop a water supply strategy that will meet the demands of growth throughout the state and is environmentally sustainable. The projects include the use of alternative water supply technologies as well as stormwater retention and filtering and wastewater treatment. Each district has certified that the projects submitted for funding are regional in scope and that matching funds are available either from the District budget or from a local government sponsor. Two projects within the SWFWMD are on the current list. They are the Manatee Agricultural Reuse Supply Project (MARS) and the Tampa Bay Regional Reservoir.

District staff considers funding for these projects to be a top priority and continues to work with the Office of the Governor, the FDEP and the members of the Florida Congressional Delegation to secure federal funding for these and other new water supply projects.

3.0 U.S. Environmental Protection Agency (USEPA) Funding

3.1 Recent Efforts to Obtain USEPA Funding for Water Resource Development

At the beginning of the 106th Congress, the 1999 Alternative Water Sources Development Act was introduced in both the U.S. House of Representatives and Senate by members of the Florida Congressional Delegation. This legislation would establish a program within the USEPA to make grants available for the development of alternative water source projects.

3.2 Federal Clean Water Act Section 319(h)

The FDEP administers the 319 funding for the USEPA. The 319 funding comes through Section 319(h) of the Federal Clean Water Act, and its purpose is to implement projects or programs that will reduce non-point sources of pollution.

Projects must be conducted within Florida's nonpoint source (NPS) priority watersheds that are identified in the Florida NPS Management Program (1988), which includes the State's Surface Water Improvement and Management Program (SWIM) watersheds and National Estuary Program (NEP) waters. They also include the Total Maximum Daily Load (TMDL) priorities and Unified Watershed

Assessment water bodies, and all ground waters.

Section 319 funds can be used only for implementation activities, not for planning, research or development activities. They cannot be used for general monitoring, conducting water body assessments
or preparing watershed plans. Examples of definable projects include: demonstration and evaluation of BMPs, nonpoint pollution reduction in priority watersheds, ground-water protection from nonpoint sources, and public education programs on nonpoint source management. All projects must include at least a 40 percent non-federal match. In-kind services for a project can come from other federal agencies; however, these cannot count as match for Section 319 grant funds.

4.0 U.S. Department of Agriculture-Natural Resources Conservation Service (NRCS) Funding

4.1 Environmental Quality Incentive Program (EQIP)

The EQIP provides technical, educational, and financial assistance to eligible farmers and ranchers to address soil, water and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program provides assistance to farmers and ranchers by complying with federal, State of Florida, and tribal environmental laws and encourages environmental enhancement. The program is funded through the Commodity Credit Corporation (CCC). The purpose of the program is achieved through the implementation of a conservation plan, which includes structural, vegetative, and land management practices on eligible land. The program is carried out primarily in priority areas that may be watersheds, regions and/or multi-state areas and for significant statewide resource concerns that are outside of geographic priority areas. Water supply and nutrient management through detention/retention or tailwater recovery ponds could be pursued through this program.

4.2 Small Watershed Program and Flood Prevention Program

The Small Watershed Program works through local government sponsors and helps participants solve natural resource and related economic problems in watersheds of 250,000 or fewer acres. Technical and financial assistance is available through this program. The purposes of watershed projects include watershed protection, flood prevention, water quality improvements, soil erosion reduction, rural-municipal-industrial water supply, irrigation water management, sedimentation control, fish and wildlife habitat enhancement and creation and restoration of wetlands and wetland functions.

The program empowers local individuals or decision makers, builds partnerships and requires local and state funding contributions. Watershed plans involving an estimated federal contribution in excess of $5 million for construction of any single structure that has a capacity in excess of 2,500 acre feet require Congressional committee approval. Other plans are approved administratively. After approval, technical and financial assistance can be provided for the installation of works of improvement specified in the plans. There are currently over 1,600 projects in operation. Tailwater recovery systems and agricultural cooperative reservoirs should be considered in this program to augment water supply.

4.3 Resource Conservation & Development Program (RC&D)

The purpose of the Resource Conservation and Development (RC&D) program is to accelerate the conservation, development and utilization of natural resources; improve the general level of economic activity; and to enhance the environment and standard of living in authorized RC&D areas. It improves the capability of State of Florida, tribal and local units of government and local nonprofit organizations in rural areas to plan, develop and carry out programs for resource conservation and development. The program also establishes or improves coordination systems in rural areas. Current program objectives focus on the improvement of the quality of life achieved through natural resources conservation and community development, which leads to sustainable communities, prudent use (development), and the management and conservation of natural resources. Authorized RC&D areas are locally sponsored areas designated by the Secretary of Agriculture for RC&D technical and financial assistance programs funds. The NRCS can provide grants for land conservation, water management, community development, and environmental needs in authorized RC&D areas.

4.4 Conservation Technical Assistance (CTA)

The purpose of this program is to assist land users, communities, units of state and local government, and other federal agencies in planning and implementing conservation systems. The purpose of the conservation systems are to reduce erosion, improve soil and water quality, improve and conserve wetlands, enhance fish and wildlife habitat, improve air quality, improve pasture and range condition, reduce upstream flooding, and improve woodlands.

Section 6. Private Investment

Private investment is a potential source of funds to support water resource and water supply development in the District. A range of public/private ownership and investment options is available. These options range from all-public ownership and operation to all-private ownership and operation. Typically, in projects that depend heavily on the use of private investment, that investment is used to support initial capital costs. In these cases, funds to pay back the private capital investment and to support project operation and maintenance ultimately come from revenues from customer charges. However, competition among private investors desiring to fund water supply development projects could act to reduce project costs, potentially resulting in lower customer charges.

Aside from investor-owned water supply utilities, which are addressed in the Water Utility section above, private investment could take three distinct forms: 1) government-owned utilities, the District, or regional water supply authorities contracting with private entities to design, build and operate facilities with private funds; 2) self-supplied entities joining in cooperative institutions such as irrigation districts; and 3) private entities which could identify a customer base and become water supplier to one or more water use types.

An example of the first type is the arrangement that Tampa Bay Water has to construct and operate a desalination plant. Private companies were asked to bid to provide 25 mgd of water through desalination. A primary consideration of the bid evaluation process was the rate that would be charged to the water supply authority for the water produced. The plant would be financed, built, owned and operated by the private company but would supply water to the authority. The competition among the bidders, combined with other factors, will result in the least expensive desalination water known to date when the facility is completed. Other government-owned utilities and the District could enter into such arrangements. The two major advantages of this type of arrangement are that the competition reduces price and the risk may be shifted to the private investors. Just as a regional water supply authority is able to induce multiple private investors to bid on projects, it may be possible that community development districts could pursue the same type of strategy for more isolated areas. A community development district can be established under Chapter 190, F.S., for water supply purposes and may collect ad valorem taxes and charge fees for services (York, 1997). The taxes and fees could be used to initiate water supply development planning, request and evaluate bids, and then be used to pay back private investment.

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

The third form is where investors identify an unserved customer base and develop water resource/supply facilities to meet those needs. It is this type of investment that many look to for the development of alternative water supplies. Such private investment will not likely occur unless regulatory measures to protect water resources and related environmental features limit further development of traditional, lower cost sources. Although the purpose of the regulatory measures is resource protection, they indirectly create a customer base for alternative source developers. The cost of the alternative sources developed and the extent of public participation and funding will determine the likely customers of such an enterprise.

Section 7. Introduction of Market Forces into Water Allocation

A potentially lower cost means of meeting the future water supply needs of self supplied users is the temporary or permanent trading of permitted water quantities subject to District regulation. This would be particularly true for ground-water users within a specific basin. The cost of off-site transmission and distribution facilities could be avoided since the aquifer would act as the transmission and distribution facility. The benefitting water user could finance the cost of any needed wells and any costs associated with the water trade. Revenues from trades could be used to fund additional water conservation activities. Permitted quantity trading programs may require legislative authorization and may only be feasible in specific hydrologic regions.

Section 8. Summary

There are many potential institutions and sources of funding for water resource and water supply development. Because of their large and readily identifiable customer bases, public supply utilities and water supply authorities will likely have the least problems in securing funding. Funding mechanisms are already established for many District water supply and resource development projects. The most difficult challenge will be identifying cost-effective and economically efficient methods of meeting the needs of self-supplied users, which have a wide range of ability-to-pay for water, when their traditional, lower-cost sources of water are no longer readily available.

Part C. Potential Funding for Plan Implementation

The following analysis compares potentially available funding sources to the total estimated cost needed to secure the remaining water supply or demand management components of the RWSP. The analysis consists of separating the water supply needs from 1995 through 2020 into two categories: (1) quantities that have been addressed by completed, ongoing, or planned projects with secured or pledged funding; and, (2) quantities that do not have secured or pledged funding. Cost data from the first category is used to develop an average capital cost per mgd, which is then multiplied by the total needs for which funding has not yet been secured or pledged. This figure is then compared to potential long-term funding sources. It should be noted that there is substantial uncertainty involved in conducting such an analysis. Therefore, this analysis is intended to illustrate just one possible funding scenario.

In Chapter IVA, 364.1 mgd of projected increase in demand from 1995 through 2020 is identified. This does not include demand for environmental restoration, i.e., replacing the 68 mgd reduction in ground-water withdrawals from Tampa Bay Water's 11 central system well fields required as part of a recovery plan associated with the adoption of MFLs in the NTB area. It is recognized that there is potential for additional water supply and demand management initiatives to achieve further water resource and ecological recovery as MFLs continue to be adopted in the planning region. Table VI-1 lists these projected quantities by five-year planning increment and water use category.

Table VI-1. Projected Additional Demands in the Planning Region, 1995-2020 (mgd).

Time Interval	95 - 00	00 - 05	05 - 10	10 - 15	15 - 20	Total
Agriculture	21.8	26.5	26.2	24.3	24.1	122.9
Public Supply	43.0	33.7	36.7	34.8	32.6	180.8
Commercial/Mining/ Industry/Power	3.8	3.8	3.9	4.1	4.2	19.8
Recreation	7.7	8.3	8.3	8.1	8.3	40.6
Environmental Restoration	0	38.0	30.0	TBD	TBD	68.0
Total	**76.3**	**110.3**	**105.1**	**71.3**	**69.2**	**432.1**

Each completed, ongoing, or planned project for which funding has been secured or pledged was then assessed to estimate the amount of the 1995 through 2020 additional demands that have been or will be met by that project. The quantity of water produced by these projects was then assigned to the appropriate five-year planning increment and is included in Table VI-2. As shown in this Table, it is estimated that 215 mgd of the 432 mgd needed through 2020 has been met by completed, ongoing, or planned projects that have secured or pledged funding. This leaves 217 mgd for which funding has not yet been secured.

Table VI-2. Estimated Quantities Associated with Projects that have or do not yet have Secured or Pledged Funding, Identified by Water Use Category and Five-Year Planning Increment (mgd).

Time Interval	95 - 00	00 - 05	05 - 10	10 - 15	15 - 20	Total
Estimated Quantities Completed, Ongoing, or Planned with Secured or Pledged Funding						
Agriculture	21.8	23.2	0	0	0	45.0
Public Supply	43.0	29.4	8.0	0	0	80.4
Commercial/Mining/ Industry/Power	3.8	3.4	0	0	0	7.2
Recreation	7.7	7.2	0	0	0	14.9
Environmental Restoration	0	38.0	30.0	0	0	68.0
Total	**76.3**	**101.2**	**38.0**	**0**	**0**	**215.5**
Estimated Quantities that do not have Secured or Pledged Funding						
Agriculture	0	3.3	26.2	24.3	24.1	77.9
Public Supply	0	4.3	28.7	34.8	32.6	100.4
Commercial/Mining/ Industry/Power	0	0.4	3.9	4.1	4.2	12.6
Recreation	0	1.1	8.3	8.1	8.3	25.7
Environmental Restoration	0	TBD	TBD	TBD	TBD	TBD
Total	**0**	**9.1**	**67.1**	**71.2**	**69.2**	**216.6**
All Quantities						
Total	**76.3**	**110.3**	**105.1**	**71.2**	**69.2**	**432.1**

The 2000 through 2005 planning increment can be used to illustrate how Table VI-2 was developed. During this increment it was estimated that funding has already been secured or pledged for initiatives that will yield 101mgd of the 110 mgd needed. Four major public supply projects account for 59 mgd of the 101 mgd: Tampa Bay Water's Big Bend Seawater Desalination Plant, Enhanced Surface Water System (excluding the reservoir component), and Brandon Urban Wellfield; supplying 25 mgd, 22 mgd, and six mgd respectively and, the PR/MRWSA's Peace River Option; supplying six mgd.

Twenty-six mgd was estimated to be met by reclaimed water. This is based on the assumption that 35 percent of the 74 mgd of treated wastewater that will be distributed by projects constructed during this five-year planning increment will offset existing or future water needs identified in Table VI-1. Seven mgd will be saved by additional demand management initiatives. This is the estimated demand reduction assuming that the conservation initiatives implemented between 2000 and 2005 reduce the year 2005 projected demand by one percent and assuming that 50 percent of these conservation initiatives already have funding secured or pledged.

Finally, an estimated nine mgd will be produced by all other parties that develop their own water supply (i.e., power plants, golf courses, or agricultural operations). The nine mgd was calculated by subtracting the sources described above from the total estimated demand of 110 mgd for this five-year planning increment, and assuming that 50 percent of these sources already have secured or pledged funding.

The only source included in the 2005 to 2010 planning increment that is known to have secured or pledged funding is the 38 mgd of additional supply anticipated from Tampa Bay Water's Enhanced Surface Water System once the reservoir is built and becomes operational.

The identifiable cost associated with the 215 mgd of water from projects that are completed, ongoing, or planned that have secured or pledged funding is $1,025 million. These funds are comprised of $244 million from the District's NWSI; $244 million of matching funds from NWSI cooperators, primarily local governments or regional water supply authorities; $129 million from the District's Cooperative Funding Program; $129 million of matching funds from the Cooperative Funding Program cooperators, primarily local governments; $13 million in Preservation 2000 funds to acquire lands needed for water supply development; $217 million in unmatched funds that Tampa Bay Water is dedicating to developing the remainder of their projects, $45 million in federal government grant funds associated with major water supply and reclaimed water projects, $2 million from the District's Water Supply and Resource Development Fund and $2 million of matching funds from cooperators receiving grants from the Water Supply and Resource Development Fund. Table VI-3 summarizes these funding sources.

Dividing the 215 mgd into the identifiable $1,025 million of funding yields an average capital cost of about $4.77 million per mgd. However, there are significant costs associated with the development of the 215 mgd that could not be readily identified. For example, costs associated with source development and demand management for public supply, industry, golf courses, and agricultural operations that did not receive any of the funding identified above, and funding in excess of the cost share dollars identified above for projects those funds were associated with (i.e., the funding above may include cooperative funding for reuse transmission lines but not the distribution lines, as distribution lines have historically not been eligible for cooperative funding). In order to capture these funds and other development costs not readily identified, the average annual capital cost was set at $6 million per mgd. This provides a 20 percent increase in the estimate as is reasonable for planning purposes. This is the figure used to project additional funding needed to develop the remaining 217 mgd, and yields necessary funding of $1.3 billion. It should be noted that if future MFLs establishment results in additional need for environmental restoration, funding in excess of this amount may be needed.

Table VI-3. Secured or Pledged Sources of Funding for Completed, Ongoing, or Planned Projects that have or will Produce 215 mgd of the 432 mgd Demand Needed between 1995 and 2020.

Funding Sources	
District NWSI funding @ $20 million per year from fiscal year 1994 through 2007, minus $26 million of these funds that were not pledged at the completion of the fiscal year 2001 budget development.	$244 million
Matching funds from NWSI Partners of funds described above. These funds were provided primarily by local governments and regional water supply authorities.	$244 million
Reimbursed or pledged Basin Board Cooperative Funding Program funds for water supply projects for fiscal years 1994 through 2007 as of completion of fiscal year 2001 budget development.	$129 million
Matching funds from Cooperative Funding Program Partners of funds described above, primarily local governments, for water supply projects.	$129 million
Reimbursed or pledged funds from the District's Water Supply and Resource Development Fund. The only funds pledged from this fund to date was from fiscal year 2000, the year the fund was originally established.	$2 million
Matching funds from the District's Water Supply and Resource Development Fund partners as described above.	$2 million
Preservation 2000 funds used to acquire land for water supply development.	$13 million
Unmatched funds provided by Tampa Bay Water to develop their water supply projects.	$217 million
Federal grant funds that have been obtained for major water supply and reclaimed water projects in the planning region as of completion of fiscal year 2001 budget development.	$45 million
Total	**$1.025 billion**

The final step in this analysis is to identify potential future funding sources that could be used to fund the estimated $1.3 billion of investment needed to develop the remaining 217 mgd. The two major historical District funding sources to fund such activities are the NWSI and Cooperative Funding Program. If the Governing Board and Basin Boards were to maintain their current NWSI funding commitment of $20 million per year through 2020, $286 million could be produced (excludes current NWSI funding pledges of $94 million through 2007). Secondly, if the District's Basin Boards elect to maintain their recent commitments to water supply development and demand management under the Cooperative Funding Program, which is also about $20 million per year collectively, this could yield $361 million (excludes $19 million in existing Cooperative Funding Program pledges through 2003). Together, these two funding sources could yield $647 million of the required $1.3 billion or roughly 50 percent, before any matching funds are contributed.

Historically, both the NWSI and Cooperative Funding Programs have required cost share on an equal basis (50/50 cost share for eligible costs). Therefore, if a similar match was required in the future, adequate funding could be available. However, many of the future projects may require a higher percentage funding from the District. For example, if it is determined that a seawater intrusion barrier needs to be established in the SWUCA, it may be funded entirely by the District. In recognition of this,

this analysis has assumed that 50 percent of the future NWSI and Cooperative Funding Program budgets would be set aside for projects to be funded completely by the District. The remaining 50 percent would be matched on an equal cost basis, which would yield an additional $324 million.

Another potential source of funding is the continuation of the District's recently implemented Water Supply and Resource Development Fund. If the Governing Board were to set aside $3 million for this fund annually, and the Basin Boards were to collectively match this amount, $114 million could be set aside from 2002 through 2020. As with NWSI and the Cooperative Funding Program, if half of these funds were matched on an equal cost share basis an additional $57 million could be leveraged.

Another potential source is the state's recently implemented Florida Forever Program. This program allows up to 50 percent of the funds available to the District (estimated at $26 million annually through 2010) to be used for water resource and supply development. The Governing Board could request an estimated $130 million from this fund for implementation of the RWSP over the next ten years. A potential down side of this funding source is that as these funds are used for water supply and resource development, it reduces funding potentially available for the District's land acquisition efforts.

The last potential source is federal grants for water supply and resource development projects. Since 1994, the District has worked with local governments, water supply authorities, the FDEP, other water management districts, the state legislative delegation and the Govenor's Office to secure $45 million in federal funding grants for water supply within the District. Although it is always difficult to gauge the likelihood of receiving future federal grants, the District will continue to be an active partner in obtaining such funds.

Table VI-4 compares the dollars needed to implement the water supply development and demand management components of the RWSP that have yet to secure funding, to the various potential funding sources described above. As illustrated in this Table, the potential funding sources described above have the potential to yield the magnitude of funds that will be required. As stated previously, a number of assumptions are used in this analysis that result in a relatively close match between potential funding sources and funds needed. **However, if additional water supply development and demand management is needed to address water resource or ecological restoration due to future establishment of MFLs, the deficit of fiscal resources may be greater than that identified based on the potential funding sources and associated assumptions described above.**

Table VI-4. Remaining 216.6 mgd Water Use Demand that does not yet have Secured or Pledged Funding and Potential Sources of Funding.

Funding Needs	
Estimated cost of developing 217 mgd of new water supplies @ $6 million per mgd.	$1.3 billion
Funding Sources	
District NWSI funding @ $20 million per year through 2020 (excludes existing NWSI pledges through 2007).	$286 million
Funding provided assuming one half of the $286 million of District NWSI funds are used for projects that would be matched by a partner on an equal cost share basis.	$143 million
Basin Board Cooperative Funding Program @ $20 million per year through 2020 (excludes 19 million in existing Cooperative Funding Program pledges through 2003).	$361 million
Funding provided assuming one half of the $361 million of District Cooperative Program funds are used for projects that would be matched by a partner on an equal cost share basis.	$180.5 million
District Water Supply and Resource Development Fund.	$114 million
Funding provided assuming one half of the $114 million of District's Water Supply and Resource Development Fund are used for projects that would be matched by a partner on an equal cost share basis.	$57 million
State of Florida, Florida Forever Program	$117 million
Federal Funds	TBD
Total potential funding sources through 2020	**$1.26 billion**
Less estimated cost of developing 217 mgd of new water supplies @ $6 million per mgd	**$1.3 billion**
Balance	**$40 million (deficit)**

Chapter VII. Recommendations

Part A. Background

The District has developed strategies for implementation of the Regional Water Supply Plan. These strategies are included in the following categories:

- Minimum Flows and Levels (MFLs)
- Water Supply Development
- Resource Development
- Water Supply Planning
- Coordination With Other Agencies and Affected Parties
- Funding for Water Resource Development

Section 1. Minimum Flows and Levels

1.0 Proposed Actions:

1.1 The District, in accordance with F.S. 373.042, will continue to identify priority water bodies for establishment of MFLs on an annual basis. As part of the annual update, the District will give due consideration to water bodies for which withdrawals are projected to occur as identified in the RWSP.

1.2 Adoption of future MFLs will continue in accordance with the annually updated MFLs priority schedule.

1.3 The District will continue to monitor hydrologic and biologic systems to determine the effectiveness of adopted MFLs and recovery and prevention strategies.

1.4 The District will continue to evaluate, update, and expand methodologies used in the establishment of MFLs.

1.5 The District will continue to evaluate the use of "tools in the toolbox" in the implementation of MFLs. These "tools" include, but are not limited to, modifications to surface-water control structures, reductions in ground-water withdrawals, and augmentation of water bodies where appropriate and consistent with an adopted recovery strategy.

Section 2. Water Supply Development

2.0 Proposed Actions:

2.1 Aggressively pursue the expansion of demand management measures whenever possible.

2.2 Require the increased use of reclaimed water through the District's water use permitting program.

2.3 For projects funded by the District, require increased efficiency and utilization of reclaimed water. This can be done through the use of appropriate codes and ordinances which require increased water efficiencies for new developments.

2.4 Investigate working with FDEP to require more efficient and beneficial use of reclaimed water. The District and FDEP should work together to develop strategies for optimizing the use of reclaimed water to achieve potable water offsets in the region.

2.5 Continue to fund research on advanced water supply technologies such as ASR, conservation, and desalination.

2.6 Continue to work with water suppliers and other affected parties to develop strategies that promote the development and coordination of regional water supplies. This will include the coordination of local water supplies through entities such as regional water supply authorities.

2.7 Investigate options to optimize and maximize development of surface-water sources while protecting existing legal uses and environmental systems. This may include assigning responsibility for the development of individual surface-water sources to a single entity, such as the District or water supply authority.

2.8 Investigate options that optimize and maximize the development of water sources in the planning region and ensure that self-supplied users have reasonable access to future water supplies.

2.9 Work with local governments to ensure that the availability of water resources is a key component in the process to approving new development.

Section 3. Water Resource Development

3.0 Proposed Actions:

3.1 Continue to collect the necessary hydrologic and biologic data to support investigations of water resource availability.

3.2 Continue to conduct hydrologic and biologic investigations for determining water resource availability and developing methodologies for establishment of MFLs. This includes the development of models and analyses that can be used for predicting effects of water withdrawals on water resources.

3.3 Look for opportunities to conjunctively develop flood protection and water supply projects to achieve multiple benefits. This includes development of ‘tools in the toolbox” for maintaining natural systems.

3.4 Continue to collect aerial photography to be used in water resource and flood management investigations.

3.5 Continue to develop analytical tools for assessing the effectiveness of advanced water supply technologies such as the concept of using pressure troughs to manage regional movement of the freshwater/saltwater interface while providing brackish ground water for additional water supply.

3.6 Investigate development of large scale aquifer recharge projects to manage water supply constraints (e.g., saltwater intrusion and lake level declines) and enhance water supply opportunities in the region.

3.7 Implement a program to locate and study offshore springs to provide definitive data on the issue of the existence of offshore springs, their magnitude of discharge and water quality, and potential for water supply development.

Section 4. Water Supply Planning

4.0 Proposed Actions:

4.1 In the NTB region, provide an interim evaluation of the effectiveness of the adopted Recovery Plan by 2005. This may be used to project the need for additional recovery and water supplies beyond the 2010 time frame.

4.2 Conduct a reassessment of water supply demands by 2003.

4.3 By 2005, prepare a second regional water supply plan that updates water supply development in the current planning region and that addresses the water supply planning needs of the northern portion of the District.

4.4 Continue to work with user groups in the region to ensure that proper data is being collected that can be used to monitor changes in demand and to refine methodologies for projecting future demand.

Section 5. Coordination

5.0 Proposed Actions:

5.1 Continue to coordinate with adjacent WMDs to ensure consistency in determining water supply constraints and evaluation of impacts of withdrawals.

5.2 Coordinate with adjacent WMDs to ensure that a coordinated approach to the development of water supplies in boundary regions occurs.

5.3 Coordinate the review of WUPs in the boundary regions of adjacent WMDs with the respective WMDs. This can be conducted through the current MOU with SFWMD and SJRWMD to address and resolve concerns about interdistrict impacts.

5.4 Provide incentives to encourage local governments and water suppliers to coordinate water supply projects through their respective water supply authorities in order to facilitate a regional approach to water supply development.

5.5 Enhance outreach programs to educate citizens on water supply issues and provide access to all available information.

5.6 Continue to seek input from affected parties throughout the water supply planning process in the development and implementation of RWSPs.

Section 6. Funding for Water Resource Development

6.0 Proposed Actions:

6.1 The District will continue to provide sources of funding for water supply projects that meet the needs of users in the region, are consistent with the District's approach to regional water supply development, and ensure the protection of the environment. The New Water Sources Initiative, Water Supply and Resource Development Fund, and Cooperative Funding Program will continue to be used to assist in the development of beneficial projects.

6.2 Continue to seek federal funding support for water supply projects.

6.3 Continue to provide adequate funding to maintain expertise relative to conducting hydrologic and biologic assessments and development of methodologies for establishing MFLs.

6.4 Continue to provide adequate funding for data collection programs in support of water resource assessments and establishment of MFLs.

6.5 Continue to provide adequate funding for advanced technological support for water resource assessments and establishment of MFLs.

6.6 Continue to provide adequate funding for implementation of the water use permitting program as one of the essential District tools in managing water supply issues.

6.7 Integrate the RWSP process into the Comprehensive Watershed Management (CWM) decision support system.

REFERENCES

Aucott, W. R., 1988, Areal variation in recharge to and discharge from the Floridan aquifer system in Florida: United States Geological Survey water-resources investigations report 88-4057 (map), 1 p.

Ayres Associates, Inc, 2000, Development of Water Conservation Options for Non-Agricultural Water Users: Consultant's Report Submitted to the Southwest Florida Water Management District, Brooksville, FL.

Black and Veatch, 1993, Florida Water & Wastewater Utility Rate & Impact Fee Survey.

Boyle Engineering, 1998, The City of Oldsmar Municipal Water Supply Feasibility Study.

Brown, D. P., 1983, Water resources of Manatee County, Florida: United States Geological Survey water-resources investigation 81-74, 112 p.

Camp, Dresser & McKee, 1995, Freshwater Releases from Lake Manatee- Effects on Manatee River Salinity and Future Water Supply: Consultant's report to Manatee County, FL.

CH2M HILL, Inc., 2000, Water resource and water supply development: surface water and storm water, technical memorandum 4: feasibility analysis of task 3 short list projects. Consultant's Report Submitted to the Southwest Florida Water Management District, Brooksville, FL.

Duerr, A.D., Hunn, J.D., Lewelling, B.R., and Trommer, J.T., 1988, Geohydrology and 1985 water withdrawals of the aquifer systems in southwest Florida, with emphasis on the intermediate aquifer system: U.S. Geological Survey Water-Reesouces Investigation Report 87-4259, 115p

Florida Department of Agriculture and Consumer Services, 1970 *et seq*., Citrus Summary: Orlando, Florida Agricultural Statistics Service.

Florida Department of Environmental Protection, Northwest Florida Water Management District, South Florida Water Management District, Southwest Florida Water Management District, St. Johns River Water Management District, Suwannee River Water Management District, 1998, Development and Reporting of Water Demand Projections in Florida's Water Supply Planning Process - Final Report: Prepared by the Water Demand Projection Subcommittee of the Water Planning Coordination Group.

Florida Citrus Mutual, 1994, *Triangle*; August 12, 1994.

Florida Sports Foundation, 1998, Florida Golf Guide, Destination: Florida Golf, Tallahassee, FL.

Floyd, Susan F, 1996, Households and average household size: Estimates in the state and counties of Florida, 1996 Florida Statistical Abstract, Gainesville, FL

Governor's Water Supply Development and Funding Work Group, 1997, Report on Recommendations Pursuant to Executive Order 96-297.

Guyton, W.F., and Associates, 1976, Hydraulics and water quality: prepared for Swift Agricultural Chemicals Corporation, Manatee Mine Site, Manatee County Florida; 76 p.

Hazen and Sawyer, 1999, Second draft report: Evaluation model and key parameters for alternative water resource / supply management strategies in the Southern Water Use Caution Area, submitted to the Southwest Florida Water Management District, 60 pp.

HSW Engineering, 2000(a), Irrigation Water Conservation Options and Water Resource/Water Supply Development Opportunities for Agricultural Water Users; Technical Memorandum No. 1: Inventory and Summarize Agricultural Irrigation Practices: Consultant's Report submitted to the Southwest Florida Water Management District, Brooksville, FL.

HSW Engineering, 2000(b), Irrigation Water Conservation Options and Water Resource/WaterSupply Development Opportunities for Agricultural Water Users; Technical Memorandum No. 2: Conservation and Water Resource/Supply Development Options: Consultant's Report submitted to the Southwest Florida Water Management District, Brooksville, FL.

HSW Engineering, 2000(c), Irrigation Water Conservation Options and Water Resource/Water Supply Development Opportunities for Agricultural Water Users; Technical Memorandum No. 3: Preliminary Opinion of Cost and Feasibility Analyses for Model Farms. Consultant's Report submitted to the Southwest Florida Water Management District, Brooksville, FL.

HSW Engineering, 2000(d), Irrigation Water Conservation Options and Water Resource/Water Supply Development Opportunities for Agricultural Water Users; Technical Memorandum No. 4: Development of Funding Mechanisms. Consultant's Report submitted to the Southwest Florida Water Management District, Brooksville, FL.

Hochmuth, George J., and Clark, Gary A., 1991, Fertilizer Application and Management for Micro (or Drip) Irrigated Vegetables in Florida: Institute of Food and Agricultural Sciences, University of Florida; Florida Cooperative Extension Special Series Report SS-VEC-45.

Jones, G.W., S.B. Upchurch, K.M. Champion, and D.J. Dewitt, 1997. Water Quality and Hydrology of the Homosassa, Chassahowitzka, Weeki Wachee, and Aripeka Spring Complexes, Citrus and Hernando Counties, Florida - Origin of Increasing Nitrate Concentrations. Southwest Florida Water Management District, Brooksville, Florida.

Jones, G.W., S.B. Upchurch, and K.M. Champion, 1998. Origin of Nutrients in Ground Water Discharging from the King's Bay Springs, Citrus County, Florida (revised). Southwest Florida Water Management District, Brooksville, Florida.

Mayer, Peter W., DeOreo, William B., Optiz, Eva M., et.al, 1999, Residential End Uses of Water: American Water Works Association Research Foundation Project Report, Denver CO.

McSweeney, Patrick, 1997, *Growers Find a Better Way to Farm*: Streamlines, Volume 7, Issue 3; Fall 1997.

Menke, C.G., E.W. Meredith, and W.S. Wetterhall, 1961, Water resources of Hillsborough County, Florida: Florida Geological Survey Report of Investigations No. 25, 101 p.

Missimer, International, 2000, Tampa Bay Water Phase I Brackish Groundwater Desalination Study: Final Report,

National Golf Foundation, 1998, Trends In The Golf Industry, 1998 Edition, Jupiter, FL. Northern Tampa Bay and New Water Supply and Ground Water Withdrawal Reduction Agreement Between West Coast Regional Water Supply Authority, Hillsborough County, Pasco County, Pinellas County, City of Tampa, City of St. Petersburg, City of New Port Richey, and Southwest Florida Water Management District (Partnership Agreement), 1998.

Office of Program Policy Analysis and Governmental Accountability, 1999, Florida Water Policy: Discouraging Competing Applications for Water Permits; Encouraging Cost-Effective Water Development: Florida Legislature: Report No. 99-06.

One-in-10-year Drought Subcommittee of the Water Planning Coordination Group (Subcommittee), Final Report: 1-in-10-year Drought Requirement in Florida's Water Supply Planning Process, 1998.

PBS&J, 2000, Reclaimed Water: Water Resource and Water Supply Development, v.I Task 1 & 2 Consultant's Report, v.II Task 3 & 4: Consultant's Report submitted to the Southwest Florida Water Management District, Brooksville, FL.

Pyne, R. David G., Groundwater Recharge and Wells: A Guide to Aquifer Storage Recovery, Lewis Publishers, 376 p.

SDI, Inc., 1995, Response to request for additional information for the Starkey Wellfield Water Use Permit, Water Use Permit File of Record No. 204446.04.

Smith, Scott A., and Taylor, Timothy G., 1999, *Production Costs for Selected Florida Vegetables - 1997-1998*: Gainesville, Food and Resource Economics Department, Institute of Food and Agricultural Sciences, University of Florida; Economic Information Report EI 99-3.

Stanley K. Smith and June Marie Nogle, 1996, Florida Population Studies, V. 29, No. 3, Bulletin #115, July 1996, University of Florida, Gainesville, Florida.

Southwest Florida Water Management District, 1988a, Ground-Water Resource Availability Inventory: Hillsborough County, Florida, May 1988: 203 p.

Southwest Florida Water Management District, 1988b, Ground-Water Resource Availability Inventory: Manatee County, Florida, May 1988: 217 p.

Southwest Florida Water Management District, 1988c, Ground-Water Resource Availability Inventory: Sarasota County, Florida, May 1988: 207 p.

Southwest Florida Water Management District, 1990, Ridge II: A hydrologic investigation of the Lake Wales Ridge: Southwest Florida Water Management District, 130 p.

Southwest Florida Water Management District, 1992, 1998, AGMOD - Agricultural Water Use Model, Version 2.0, Brooksville, Florida

Southwest Florida Water Management District, 1992, Water supply needs & sources: 1990-2020: Southwest Florida Water Management District

Southwest Florida Water Management District, 1993, Eastern Tampa Bay Water Resource Assessment Project: March, 1993.

Southwest Florida Water Management District, 1996, Norther Tampa Bay Water Resources Assessment Project, Volume 1: surface-water/ground-water interrelationships

Southwest Florida Water Management District, 1997(a), 1995 Estimated Water Use in the Southwest Florida Water Management District, Brooksville, FL.

Southwest Florida Water Management District, 1997(b), Tri-County Water Conservation Initiative, 1994 - 1997: Summary Report, Brooksville, FL.

Southwest Florida Water Management District, 1997(c), Water Use Demand Estimates and Projections 1996 - 2020, Brooksville, Florida

Southwest Florida Water Management District, 1998(a), Southwest Florida Water Management District Water Supply Assessment, Brooksville, FL

Southwest Florida Water Management District, 1998(b), 1996 Estimated Water Use in the Southwest Florida Water Management District, Brooksville, FL.

Southwest Florida Water Management District, 1998(c), Retrofit Programs and Reuse Projects: Summary Report, Brooksville, FL.

Southwest Florida Water Management District, 1999(a), 1997 Estimated Water Use in the Southwest Florida Water Management District, Brooksville, FL.

Southwest Florida Water Management District, 1999(b), 1998 New Water Sources Initiative Project Status Report, Brooksville, FL

Southwest Florida Water Management District, 1999(c), Retrofit Programs, Reuse Projects, and Outdoor Water Conservation Efforts: Summary Report, Brooksville, FL.

Southwest Florida Water Management District, 1999(d), Estimated 1997 Water and Wastewater Charges in the Southwest Florida Water Management District. Brooksville, Fl.

Southwest Florida Water Management District, 1999, 2000, Regulatory Data Base, Brooksville, FL. Southwest Florida Water Management District, 1999, Northern Tampa Bay: Minimum Flows & Levels White Papers, Brooksville, FL.

Southwest Florida Water Management District, 1999, An Analysis of Hydrologic and Ecological Factors Related to the Establishment of Minimum Flows for the Hillsborough River, Brooksville, FL.

Stanley, C. D., Csizinszky, A. A., and Clark, G. A., 1989, *Multiple Cropping of Vegetables Using a Combined Microirrigation/Seepage Irrigation System*: Bradenton, Gulf Coast Research and Education Center, Institute of Food and Agricultural Sciences, University of Florida.

Taylor, Timothy G., and Reynolds, John E., 1999, Agricultural Land Use Projections for the Southwest Florida Water Management District: Gainesville, Food and Resource Economics Department, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL.

Wade Miller Associates, Inc., 1993, A Summary of Findings from the Water Utility Finance and Management Survey.

Water Demand Projection Subcommittee of the Water Planning Coordination Group (Demand Subcommittee), 1998, Final Report: Development and Report of Water Demand Projections in Florida's Water Supply Planning Process

Water Resource Associates, 2000, Water Resource and Water Supply Development: Seawater Desalination, prepared for the Southwest Florida Water Management District.

White, W. A., 1970, The geomorphology of the Florida Peninsula: Florida Bureau of Geology Bulletin no. 51, 164 p.

Wolansky, R. M., 1983, Hydrogeology of the Sarasota-Port Charlotte Area, Florida: United States Geological Survey water-resources investigation 82-4089, 48 p.

Woods, Chuck, 1988, *Future Water Restrictions May Cause Growers to Use Drip Irrigation*: Florida Grower and Rancher; December 1988.

Yobbi, D. K., 1996, Analysis and simulation of ground-water flow in Lake Wales Ridge and adjacent areas of central Florida: Water-resources investigations report 94-4254, 82 p.

York, Marie L., 1997, Community Development Districts: A Florida Profile: FAU/FIU Joint Center for Environmental and Urban Problems: Environmental and Urban Issues, Fall 1997, No. 1.