Rainbow River Surface Water Improvement and Management (SWIM) Plan

A Comprehensive Conservation and Management Plan

November 2015 - REVISED

Anticipated Governing Board Approval: March 26, 2024

Background

Rainbow River is a first-magnitude spring system located in Marion County and was designated as an Aquatic Preserve in 1986 and an Outstanding Florida Waterway in 1987. The Surface Water Improvement and Management (SWIM) Act of 1987 directed the State's water management districts to "design and implement plans and programs for the improvement and management of surface water" (Section 373.451 F.S.). The most recent SWIM Plan for Rainbow River was developed in the framework of the Springs Coast Steering Committee (SCSC), the Springs Coast Management Committee (SCMC), and the Technical Working Group (TWG) before its adoption in 2015. This SWIM Plan includes numeric targets called quantifiable objectives that can be used to develop and prioritize management actions and projects.

SWIM Plans are living documents created with adaptive management at their core. As such, plans will be revised periodically, including reviewing the quantifiable objectives. The Rainbow River TWG was called to reconvene in April and May 2021 to determine if the quantifiable objectives in the 2015 Rainbow River SWIM Plan, specifically those in the water quality and natural systems focus areas, were still suitable. The SCSC took action at their public meeting on July 28, 2021, to refine the quantifiable objectives based on the recommendations from the SCMC, also reviewed over two public meetings, and vetted through discussions from the TWG. The Quantifiable Objective Refinements section details these actions.

Quantifiable Objective Refinements

At the time of SWIM Plan establishment, the Minimum Flows and Levels (MFLs) for Rainbow River was not yet set. The minimum flow for the Rainbow River System was set in 2017 as a long-term average flow of 649 cubic feet per second (cfs). This recommended flow is a five percent reduction from the long-term average flow of 683 cfs adjusted for groundwater withdrawals for the period of record from 1965 through 2015 at the USGS Rainbow River at Dunnellon, FL Gage. Based on this adopted MFL, the SCSC has included a target of >95% natural flow for the minimum flows quantifiable objective.

To better capture changes occurring throughout the river, the water clarity and the submerged aquatic vegetation (SAV) targets will be presented as different river portions. Previously, the targets for water clarity and SAV were calculated as averages of all sampling locations within the river (see Figure 1 for sampling locations). Water clarity is redefined into the headsprings, middle, and lower portions of the river that will be calculated by the RR1, RR4, and RR7 sampling locations respectively (see Figure 1A). The desirable and invasive SAV targets are redefined into upper and lower portions of the river and will be calculated by transects 1-10 and transects 11-28 respectively (see Figure 1B).

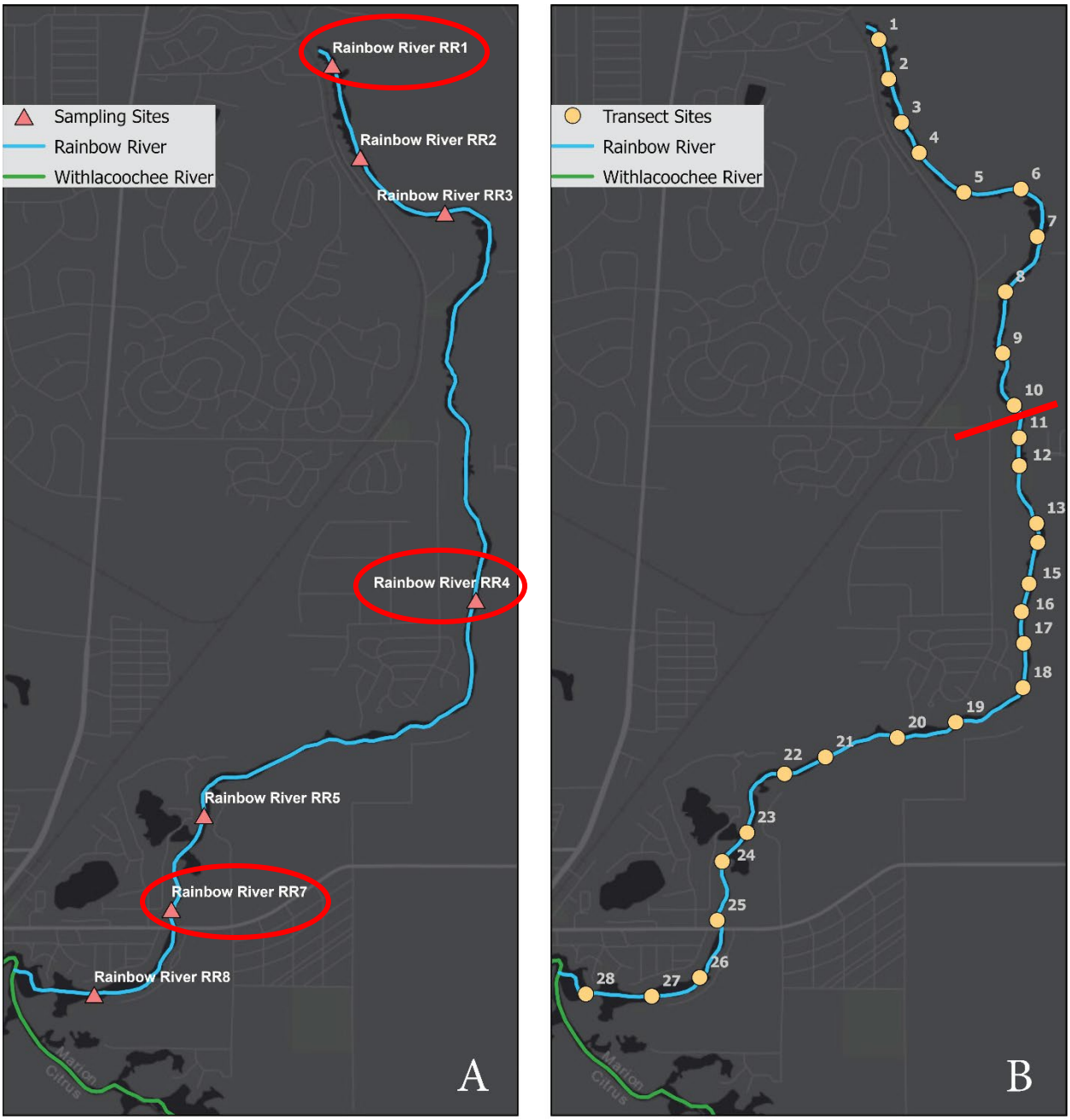

Figure 1: Sampling locations for (A) water clarity and (B) submerged aquatic vegetation in Rainbow River.

Water clarity is influenced by numerous factors including rainfall, suspended solids, and color. Due to these influences, water clarity was redefined as an indicator and will be monitored until the threshold is surpassed. The thresholds were derived by using one standard deviation of degradation from the 2006-2020 average of the headsprings, middle, and lower sampling locations. If surpassed, the SCMC may determine what next steps, if any, are warranted.

Based on these discussions, the SCSC and SCMC have approved refinements to the quantifiable objectives, shown in Table 1. These refinements include the following: including the

minimum flows target as >95% natural flow; presenting water clarity and submerged aquatic vegetation as different river portions; and redefining water clarity as an indicator.

Table 1: Indicators and Quantifiable Objectives

Indicators

Water clarity	**Threshold**
Near the headspring	194 ft
Middle portion of river	47 ft
Lower portion of the river	26 ft

Quantifiable Objectives

Water quality	**Target**
Nitrate concentration in the springs and river	< 0.35 mg/L
Water quantity	
Minimum flows for the springs and river	> 95% natural flow
Natural systems	
Desirable submerged aquatic vegetation in the upper and lower portions of the river.	> 65%
Invasive aquatic vegetation in the upper and lower portions of the river.	< 10%

Springs Coast Steering Committee Members

Each spring system in the Springs Coast region is a unique, complex system with different sets of challenges. To address these issues, the Springs Coast Steering Committee (SCSC) was formed of local, regional and state agencies. The first goal of the SCSC is to develop management plans tailored for each spring system to identify issues, objectives, projects and responsibilities. This document serves as satisfaction of that first goal for Rainbow River.

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Executive Summary

The Rainbow River in southwestern Marion County is a first-magnitude spring system with clear waters and an abundance of fish and wildlife. The river contains numerous spring vents and represents the fourth largest spring system in Florida. Because of its natural beauty and aesthetics, the Rainbow River was designated an Aquatic Preserve in 1986 and an Outstanding Florida Waterway in 1987.

In recognition of the need to place additional emphasis on restoration, protection, and management of the surface water resources of the State, the Florida Legislature, through the Surface Water Improvement and Management (SWIM) Act of 1987, directed the State's water management districts to "design and implement plans and programs for the improvement and management of surface water" (Section 373.451 F.S.). SWIM Plans are generally limited in scope to the areas of responsibility of the Southwest Florida Water Management District (SWFWMD). While this plan is considered an update of the 2004 Rainbow River SWIM plan, it is much more than that. Within the framework of the Springs Coast Steering Committee (SCSC), Springs Coast Management Committee (SCMC), and Technical Working Group (TWG), this plan takes a much broader approach by identifying management actions and projects from a wide variety of stakeholders. It is only through this consensus-building approach that the Rainbow River can adequately be protected and restored for generations to come. Recognizing that one entity alone cannot do it all, the most important element of this plan is the consensus and partnerships that came together and made this plan a reality.

This plan is a living document with adaptive management at its core. As such, this plan will be revised periodically to assess overall progress in meeting the quantifiable objectives. The primary goal of this SWIM plan is to identify and implement management actions and projects that will address the major issues the system faces and that will restore, maintain, and preserve the ecological balance of the Rainbow River. The primary issues are:

- Elevated nitrate concentrations
- Reduced water clarity
- Long-term stream flow reduction
- Altered aquatic vegetation community

To address these issues and their respective drivers, this plan presents several management actions and specific projects and initiatives supporting those management actions that fall within one of three focus areas:

- Water Quality
- Water Quantity
- Natural Systems (Habitat)

The Rainbow River SWIM plan includes numeric targets called quantifiable objectives. If these objectives are achieved, the expected result is a healthy spring ecosystem. These are long term goals and may require considerable time and effort to achieve. Quantifiable objectives can be used to develop and prioritize management actions and projects, thus promoting effective and efficient resource management. Table 1 describes the quantifiable objectives for each of the three focus areas: water quality, water quantity, and natural systems.

Table 1: Quantifiable Objectives

Water Quality	**Target**
Water clarity in the river	>100 feet[1]
Nitrate concentration in the springs and river	<0.35 mg/L[2]
Water Quantity	
Minimum flows for the springs and river system	TBD in 2016[3]
Natural Systems	
Coverage of desirable submerged aquatic vegetation in the river	>65%[4]
Coverage of invasive aquatic vegetation (hydrilla/filamentous algae) in the river	<10%[4]

[1] Based on Anastasiou 2006 and average river-wide data presented in Table 3
[2] FDEP 2013 – Nutrient TMDL for Rainbow Springs Group and Rainbow Springs Group Run
[3] SWFWMD 2015 Minimum Flows and Levels Priority List and Schedule
[4] Based on data presented in Table 4 from the 2011 Rainbow River vegetation evaluation (Atkins and DCWI 2012)

The water quality management actions and projects are focused primarily on reducing nitrogen from the sources identified by the Florida Department of Environmental Protection (FDEP) during the Basin Management Action Plan (BMAP) process. The SCSC recognizes that agricultural operations and septic tanks are the priority water quality management action categories for the Rainbow River. This SWIM plan includes 26 ongoing projects and 7 proposed priority projects to address water quality issues (Figure 1).

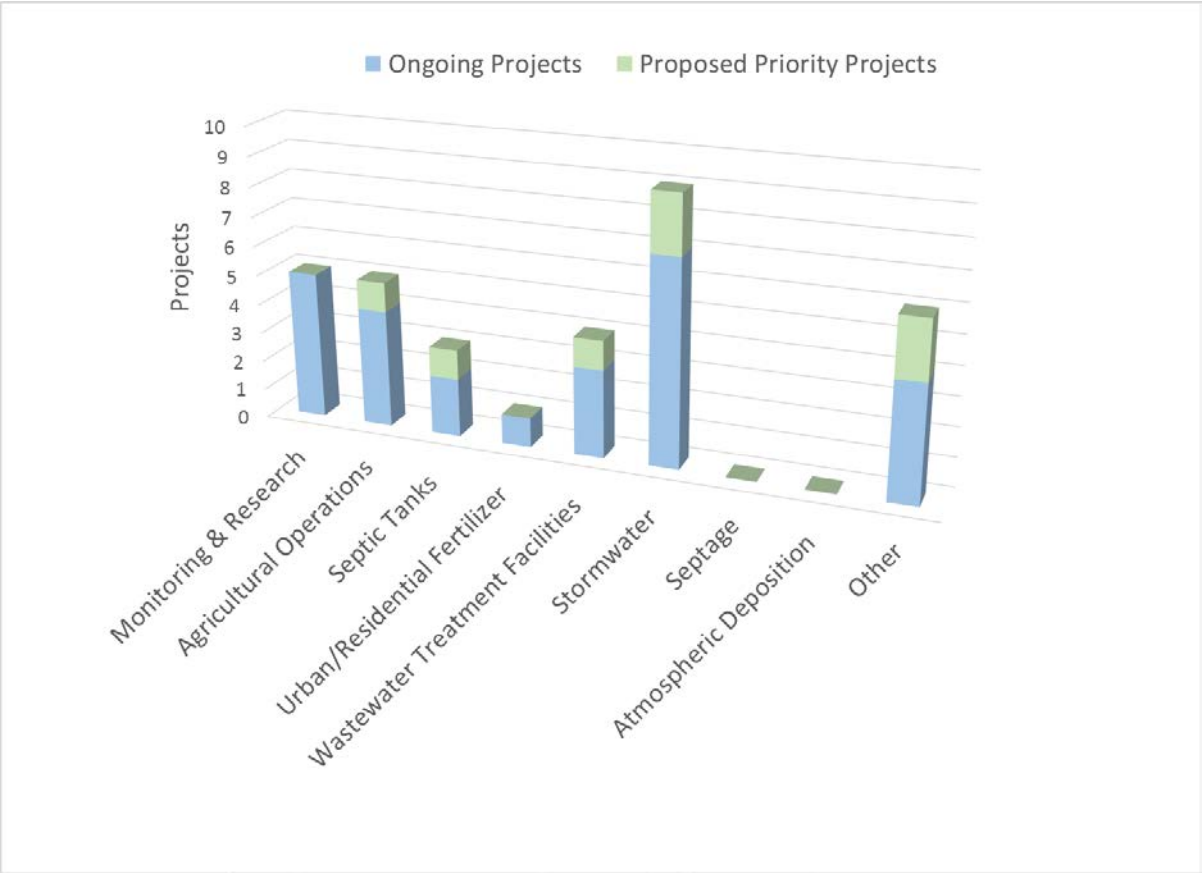


Figure 1: Water Quality Projects per Management Action Category

The water quantity management actions and projects are intended to protect and maintain flows in the Rainbow River. The SCSC recognizes that water conservation and Minimum Flows and Levels (MFL) adoption are the priority water quantity management action categories for the Rainbow River. The SWIM plan includes 19 ongoing projects and 2 proposed priority projects to address water quantity issues (Figure 2).

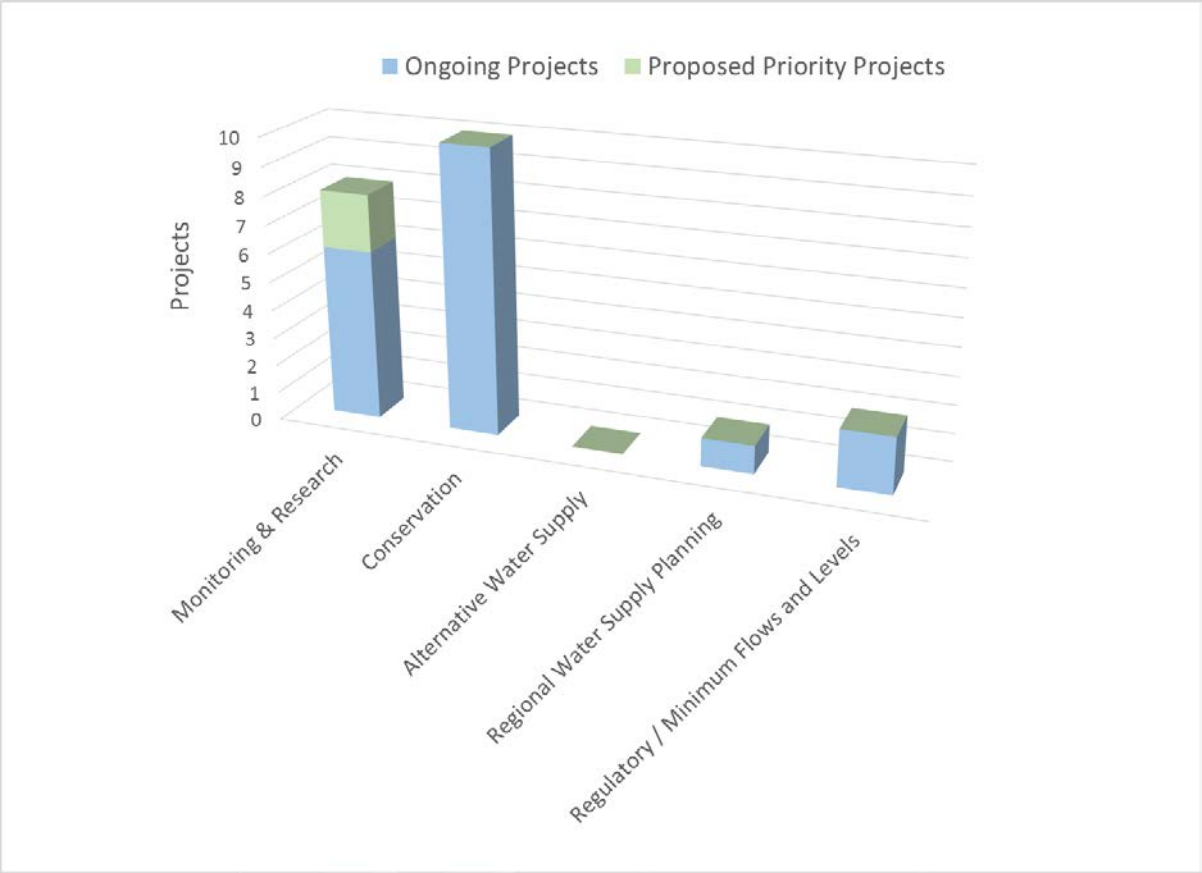


Figure 2: Water Quantity Projects per Management Action Category

The natural systems management actions and projects are designed to directly restore and maintain fish and wildlife habitat both within and along the Rainbow River. The SCSC recognizes that invasive species management and recreation management are the priority natural systems management action categories for the Rainbow River. The SWIM plan includes 8 ongoing projects and 2 proposed priority projects to address natural systems issues (Figure 3).

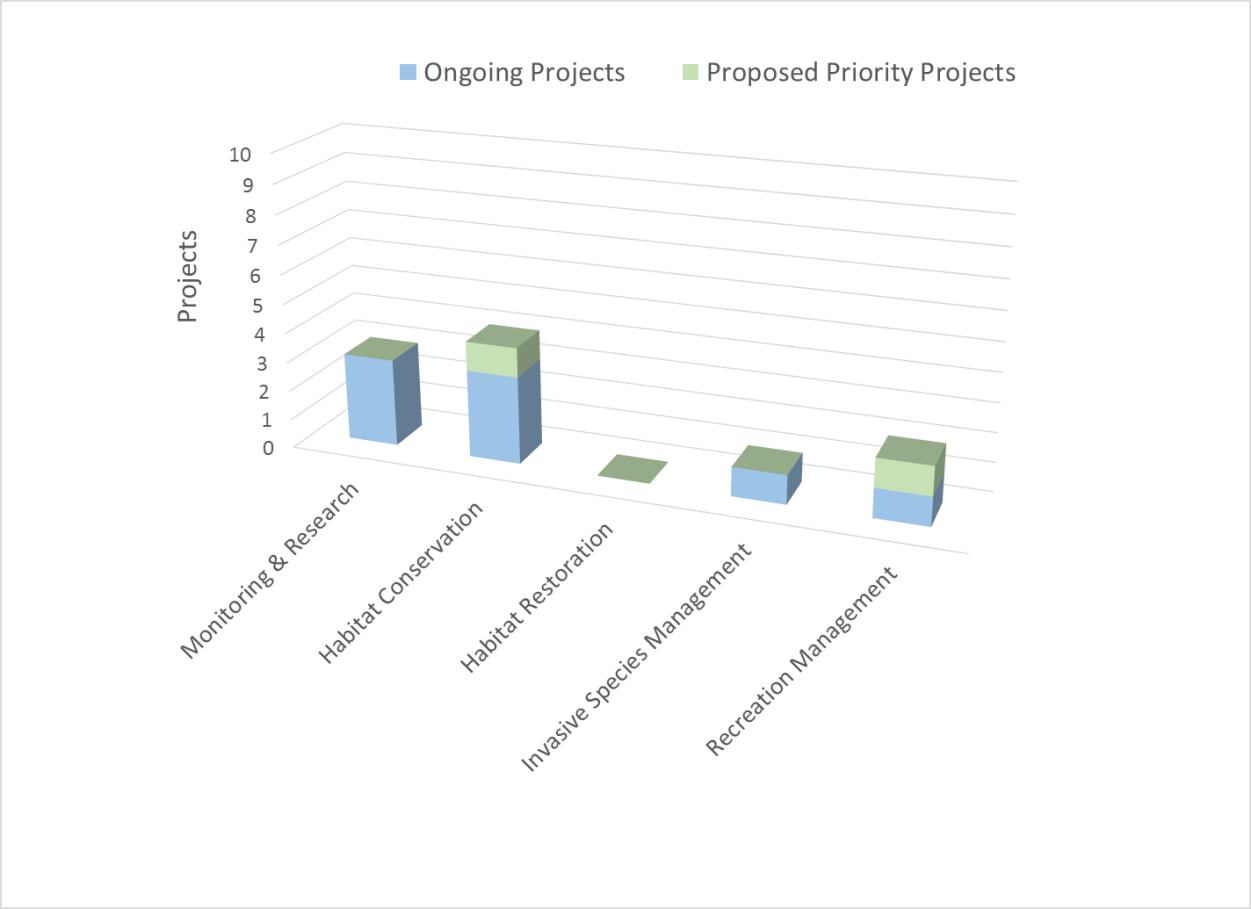


Figure 3: Natural Systems Projects per Management Action Category

Introduction

Among our most precious water resources along the West-Central Florida Gulf Coast are the more than 200 documented springs and the rivers, bays, and estuaries that are fed by them. Over the past half century many of these spring-fed systems have experienced significant ecological changes caused by both natural variability and human activities. This SWIM plan is created to identify actions needed to improve and protect the Rainbow River. Goals and objectives were developed and are used to guide programs and projects for maintaining or improving water quantity, water quality, natural systems, and other functions consistent with the SWIM Act. This plan is a living document with adaptive management at its core. As such, this plan will be revised periodically to assess overall progress in meeting the quantifiable objectives.

The Springs Coast

While recognizing the need to manage all springs, priority is placed on the five first-magnitude spring groups: Rainbow, Crystal River/Kings Bay, Homosassa, Chassahowitzka, and Weeki Wachee (Figure 4). These spring groups, located in or discharging to an area known as the Springs Coast, collectively discharge more than one billion gallons per day.

The source of spring discharge is groundwater from the aquifer, which is replenished by seasonal rainfall that soaks into the ground. Another source of water to these spring systems is surface water runoff within the area known as the watershed. The area of land contributes

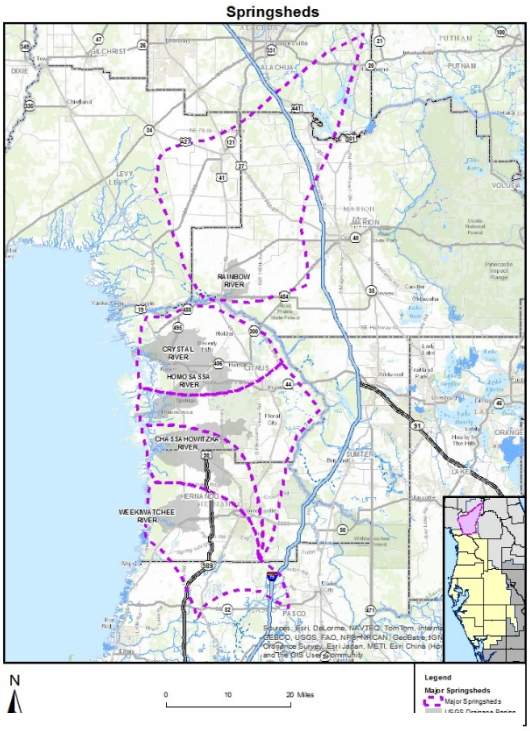


Figure 4: SWFWMD Major Springsheds

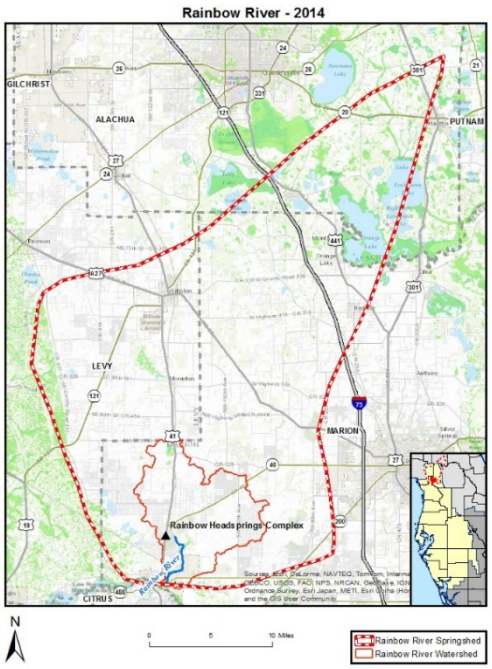


Figure 5: Rainbow River Watershed and Springshed Boundaries

rainfall to a spring is referred to as a springshed. This area extends much farther than just the land immediately surrounding a spring (Figure 5). For example, the Rainbow Springs springshed covers approximately 735 square miles and includes parts of three counties. Unlike watershed boundaries, springshed boundaries are not easily defined and often move in response to rainfall patterns and aquifer levels.

The planning boundary for Rainbow Springs and River encompasses both the surface watershed and the much larger springshed as defined by the SWFWMD. Both areas must be considered when evaluating an effective plan for impacts to the system since both areas have direct impacts to the spring system.

Springs Coast Steering and Management Committees

The Springs Coast Steering and Management Committee's mission is to build consensus and partnerships to restore and protect our Springs Coast through effective implementation of system-specific, scientifically sound, and community-based management plans. Modeled after the National Estuary Programs (NEP), like the Tampa Bay Estuary Program, the first goal of the SCSC is to develop plans tailored for each of the five first-magnitude spring systems (Rainbow River, Crystal River/Kings Bay, Homosassa River, Chassahowitzka River, and Weeki Wachee River), beginning with Rainbow River and Kings Bay. These plans will be living documents identifying issues, solutions, costs and responsibilities to ensure the region's long-term sustainability. These plans will build upon previous and existing efforts such as the Kings Bay and Rainbow River SWIM Plans, The Nature Conservancy's Springs Coast Watershed Plan, and the Rainbow Springs Restoration Plan (Florida Springs Institute 2013).

In August 2014, the SWFWMD along with local, regional and state agencies, formed the Springs Coast Steering Committee (SCSC). The members of this committee are listed in Table 2.

Table 2: Members of the Springs Coast Steering Committee

Organization	Representative	Title
City of Crystal River	Robert Holmes	City Council Member
Citrus County	Dennis Damato	County Commissioner
Hernando County	Nick Nicholson	County Commissioner
Marion County	Stan McClain	County Commissioner
FDEP	Tom Frick	Environmental Assessment and Restoration Division, Director
FFWCC	Shannon Wright	Northeast Regional Director
FDACS	Darrell Smith	Office of Ag Water Policy, Assistant Director
SWFWMD	Michael Babb	Governing Board Member, Chair
* Hernando County Commissioner Diane Rowden contributed to the development of this plan		

To assist in the effort, the SCSC created the Springs Coast Management Committee (SCMC) to review technical data and make recommendations to the SCSC. The SCMC is composed of representatives from the founding organizations of the SCSC, along with other involved stakeholder groups. The members of this committee are listed in Table 3.

Table 3: Members of the Springs Coast Management Committee

Organization/Interest	Representative	Title
City of Crystal River	Dave Burnell	City Manager
Citrus County	Ken Cheek	Director of Water Resources
Hernando County	Alys Brockway	Water Resource Manager
Marion County	Flip Mellinger	Utilities Director
FDEP	Rick Hicks	Administrator
FFWCC	Kevin Kemp	Biologist
FDACS	Jessica Stempien	Environmental Manager
SWFWMD	Michael Molligan	Public Affairs Assistant Bureau Chief
Agriculture	Curt Williams	Florida Farm Bureau, Assistant Director of Government Affairs
Public Supply	Richard Owen	Withlacoochee Regional Water Supply Authority (WRWSA), Executive Director
Environmental	Charles Lee	Audubon Society, Director of Advocacy
Regional Planning Council	Maya Burke	Tampa Bay Regional Planning Council, Senior Environmental Planner
Industry	David Bruzek	Duke Energy, Lead Environmental Specialist
Academia	Mahmoud Nachabe	Professor, Department of Civil and Environmental Engineering, USF
State Parks	Rick Owen	Biologist, Florida Park Service
* Former Management Committee Members who contributed to the development of this plan include: Doug Yowell, Duke Energy Bruce Day, Withlacoochee Regional Planning Council Tom Frazer, University of Florida Kim Tennille, Homosassa Springs Wildlife State Park		

Springs Coast Technical Working Group

To further assist the SCSC, the Technical Working Group (TWG) was assembled, and is an informal group of stakeholders whose primary charge is to engage at the technical level to develop the management plans, beginning with Rainbow River. The TWG consists of members from federal, state, regional, and local governments, private industry, academia, and non-governmental organizations (see Appendix A for membership list).

The SCSC and SCMC requested the TWG focus on three key elements: Water Quality, Water Quantity, and Natural Systems. While these are interdependent, for the purpose of writing the management plans, each of these elements was considered individually.

The SWIM Act & SWIM Priority Water Bodies

In recognition of the need to place additional emphasis on restoration, protection, and management of the surface water resources of the State, the Florida Legislature, through the Surface Water Improvement and Management (SWIM) Act of 1987, directed the State's water management districts to "design and implement plans and programs for the improvement and management of surface water" (Section 373.451 F.S.). The SWIM legislation requires the water management districts to protect the ecological, aesthetic, recreational, and economic value of the State's surface water bodies, keeping in mind that water quality degradation is frequently caused by point and non-point source pollution, and that degraded water quality can cause both direct and indirect losses of habitats.

Under the act, water management districts identify water bodies for inclusion into the program based on their regional significance and their need for protection and/or restoration. This process is carried out in cooperation with the FDEP, the Florida Fish and Wildlife Conservation Commission (FFWCC), the Florida Department of Agriculture and Consumer Services (FDACS), and local governments.

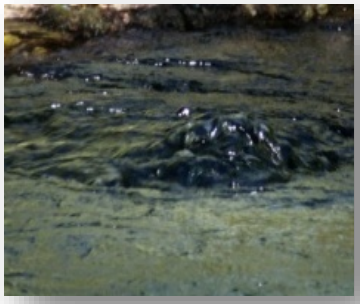
In accordance with the SWIM Act, once a water body is selected, a SWIM plan must be adopted by the water management district's governing board and approved by the FDEP. Before the SWIM plan can be adopted, it must undergo a review process involving the required state agencies. The purpose of this updated Rainbow River SWIM plan is to set forth a course of action by identifying the quantity, scope, and required effort of projects appropriate for the system, while considering the levels of funding. In 1989, the SWFWMD adopted the Rainbow River as a SWIM water body and developed the first Rainbow River SWIM plan. The 1989 SWIM plan identified a variety of projects that included public education, habitat restoration, baseline vegetation and wildlife surveys, and sediment analysis. These projects were diagnostic in nature with a focus on obtaining an initial understanding of the system. As projects were completed and the SWFWMD staff's understanding of the system increased, SWIM plans were periodically updated. The Rainbow River SWIM plan was updated in 1995 and again in 2004 to evaluate management issues and to determine which areas to focus management strategies in the

future. As each SWIM plan was updated, management issues shifted from the area immediately surrounding the river in the watershed to more regional issues within the springshed. This current SWIM plan will adopt the springshed and watershed as the management boundary area.

What Makes a Healthy Spring?

There are three attributes that are common to healthy springs and can be used to assess their condition: water quality, flow and discharge (water quantity), and fish and wildlife habitat (natural systems).

The quality of water is a key attribute of the ecology and aesthetics of a spring, especially with regard to clarity, nutrients, and salinity. A defining characteristic of many Florida springs is exceptionally clear water, which is a primary driver of the productive aquatic vegetation that supports spring ecosystems. Nutrients control many ecological processes and may lead to imbalances of flora and fauna at elevated levels relative to background concentrations. For the coastal spring systems, salinity variation has a major influence on the type and abundance of organisms that live in these historically freshwater ecosystems.



The amount of water that discharges from a spring vent, or in most cases a collection of spring vents, is the primary feature of a spring system. Spring discharge is the main source of flow that creates and maintains the riverine portion of spring systems. Adequate flow influences springs ecology by maintaining water temperature, inhibiting algal blooms, reducing detrital buildup, and stimulating productivity. Without adequate flow the ecology and human use potential of a spring diminishes.

Florida spring ecosystems are known for their abundance and diversity of aquatic vegetation, invertebrates, fish, and wildlife, including birds, turtles, alligators and otters. Native aquatic vegetation is the foundation of spring ecosystems by providing habitat for many organisms, removing nutrients from the water, stabilizing sediments, and improving water clarity by filtering particles.

Rainbow River System Description

Numerous springs form the Rainbow Springs Group and the resulting Rainbow River. Located in the southwestern part of Marion County, adjacent to the City of Dunnellon, the river flows nearly 6 miles before joining the lower Withlacoochee River and which ultimately discharges into the Gulf of Mexico near Yankeetown north of Crystal River. Water flowing down the Rainbow River is an aggregation of discharge from numerous spring vents and represents the fourth largest spring group in Florida. Rainbow River was designated as both an Aquatic Preserve in 1986 and an Outstanding Florida Waterway in 1987 due to the natural beauty and aesthetics of the springs and river. In 1989 the river was designated as a SWIM waterbody.

Geology

The Florida peninsula is formed on top of thick sedimentary rocks. Extensive marine carbonate deposits have turned into alternating layers of limestone and dolostone rock formations that collectively are several thousand feet thick. Subsequent sediment deposition and geologic processes have created a mantle of overlying sand and clay deposits that, along with dissolution of the underlying rock formations, have formed the karst landscape surrounding Rainbow Springs and the Rainbow River. The saturated carbonate rocks beneath the land surface form the Floridan aquifer system, one of the most productive aquifers on earth and the source of groundwater discharging from Rainbow Springs and most of the other springs in the state.

Understanding the dominant role of karst processes on groundwater flow is prerequisite to characterizing the hydrology of the aquifers in the region. The topography and internal drainage in the Rainbow Springs groundwater basin, or springshed area, has been formed by karst processes, and contains numerous sinkholes, sinking streams, and springs. In karst areas, the dissolution of limestone by slightly acidic rainfall water acts to dissolve the limestone bedrock, enlarging fractures in the rock and forming cavities which may eventually collapse to form sinkholes. Sinkholes capture surface water drainage and funnel it underground which further promotes dissolution of the limestone. This leads to progressive integration of voids beneath the surface, and allows larger and larger amounts of water to be funneled into the underground drainage system.

Hydrology

The ultimate source of water flowing through the aquifer and discharging from Rainbow Springs is rainfall. Rainfall across the Florida peninsula is the result of three types of systems: frontal, convective, and tropical or cyclonic. Although most of the rainfall is associated with summer convective storms, the region has two distinct peak rainfall periods: June through September and February through April. Average rainfall in the Rainbow Springs springshed is 54 inches per year with the highest monthly rainfall in August.

Topographic elevation differences direct rainfall runoff from higher to lower elevations across the land. The resulting surface water catchment area for a receiving waterbody forms a watershed. The watershed for Rainbow River is approximately 73 square miles (Florida Geological Survey 2007). However, much of the watershed is internally-drained with little to no runoff. The majority of water flowing down the Rainbow River is derived from a much larger groundwater basin called the springshed.

Springsheds are catchment areas that contribute groundwater to a spring vent or spring group. The boundaries of a springshed are mostly defined by groundwater potentiometric surface elevations as measured by water levels in monitoring wells. Similar to topographic drainage, groundwater elevation differences and other aquifer properties cause groundwater movement through the springshed to the springs. Springshed boundaries are dynamic and can move slightly seasonally, based on variations in rainfall and groundwater recharge. The Rainbow Springs springshed covers a significant land area and includes large portions of Alachua, Levy, and Marion counties. The FGS estimated springshed for Rainbow Springs is approximately 735 square miles (471,700 acres, Figure 6).

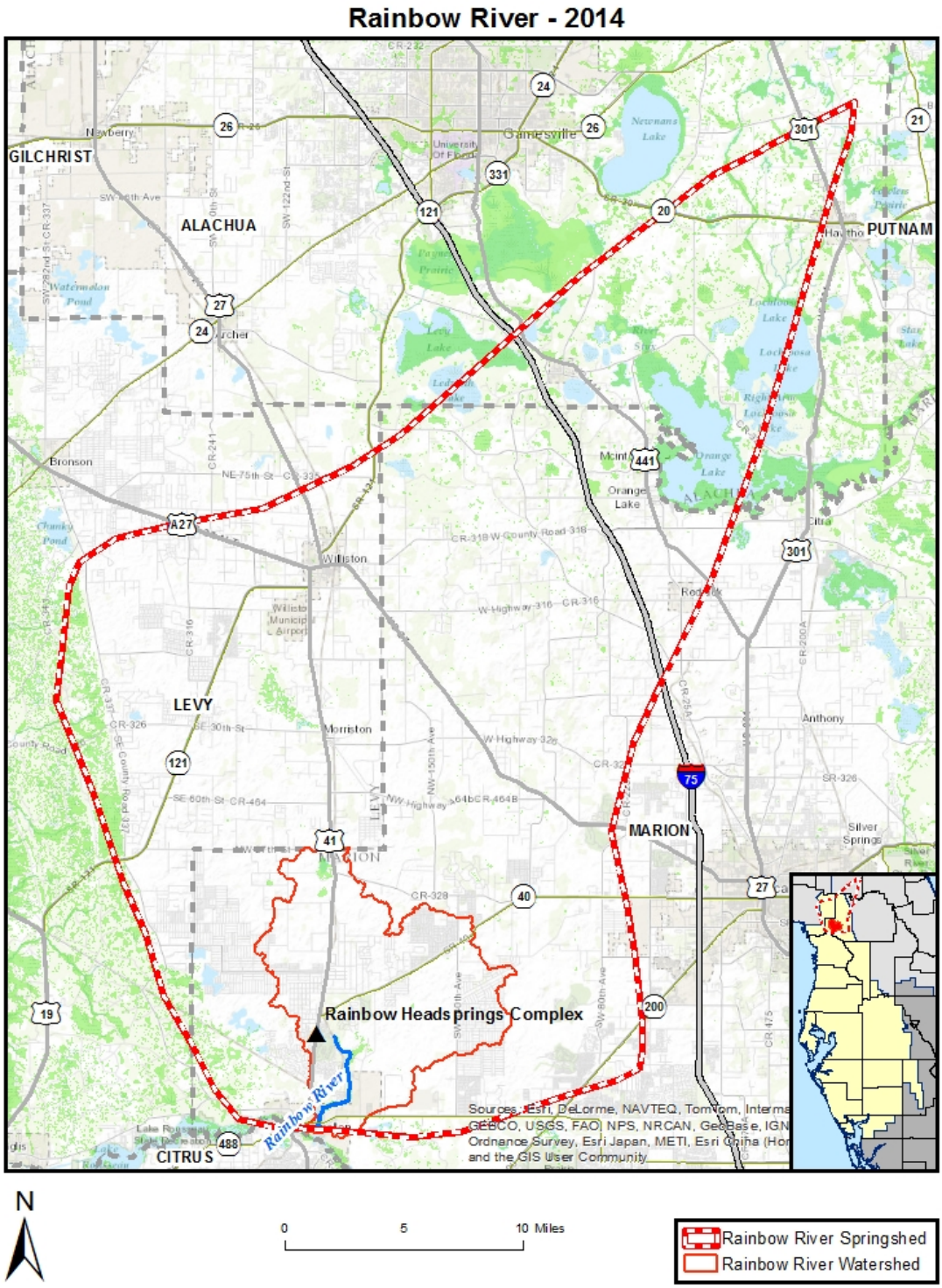


Figure 6: Rainbow River Watershed and Springshed Boundaries

The hydrogeology in the Rainbow Springs springshed includes a surficial aquifer, a discontinuous intermediate confining unit, and a thick carbonate Upper Floridan aquifer. In general, a regionally extensive surficial aquifer is not present because the clay confining unit is thin, discontinuous, and breeched by numerous karst features. Because of this geology, the Upper Floridan aquifer is unconfined over most of the western Marion County area. In this unconfined setting, high infiltration soils and generally deep water table conditions exist. Within the Rainbow Springs springshed, the Upper Floridan aquifer is the primary source of water for the springs and withdrawals for public supply, agricultural, recreational, and industrial/commercial uses.

The Upper Floridan aquifer within the Rainbow Springs springshed is recharged from local rainfall. Net recharge values are determined by rainfall inputs minus evapotranspiration loss. The highest recharge rates to the aquifer occur in west-central Marion County with values ranging between 10 and 25 inches per year (Sepulveda, 2002). According to Faulkner (1970) most of the flow to Rainbow Springs is concentrated within the upper 100 feet of the Upper Floridan aquifer. This uppermost portion of the aquifer is characterized by rapid recharge and flow, with shorter groundwater residence and travel times to the point of discharge at the springs. The vulnerability of the aquifer in the Rainbow Springs springshed was evaluated based on county-specific aquifer and soil data and found that the majority of the springshed is "more vulnerable" or "most vulnerable" to contamination (Baker et al. 2007).

Ecology

The diverse ecology of Rainbow River and the surrounding lands provide opportunity to observe numerous life forms and visitors will be presented with an array of aquatic plants, invertebrates, fish, reptiles, and birds. The plant and animal life found in the Rainbow River and the surrounding lands of the watershed have been characterized by a variety of efforts.

An early effort by FFWCC characterized the terrestrial habitats of the Rainbow River watershed and the occurrence of amphibian, reptile, avian, and mammal species found therein (Joiner et al. 1992). The three major habitat types at that time were hydric hammocks, flatwoods, and sandhills. Combining field observations made during 1990-91 and reviews of available wildlife data (1985-91), there were 23 species of amphibians, 42 species of reptiles, 132 bird species, and 26 mammal species documented to occur in the watershed. Animal usage by habitat type revealed that the sandhills supported the widest variety of species and greatest number of individuals for both reptile and bird species. Amphibian abundance was greatest in hydric hammocks but species diversity was consistent between habitat types. Mammal diversity was greatest in flatwoods habitat whereas mammal abundance was greatest in sandhills.

Species lists for flora and fauna found within the Rainbow Springs State Park boundaries have been published as part of the park unit management plan (FDEP 2002). The park management plan lists 273

plant species (59 non-native), 27 fish species, 23 amphibian species, 40 reptile species (1 non-native), 125 bird species (2 non-native), and 24 mammal species (2 non-native).

Aquatic insects (especially in the Diptera, Trichoptera, and Ephemeroptera orders) utilizing Rainbow River were quantified as part of a synoptic study (WSI 2010). A total of 21 different insect families were documented, however the non-biting midges (Diptera: Chironomidae), made up the majority of observations. These aquatic insects were observed to emerge from the water in densities ranging from 10's to 100's per square meter and collectively represent an important component of the spring food web. Multiple stream condition indices (SCI) utilizing aquatic macroinvertebrates have been made by FDEP. The FDEP SCI assessments collected up to 34 different taxa, with the number of sensitive taxa ranging up to 5 and overall SCI values typically resulted in a healthy rating (FDEP 2008). Only 2 species of native mussels have been documented in Rainbow River and thus far the non-native Asian clam (Corbicula fluminea) has not been observed (Walsh and Williams 2003).

A variety of aquatic turtle studies have been conducted in Rainbow River beginning in the 1940's (Marchand 1942). Huestis and Meylan (2004) documented 8 species of aquatic turtles utilizing the river and a trend towards smaller species in comparison to historical surveys which was attributed to harvest of large species.

Multiple fish surveys have been conducted within Rainbow River (Walsh and Williams 2003, WSI 2010, Simcox et al. 2015). Up to 27 fish species have been collected, such as largemouth bass (*Micropterus salmoides*), several species of sunfish (*Lepomis sp.*), lake chubsucker (*Erimyzon sucetta*), long nose gar (*Lepisosteus ossesus*), and Atlantic Needlefish (*Strongylura marina*). According to the Rainbow Springs Aquatic Preserve and the Florida Fish and Wildlife Conservation Commission there were no documented exotic fish species in the Rainbow River in 2015. Historically, there have been exotic fish species present, for example, the Sailfin catfish (*Pterygoplichthys disjunctivus*) which was first documented in December 2002 but has been absent from the river for the past six years due in large part to the Rainbow Springs Aquatic Preserve's eradication program to rid the Rainbow River of this species (Hill and Sowards 2015). Absent from the Rainbow River fish community are estuarine species that travel between coastal rivers and the Gulf of Mexico, due to blockage by downstream structures.

Aquatic vegetation has been mapped in the Rainbow River beginning in 1991 and continuing at approximate 5 year intervals (Atkins and DCWI 2012). During the 2011 mapping effort, 13 submersed plant species (1 non-native) were documented, with strap-leaf Sagittaria (*Sagittaria kurziana*), hydrilla (*Hydrilla verticillata*), eelgrass (*Vallisneria americana*), and southern naiad (*Najas guadalupensis*) being the most common river wide species, although the filamentous algae Lyngbya (*Lyngbya wollei*) was abundant in portions of the middle and lower river (Atkins and DCWI 2012). Emergent aquatic plants are common, with 22 documented species (4 non-native) and most abundantly Egyptian paspalidium

(*Paspalidium geminatum*). Floating aquatic plants are limited to minor duckweeds (*Lemna sp*.) and water lettuce (*Pistia stratiotes*), the latter being controlled as needed by aquatic herbicides.

Aquatic mammal utilization of Rainbow River is primarily confined to both river otter *(Lutra canadensis)* and raccoon *(Procyon lotor).* Manatee utilization of Rainbow River has been prevented by the lock and dam structures on the lower Withlacoochee River. When the Cross Florida Barge Canal locks ceased operation in 1999 the last remaining access point for manatees was removed.

Historical Context

Past human activities over the last 150 years have altered the character of the river, especially in the lower reaches. By the 1880's, much of the land surrounding the river had been logged and converted to citrus (Dinkins 1984). In 1890, the discovery of hard rock phosphate deposits near Dunnellon triggered a mining boom (Dinkins 1984). Dozens of mines operated along the banks of the Withlacoochee River and the lower reaches of the Rainbow River (Figure 7). Most of these mines were dug by hand, some of which are over 40 feet deep. For example, Blue Cove, on the west bank of the lower Rainbow River, is an old mine quarry that is directly connected to the Rainbow River. In addition to the old mine pits, other artifacts of the area's mining days can still be seen. The pilings that supported cable-driven mine cars are still standing in many of the now submerged mine pits. World War I and the discovery of pebble rock phosphate in Hillsborough and Polk Counties officially ended the Dunnellon mining boom, although some phosphate mining continued until 1966 (Dinkins 1984).

Figure 7: Phosphate Mining Operations (Florida State Library)

In 1909, the Inglis Dam, located about 4 miles upstream of the town of Inglis, was constructed across the lower Withlacoochee River, forming Lake Rousseau, a 4,163 acre impoundment of the river (Downing et al. 1989). A hydroelectric power facility operated at the dam until 1965. The Inglis Lock, located next to the dam, was completed in 1969 by the U.S. Army Corps of Engineers (USACE) as part of the Cross Florida Barge Canal project. Although it is unknown if the dam changed water levels in the upper reaches of the Rainbow River, the water levels in the lower reaches of the river could have been significantly elevated (Downing et al. 1989). Unfortunately, there is no documentation of water levels prior to the installation of the dam.

Results from a modeled simulation of river levels indicated that drawing Lake Rousseau water levels down from the present elevation of about 27 feet to 18 feet would lower the water elevation in the lower Rainbow River by as much as 8 feet. The simulation predicted that lower surface water elevations would extend 2 miles upstream of the river's mouth (Downing et al. 1989). It is possible that water level changes caused by the dam have increased water residence times within the lower reaches of the river, resulting in a decline in water clarity and changes in the plant and animal communities in the Rainbow River. The dam and remnant barge canal have also created barriers for migratory aquatic fauna such as estuarine fish and manatees that commonly inhabit coastal spring ecosystems.

The lands surrounding the headsprings were a privately owned tourist attraction from the 1930s through the 1970s. The private park closed due to a decline in tourism business and the lands were unmanaged until the Florida Park Service purchased the property in 1990. The Florida Park Service continues to manage the property as a popular state park.

Land Use

Agriculture in the form of horse, cattle, row crops, and nursery operations comprise the dominant land use category, making up about 38% of the springshed (Figure 8). Upland forest lands make up about 29% of modern land use and residential areas comprise about 14% of land use within the springshed. Large tracts of land which have been zoned for residential development have not yet been developed.

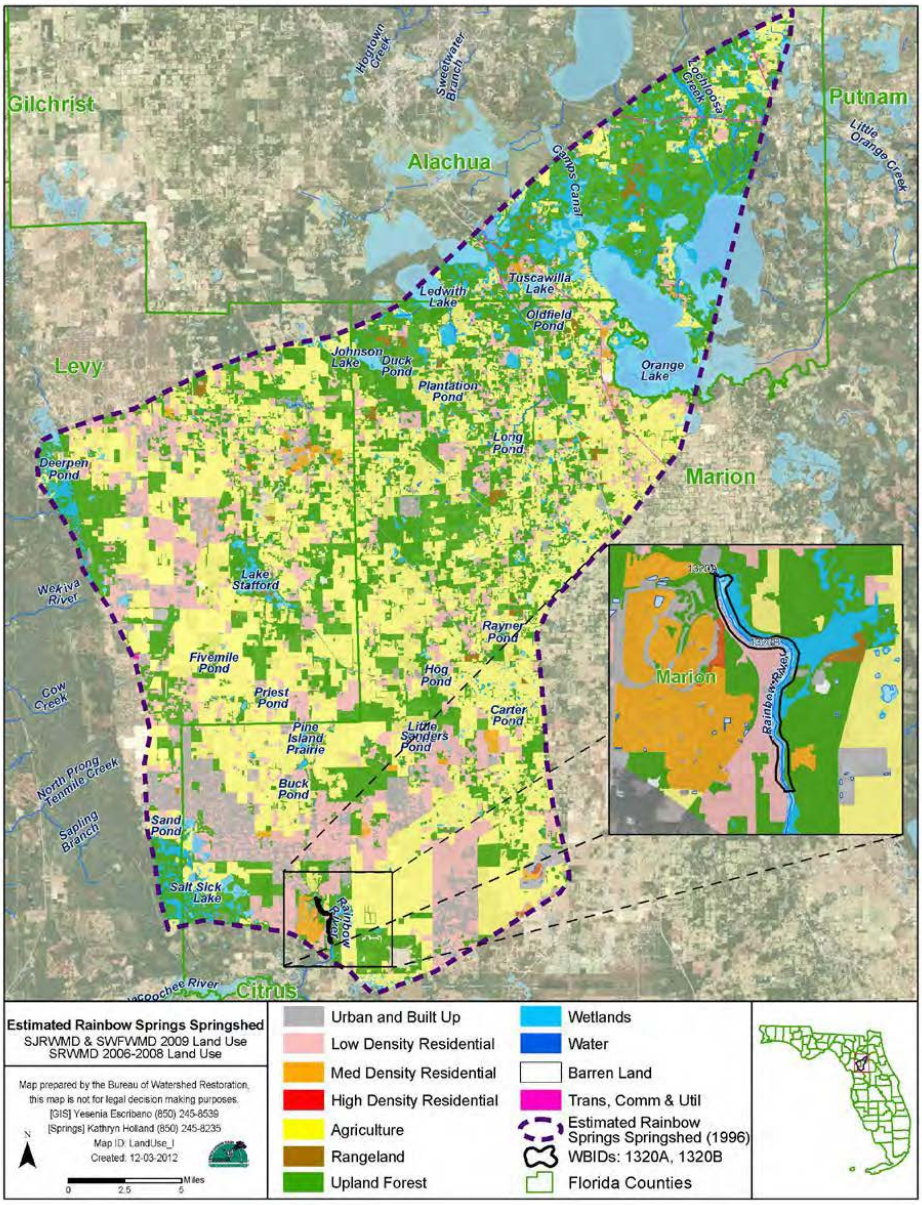


Figure 8: Principal Land Uses in Rainbow Springshed (FDEP 2013)

Because the Rainbow River is almost entirely groundwater supplied, land use activities in the springshed affect the quality and quantity of groundwater entering the river. Large expanses of natural riparian zones and floodplain wetlands adjacent to the river and within the watershed have been lost to residential development. In aggregate, both local and springshed scale changes to land use have negatively impacted water quality, flow and discharge, and fish and wildlife habitat in the Rainbow River, and therefore the overall health of the spring ecosystem.

Issues and Drivers

The primary issues affecting the ecology of the Rainbow River are elevated nitrate concentrations, reduced water clarity, long-term stream flow reduction, and an altered aquatic vegetation community. To address these issues and their drivers, the SWIM plan is organized into the following three focus areas: water quality, water quantity, and natural systems (habitat).

Water Quality

Current management related to water quality in the Rainbow River focuses largely on identifying and quantifying sources of nitrogen as well as reducing the nitrogen load delivered to the springshed (FDEP 2013, FDEP 2015, Eller and Katz 2015). Research is also ongoing to quantify sediment nutrient characteristics and their bioavailability, nutrient cycling, and the potential impact that adjoining historic phosphate mine pits have on water quality in the lower river. Water clarity is an important water quality attribute that is extremely high in the upper river, but decreases in the lower river due to increased chlorophyll concentrations.

The primary nutrients of concern are nitrogen and phosphorus, given their ability to stimulate aquatic plant abundance. Although these nutrients occur naturally in low concentrations and support natural processes associated with aquatic ecosystems, current concentrations far exceed historic concentrations. Given that increased nutrient supply in spring ecosystems has been observed to stimulate the growth of phytoplankton (Frazer et al. 2002), epiphytic algae (Notestein et al. 2003) and nuisance filamentous algae (Cowell and Dawes 2004) a great deal of concern exists. Additionally, studies have suggested that there could be toxic effects of elevated nitrogen concentrations on aquatic fauna (Mattson et al. 2007).

Nitrogen concentrations, particularly in the inorganic form nitrate, are extremely elevated in Rainbow River. Nitrate enrichment is currently an issue in the majority of springs in Florida because nitrogen applied to the land surface typically converts into nitrate which readily infiltrates into the groundwater. The SWFWMD currently monitors four of the main spring vents and eight fixed stations around the river (Figure 9). Nitrate concentrations at the Rainbow Spring 1 station (SID 23319) began exceeding 1 mg/L in 1995 and reached 2 mg/L in 2009 (Figure 10). The historical background nitrate concentration for springs is considered to be 0.1 mg/L or less.

Figure 9: Selected SWFWMD Sampling Locations in the Upper Rainbow River

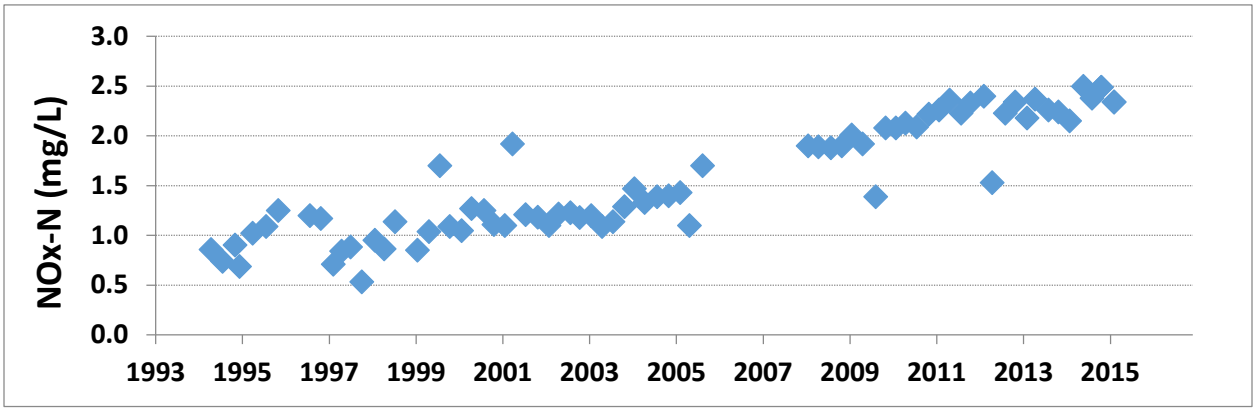


Figure 10: Nitrate Concentrations in the Headspring Area of the Rainbow River (SID 23319).

In 2010, the FDEP placed two segments of the Rainbow River, Rainbow Springs Group (WBID 1320A) and Rainbow Springs Group Run (WBID 1320B), on the Verified List of impaired waters for the Withlacoochee Basin (Section 303(d) of the Clean Water Act.) because of ecological imbalances caused by excessive nitrate. The FDEP used a methodology (per Rule 62-303, F.A.C.) for listing nutrient impaired surface waters based on documentation of an imbalance of flora and fauna. Due to elevated nitrate concentrations that were approaching 2 mg/L in these two segments, along with corresponding

evidence of algal mats, a Total Maximum Daily Load (TMDL) was established in 2013 that set the allowable nitrate concentration threshold for these segments to meet their applicable water quality criterion for nutrients (FDEP 2013).

As part of the TMDL, the FDEP attributed the excessive algal growth strictly to nitrate concentration due to an increasing temporal trend, whereas phosphorus did not appear to have an increasing trend during the period of record thus it was not included as a target nutrient for the TMDL. Using various lines of evidence such as laboratory studies, biological surveys and periphyton-nitrate relationships, the FDEP established the target monthly average TMDL nitrate concentration for both segments at 0.35 mg/L. The earliest documentation of filamentous algal mats, specifically Lyngbya sp., in the Rainbow River was in 1991 (Water and Air Research 1991); however, it is likely that filamentous algal mats were present prior to 1991 due to the high abundance of algae that was documented in the lower river.

The FDEP TMDL target will require an 82% reduction in nitrate concentration in both WBID segments to meet the TMDL. FDEP developed a draft Nitrogen Source Inventory Loading Tool (NSILT) to identify major sources of nitrogen for the Rainbow Springs Group and estimate their loads to groundwater in the Basin Management Action Plan area (Eller and Katz 2015). The NSILT is a geographic information system and spreadsheet-based tool that provides estimates of the relative contribution of nitrogen from major sources, while taking into consideration the processes affecting the various forms of nitrogen as they move from the land surface through soil and geologic strata overlying the upper Floridan aquifer. As a planning tool, the NSILT can identify areas where nitrogen load reduction efforts could be directed.

The NSILT identified agriculture (cattle farms/horse farms/crop fertilizer and miscellaneous livestock) and septic tanks as the primary sources of nitrogen loading to groundwater within the Rainbow Springs BMAP area, accounting for 66% and 19% of the loading respectively (Figure 11). The remaining sources identified were atmospheric deposition, urban fertilizer, and wastewater treatment facilities. The resulting estimates of nitrogen loading to groundwater took into account environmental processes that attenuate nitrogen and the rate of recharge to the upper Floridan aquifer using information from published studies. To account for recharge rates to the aquifer, non-attenuated nitrogen inputs in high recharge areas (>10 in/yr) were multiplied by a weighting factor of 0.9, while nitrogen inputs were multiplied by a weighting factor of 0.5 for medium recharge areas (4 to 10 in/yr). The NSILT findings estimated an annual load of nitrogen of 1.34 million pounds to groundwater in the Rainbow Springs BMAP area, approximately 11% of the estimated nitrogen loading to the land surface (Eller and Katz 2015).

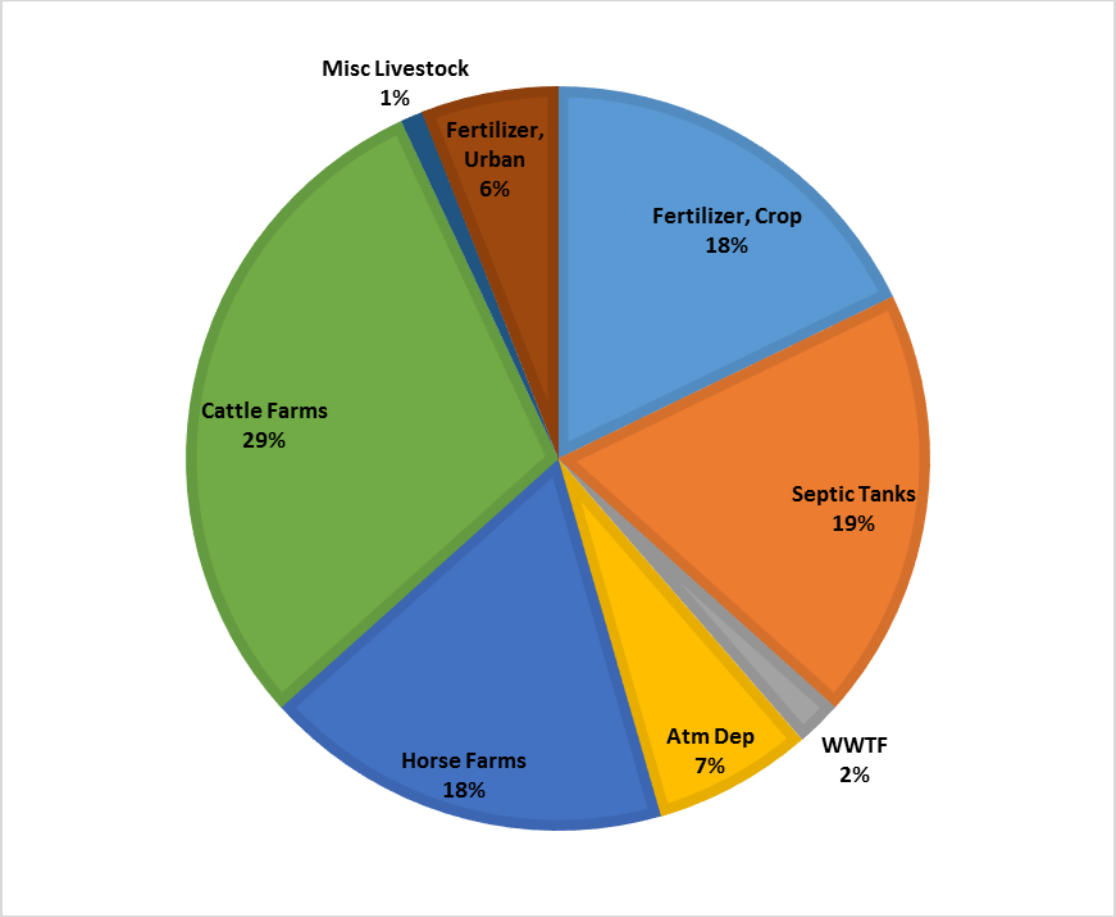


Figure 11: Relative Nitrogen Inputs to Groundwater in the Rainbow BMAP Area by Source. Adopted from Eller and Katz 2015.

Phosphorus, specifically in the biologically available form orthophosphate, is also a nutrient of concern although there is not a TMDL because an increase in phosphorus loads have not been observed in the Rainbow River. Phosphorus can reach the river from surface runoff from the watershed or from groundwater moving through areas with phosphatic deposits in the overlying geologic formation (Harrington et al. 2010). Measured orthophosphate concentrations from the upper Rainbow River do not show an increasing trend over time. Orthophosphate concentration from Rainbow Spring 1 in February 2015 was 0.024 mg/L.

The sediment that makes up the bottom of the Rainbow River is important both as a substrate for vegetation and as a potential source for nutrients. There is a shift in sediment type from mostly sand in the upper river to a mixture of sand, silt, and clay in the lower river (Water and Air Research 1991). Sediments in the lower portion of the river are nutrient enriched by phosphatic soils and the settling of organic debris. This sediment type is more favorable to rapidly growing nuisance vegetation (Ellis et al. 2007). An anecdotal account in the report associated the exotic invasive SAV, Hydrilla verticillata

with more nutrient-rich sediments that dominated the sediment regime in the downstream portions of the Rainbow River.

The springs of Florida are known for their exceptional water clarity (Duarte and Canfield 1990). In contrast to the tea colored tannic waters of the Withlacoochee River, the waters of the upper Rainbow River are very clear. High water clarity is important because it is a primary driver of the productive aquatic vegetation and beneficial algal communities which support spring ecosystems. Water clarity is most often measured using a small black and white disk known as a Secchi disk. Typically the disk is lowered from the surface until it can no longer be seen. The point at which the disk disappears is the Secchi distance. Because the waters of the Rainbow River are so clear, a modified technique is used in which the Secchi disk is pointed perpendicular to the bottom and an in-water observer with a tape measure snorkels away from the disk until it disappears. This estimate of clarity is called a horizontal Secchi disk. For the purpose of this plan, the term Secchi disk implies horizontal Secchi as opposed to vertical Secchi.

In spite of the remarkably clear water in the upper portion of the Rainbow River, it has been perceived by many that water clarity along the river has been decreasing over time. As described earlier, current management issues related to water quality on the Rainbow River focus mostly on internal and external nutrient loading. In conjunction with a reduction in rainfall and a subsequent decline in spring discharge, excess nutrients discharging from the spring vents and also diffusing from the river sediments may be stimulating the growth of chlorophyll-producing organisms in Rainbow River and in downstream receiving rivers and estuaries. The abundance of algal cells and other organic and inorganic particles in the water column contribute to decreased water clarity. From 2006 to 2014 the average water clarity in Rainbow River ranged from 79 to 92 feet, with over 200 feet of visibility at the headsprings and less than 60 feet of visibility in the lower river (Table 4; Figure 12).

Table 4: Water Clarity from 2006-2014 in Rainbow River (horizontal Secchi distance in feet; WMIS)

Station	2006	2007	2008	2009	2010	2011	2012	2013	2014	River Mile
RR1	203	215	210	217	242	219	234	211	240	0.04
RR2	118	118	116	116	128	114	119	117	124	0.45
RR3	83	77	78	74	71	80	73	81	83	0.91
RR4	50	59	50	55	64	67	59	59	56	2.80
RR5	40	47	48	58	58	59	45	51	44	4.56
RR7	32	35	37	42	44	45	35	38	34	5.06
RR8	24	27	33	34	34	37	25	25	25	5.60
Average	*79*	*82*	*82*	*85*	*92*	*88*	*84*	*83*	*86*	

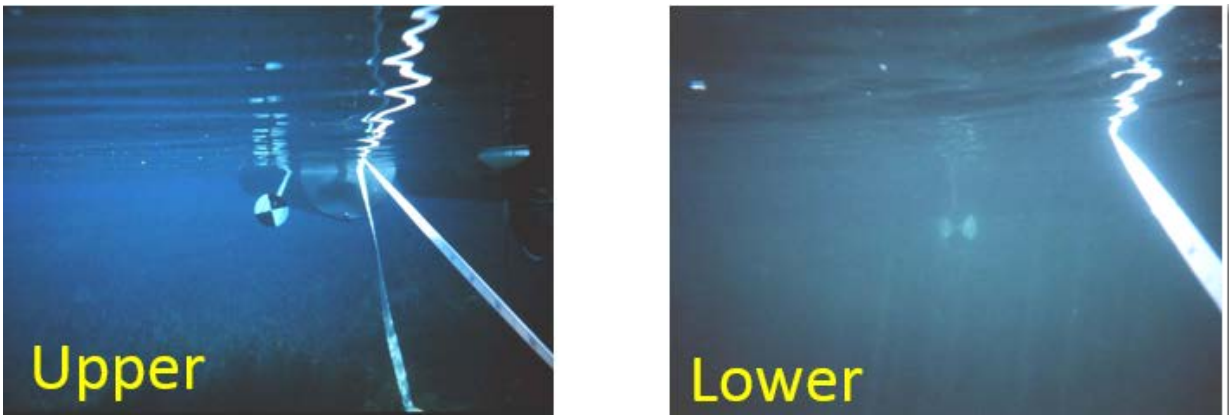


Figure 12: Horizontal Secchi disk measurement at fixed stations along the river (Anastasiou 2006)

There is little historical information available to relate present water clarity conditions with past conditions. Because water clarity is such an important issue in this system, the factors that control water clarity needed to be better understood, which provided the impetus for the development of a preliminary optical model that explained both spatial and temporal variability in water clarity through chlorophyll concentrations (Anastasiou 2006). Figure 13 shows the exponential relationship between water clarity and chlorophyll concentration for the entire river reach. Over 80% of the variability in water clarity can be explained by chlorophyll concentrations. This inverse relationship between chlorophyll concentration and water clarity is evident, where water clarity decreases as chlorophyll concentrations increase with distance downstream (Figure 14).

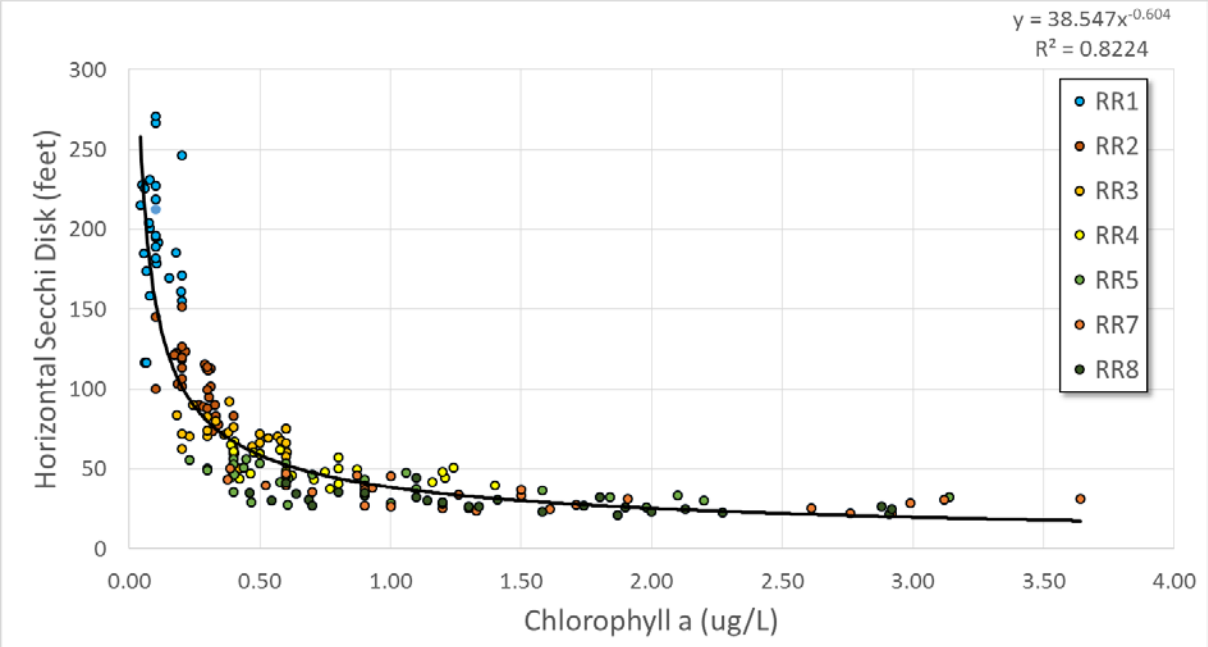


Figure 13: Rainbow River Optical Model - Horizontal Secchi Disk vs. Chlorophyll Concentration (Anastasiou 2006)

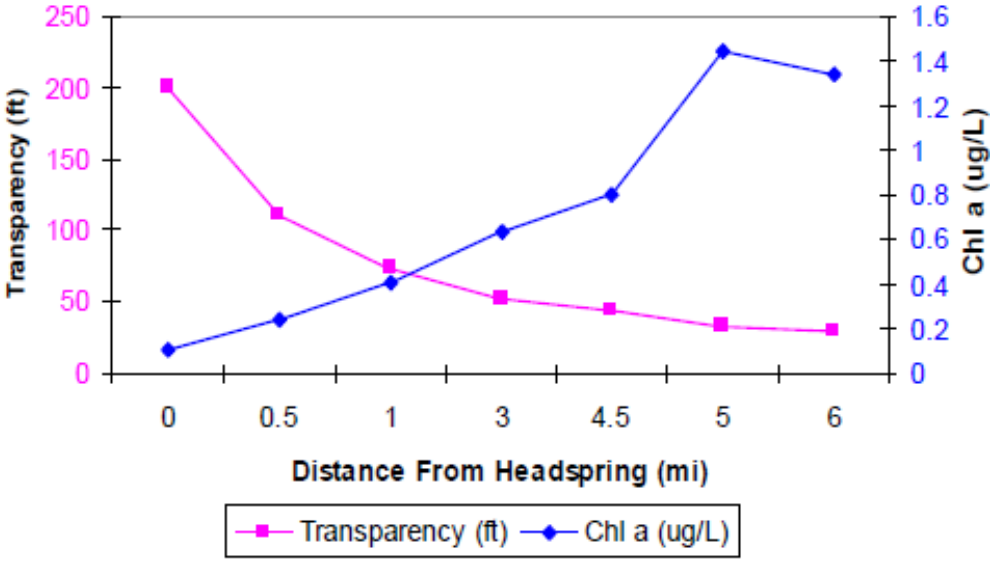


Figure 14: Spatial Distribution of Water Transparency (Secchi Disk) and Chlorophyll Concentration

Water Quantity

Rainbow River is one of the largest spring-fed rivers in Florida with a median flow of 678 cubic feet per second or cfs (based on 691 flow measurements between 1917 and 2015). While flow changes relatively little in spring-fed rivers as compared to typical river systems, flow can vary considerably over longer time periods. For the Rainbow River, the minimum flow measured was 436 cfs (March 27, 2012) and the maximum flow was 1,230 cfs (October 12, 1964). Rainbow River flow is almost entirely derived from spring discharge from the aquifer, and is therefore affected by rainfall patterns and to a lesser extent by groundwater withdrawals. Downstream factors may also affect Rainbow River flow, such as the stage of the Withlacoochee River, operation of the Inglis Dam, and the amount of vegetation in the river.

Rainbow River flow is strongly influenced by rainfall patterns. Since around 1970, there has been a long-term declining trend in rainfall and a corresponding decrease in spring discharge (Kelly and Gore 2008). Largely due to a deficit in rainfall over the last several decades, Rainbow River flow had declined by 19 percent as of 2010 compared to the historical average prior to 1970. Based on computer flow modeling and water budget results from the SWFWMD, the cumulative impact of groundwater withdrawals on Rainbow Springs flow has resulted in a relatively small impact on flow compared to rainfall changes – about a two percent reduction in the long-term average discharge. Figure 15 shows a comparison of Rainbow River average annual flow and 20-year average rainfall at the Ocala, Inverness, and Brooksville stations from 1930-2010. Similar long-term decreasing flow trends have been observed for the other first-magnitude springs systems in the region. However, based on data

analyses by the SWFWMD, above-average rainfall during the last three years has returned Rainbow River flow to above-average conditions in 2014. Rainbow River flows increased from an average of 520 cfs in 2012 to 687 cfs in 2014. In 2014, flow was about 10 cfs higher than the median flow based on historic measurements.

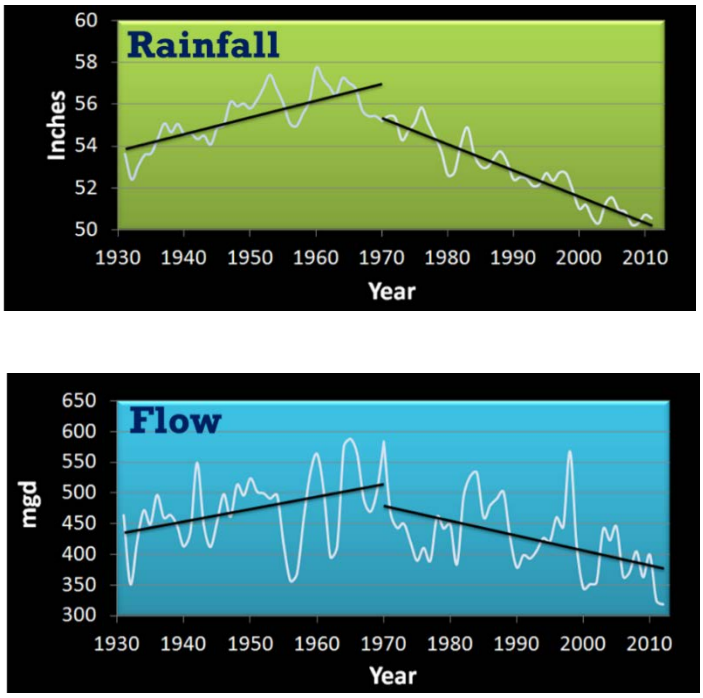


Figure 15: Regional Rainfall versus Rainbow River Flow

Groundwater withdrawals are low in magnitude and dispersed within the Rainbow Springs springshed. In 2012, groundwater withdrawals in the springshed were equivalent to 0.7 inches per year. Using an average recharge rate of 15.2 inches per year, they made up just 4.6 percent of recharge in the basin. If 50 to 60 percent of water withdrawn is returned to the aquifer in the springshed through septic tank leakage, wastewater treatment facilities, and irrigation, then consumptively-used quantities would account for a little over two percent of average recharge.

The SWFWMD maintains a metered and estimated water use database from 1992 through 2012. In the Rainbow Springs springshed, groundwater withdrawals have declined since reaching their peak of 28 mgd in 2006 (Figure 16). In 2012, groundwater withdrawals based on estimated and metered use were 19.6 mgd. Since the year 2000, groundwater use within the springshed has essentially remained flat with a growth rate of only 0.03 mgd per year. Figure 17 shows public supply, domestic self-supply, and agriculture account for the majority of groundwater use in the Rainbow Springs springshed, with lesser amounts used for recreation (e.g. golf courses).

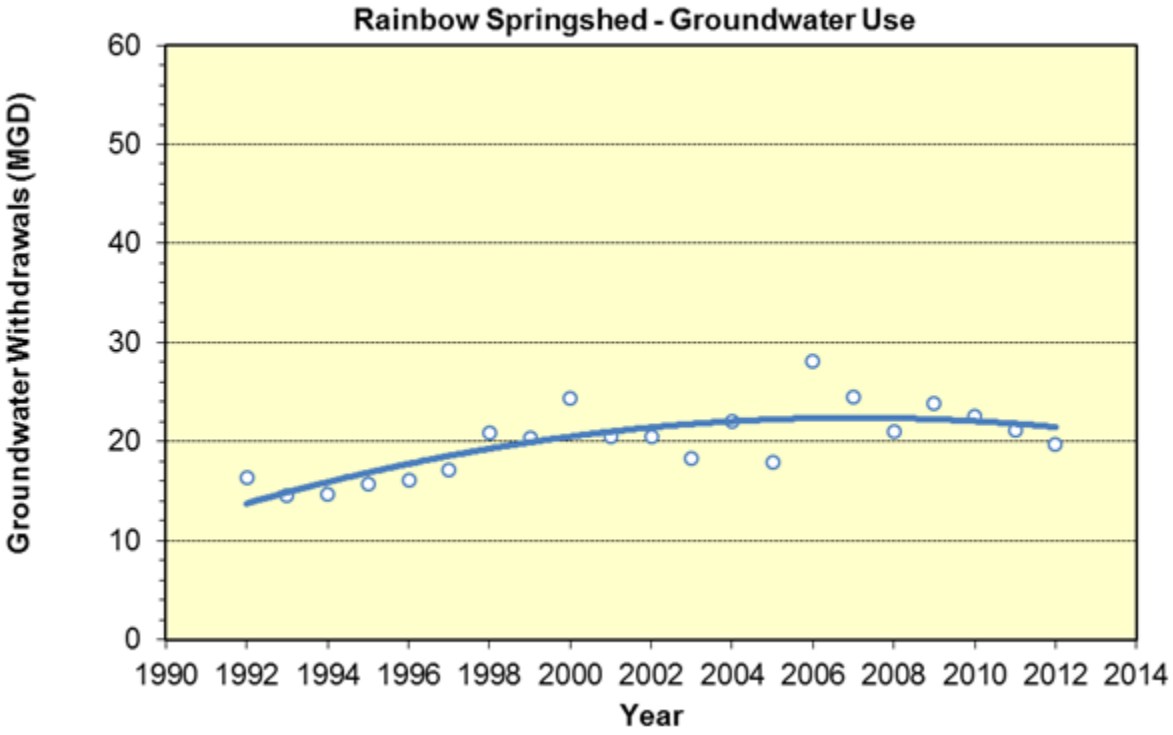


Figure 16: Groundwater Withdrawals within the Rainbow Springs Springshed from 1992-2012

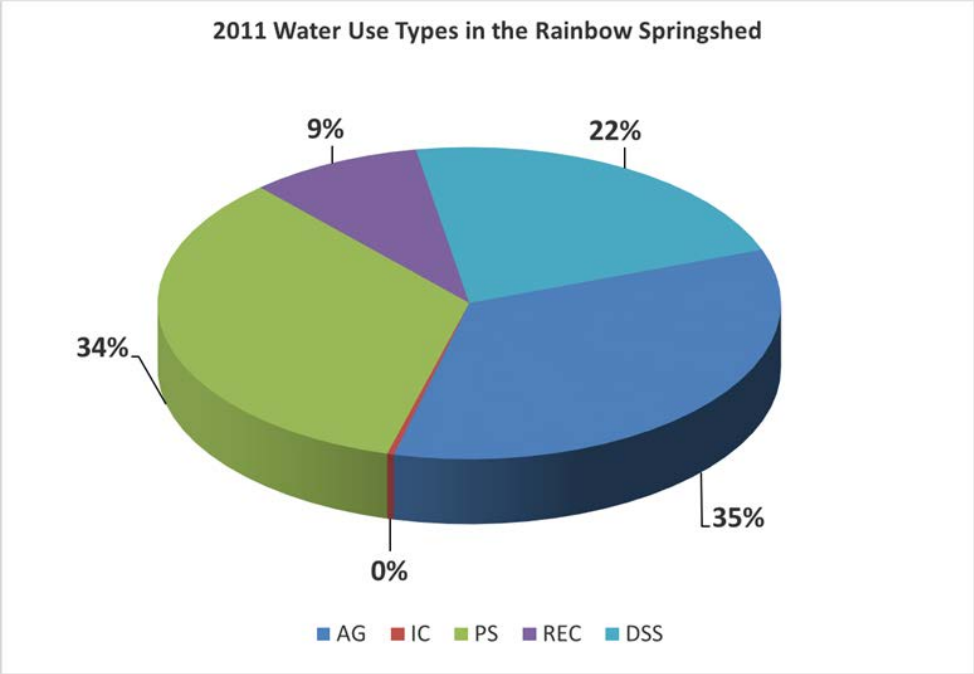


Figure 17: Groundwater Withdrawals by Category within the Rainbow Springs Springshed. AG – Agriculture, IC – Industrial/Commercial, PS – Public Supply, REC – Recreation, DSS – Domestic Self-Supply

While groundwater withdrawals currently have minimal impact on Rainbow River flow, the expected increase in demand for water over the coming decades is being addressed through the development of Minimum Flows and Levels (MFLs) and Regional Water Supply Plans. Both the SWFWMD and the Withlacoochee Regional Water Supply Authority (WRWSA) periodically publish water supply plans to address current and future demands on water resources. In accordance with Florida Statutes, the SWFWMD published its most recent water supply plan in 2010 which made an assessment of projected water demands and potential sources of water to meet these demands for the period 2005-2030. The WRWSA published a Regional Water Supply Plan Update in 2014. The Rainbow River lies within the Northern Planning Region where the 2005-2030 increase in demand is projected to be 90.4 million gallons per day (mgd).

The SWFWMD has been directed to establish MFLs for priority surface watercourses (e.g. streams and rivers) and aquifer systems within its boundaries (Section 373.042, F.S.). As defined by statute, "the minimum flow for a given watercourse shall be the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area." In scheduling the development and adoption of MFLs, State Law further directs the SWFWMD to prioritize all first-magnitude springs, and second-magnitude springs within state or federally owned lands purchased for conservation purposes. MFLs serve as a protective metric for making permitting and planning decisions regarding water withdrawals, either surface or groundwater. If it is determined that water levels or flows in a waterbody are either below or projected to fall below the applicable MFLs during the next 20 years as a result of water withdrawals, then a recovery or prevention strategy must be developed and implemented as part of a regional water supply plan. The MFL for Rainbow River is scheduled to be adopted in 2016.

While reduced flow has been observed in Rainbow River over the past few decades, the effects of reduced flow on the ecosystem have not been well documented. During especially low flows in 2012, filamentous algae was anecdotally observed to move farther upstream into the middle portions of the Rainbow River. In a nearby spring-fed river, lower flow was found to contribute to increased filamentous algae abundance by reducing drag and downstream export (King 2014). Higher flows since 2013 appear to have halted the movement of filamentous algae upstream, but algae mats persist in the lower river.

The hydrology of the lower Rainbow River is influenced by the Withlacoochee River and the downstream Inglis Dam (Downing et al 1989), which can lead to reduced flows and increased residence times in this portion of the river. Decreased water clarity and increased invasive species abundance (Hydrilla and Lyngbya) may be related to lower flows and higher residence times in this area as compared to the upper river. Longer residence times typically lead to higher amounts of phytoplankton in the water column, especially where nutrient enrichment has occurred (Hilton et al. 2006), which reduces water clarity. Lower flow also promotes accumulation of organic sediments and epiphytic

algae which could lead to shifts from desirable native plants to invasive species. Additionally, the lower river is directly connected to several remnant phosphate mining pits, forming river coves that have higher residence times and may be a source of phytoplankton to the river.

Another factor that may affect flow in the Rainbow River is the amount of aquatic vegetation. Vegetation is well known to affect the hydraulics of flow through channels by increasing roughness, and thus reducing flow rates. The Rainbow River contains substantial amounts of aquatic vegetation, which is generally considered to be indicative of a healthy spring ecosystem, but could potentially reduce flow in the river. During low flow periods, the effect of vegetation on flow may increase because the vegetation could fill more of the water column causing increased roughness. This effect of vegetation on flow has been called "vegetative damming" and is currently being studied in several spring-fed rivers in Florida. The relationship between measured Rainbow River flows and measured groundwater levels in a nearby well has changed since about 2000, which could be related to vegetative damming (Figure 18).

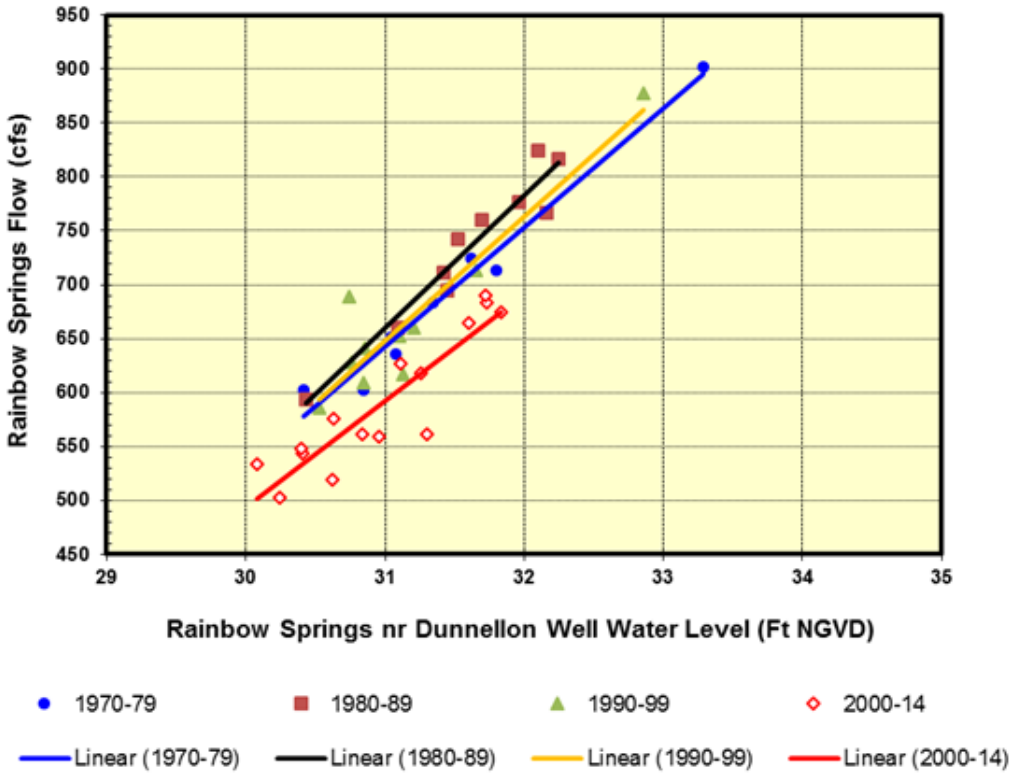


Figure 18: Rainbow River Flow in Relation to a Nearby Groundwater Well

Natural Systems

The Rainbow River contains abundant fish and wildlife habitat, primarily in the form of aquatic vegetation. A wide variety of native emergent and submerged aquatic vegetation (SAV) form diverse communities in the river (Water and Air Research 1991, PBS&J 2000, PBS&J 2007, Atkins and DCWI 2012). The vegetation communities provide habitat (Joiner et al. 1992), help maintain water clarity (LeConte 1861), support primary productivity and nutrient processing (Odum 1957a), aid in sediment stabilization, and provide an aesthetically pleasing environment for people who visit and live on the river.

The first effort to map SAV along the Rainbow River was in 1991 (Water and Air Research 1991) with subsequent mapping occurring approximately every five years (1996, 2000, 2005, 2011). These mapping efforts have found that four SAV species are typically dominant: Sagittaria kurziana, Hydrilla verticillata, Vallisneria americana, and Najas guadalupensis (Table 5). All species except for Hydrilla are native and considered desirable.

Table 5: Changes in SAV Acreage in the Rainbow River (modified from Atkins and DCWI 2012)

SAV Species	1996 Estimated Acreage	2000 Estimated Acreage	2005 Estimated Acreage	2011 Estimated Acreage
Sagittaria kurziana	50.4	49.2	48.7	38.5
Hydrilla verticillata	24.0	25.7	26.9	10.1
Vallisneria americana	6.2	5.7	8.2	7.7
Najas quadalupensis	2.5	1.0	4.7	5.7
Chara sp.	1.5	2.0	1.0	3.0
Ceratophyllum demersum	2.7	1.5	2.7	1.7
Other SAV	1.5	1.0	2.2	4.2
Total	**88.5**	**86.2**	**94.1**	**71.2**
Native Species[1]	**64.5 (43.5%)**	**60.5 (40.7%)**	**67.2 (45.3%)**	**61.3 (41.2%)**
Invasive Species[1,2]	**24.0 (16.1%)**	**25.7 (17.4%)**	**26.9 (18.2%)**	**10.1 (6.7%)**

1 Percentages represent SAV coverage of the entire Rainbow River excluding areas with emergent and forested vegetation

2 Invasive Species includes Hydrilla only; filamentous algae acreage will be estimated in the 2015 vegetation evaluation

Although submerged and emergent aquatic vegetation communities are currently healthy in the upper reaches of the river, there are concerns that the future of these communities may be at risk. While native SAV, such as Sagittaria and Vallisneria form extensive meadows in the upper river, they are less abundant in the middle reaches of the river and greatly reduced in the lower river. In the lower river, where native grasses are scarce, Hydrilla and Lyngbya, a filamentous algae, are more common. Hydrilla is an exotic invasive aquatic plant found in the Rainbow River since the 1970s. Lyngbya is a filamentous type of cyanobacteria (blue-green algae) that has become prevalent in many springs throughout the state. Hydrilla and Lyngbya can grow rapidly and have the ability to out-compete native submerged aquatic plant communities.

Heavy recreation has caused noticeable damage to aquatic vegetation communities in the Rainbow River. Between 2010 and 2011, the Rainbow River attracted over 262,000 visitors with the majority of

people visiting during the summer months. Motor boats have been shown to cause the greatest impact to SAV, with some impact from other recreational user groups such as tubers and kayakers (Mumma et al. 1996, Cichra and Holland 2012). Motor boats have also caused propeller scars in SAV beds (Cichra and Holland 2012). Recreation along the river contributes to loss of habitat, specifically loss of desirable SAV.

Sections of the Rainbow River shoreline have been developed and hardened, leading to loss of the water quality and fish and wildlife habitat benefits that the natural riparian areas provide. The 2011 vegetation evaluation found that 19% of the shoreline was hardened (2.6 miles) and the remainder was in natural condition (11 miles) (Atkins and DCWI 2012). Additionally, the overall number of docks on the river increased from 241 in 2005 to 251 in 2011.

Management Actions

Since its inclusion as a SWIM priority water body in 1989, the SWFWMD, with a variety of state and local government partners, have worked together to identify issues and develop strategies to protect and improve conditions in this unique first magnitude spring system. Information from several diagnostic studies and pilot restoration activities, some of which were the result of the 1989, 1995, and 2004 SWIM plans, and stakeholder knowledge were used to develop the management actions outlined in this plan. One of the goals of this SWIM plan is to implement these management actions to address the major issues and drivers and ultimately restore, maintain, and preserve the ecological balance of the Rainbow River.

Quantifiable Objectives

The Rainbow River SWIM plan includes numeric targets called quantifiable objectives. If these objectives are achieved, the expected result is a healthy spring ecosystem (Table 6). These are long term goals and may require considerable time and effort to achieve. Quantifiable objectives can be used to develop and prioritize management actions and projects, thus promoting effective and efficient resource management. The following section describes the quantifiable objectives for each of the three strategic management areas: water quality, water quantity, and natural systems.

Table 6: Quantifiable Objectives

Water Quality	Target
Water clarity in the river	>100 feet[1]
Nitrate concentration in the springs and river	<0.35 mg/L[2]
Water Quantity	
Minimum flows for the springs and river system	TBD in 2016[3]
Natural Systems	
Coverage of desirable submerged aquatic vegetation in the river	>65%[4]
Coverage of invasive aquatic vegetation (hydrilla/filamentous algae) in the river	<10%[4]

[1] Based on Anastasiou 2006 and average river-wide data presented in Table 3
[2] FDEP 2013 – Nutrient TMDL for Rainbow Springs Group and Rainbow Springs Group Run
[3] SWFWMD 2015 Minimum Flows and Levels Priority List and Schedule
[4] Based on data presented in Table 4 from the 2011 Rainbow River vegetation evaluation (Atkins and DCWI 2012)

Water Quality

The water quality management actions for the Rainbow River SWIM plan are primarily focused on reducing nitrogen loads in accordance with the adopted TMDL and the BMAP being developed by FDEP. The TMDL for Rainbow Springs and River sets a target nitrate-nitrogen concentration of 0.35 mg/L, which would require an 82% decrease in concentration in the surface waters (FDEP 2013). The SCSC recognizes that agricultural operations and septic tanks are the priority water quality management action categories for the Rainbow River. While nitrogen has been identified as the primary nutrient causing impairment, phosphorus is another important nutrient that will continue to be evaluated. Table 7 lists all of the management actions that have been identified by the SCSC to address water quality issues, primarily focused on reducing nitrogen loading, categorized according to the source type. These management actions are types of potential actions that would reduce nitrogen loading to springs if implemented. The lead entity (or entities) that could be primarily responsible for each action have also been identified.

Table 7: Water Quality Management Actions

Management Action	Lead Entity
Monitoring & Research	
Improve our understanding of the ecological responses to nutrient enrichment and reductions	FDEP/SWFWMD/Universities
Maintain and expand water quality monitoring programs	SWFWMD/FDEP
Report annual status and trends	SWFWMD
Evaluate new and emerging technologies	SWFWMD
Agricultural Operations (Cattle Farms, Horse Farms, Row Crops)	
Outreach and coordination	FDACS/UF-IFAS
Implement available BMPs	FDACS/SWFWMD/USDA
Evaluate available BMPs	FDACS/UF-IFAS
Research and develop advanced BMPs	FDACS/UF-IFAS/SWFWMD
Evaluate land development code regulations	Local/FDACS/FDEP/UF-IFAS
Septic Tanks	
Improve existing septic tank performance	FDOH/FDEP/Local where applicable
Conversion from septic tanks to sewer systems where practical	FDOH/FDEP/SWFWMD/Local
Limit new septic tank installations	Local
Research and develop advanced septic tank systems	FDOH/FDEP/UF-IFAS
Education campaign	FDOH/FDEP/Local
Urban/Residential Fertilizer (includes Golf Courses)	
Evaluate fertilizer application strategies	Local/FDEP/UF-IFAS
Implement fertilizer ordinances	Local/FDEP
Implement Florida Friendly Landscaping practices and golf course/green industry BMPs	Local/UF-IFAS/FDEP/SWFWMD
Expand re-use water for landscape irrigation	FDEP/SWFWMD/Local
Education campaign	Local/UF-IFAS/FDEP/SWFWMD
Wastewater Treatment Facilities	
Upgrade WWTFs to advanced treatment	Local/FDEP
Implement post-treatment nutrient removal systems	Local/FDEP/SWFWMD
Stormwater	
Develop stormwater master plans as needed	Local/SWFWMD
Implement stormwater ordinances	Local
Implement stormwater treatment systems	Local/SWFWMD/FDEP/FDOT
Evaluate performance of stormwater treatment systems	Local/Universities/SWFWMD
Implement advanced stormwater treatment systems	Local/SWFWMD
Develop new advanced stormwater treatment systems	Universities/SWFWMD
Develop a standard design manual for advanced stormwater treatment systems	Local/SWFWMD/FDEP
Septage	
Improve regulatory oversight of land disposal activities and siting	FDEP/FDOH
Establish capacity for land disposal activities	FDEP/FDOH/Local
Atmospheric Deposition	
Evaluate potential sources	FDEP

Water Quantity

The water quantity management actions for Rainbow River are intended to maintain spring flows for future generations. The SCSC recognizes that water conservation and MFL adoption are the priority water quantity management action categories for the Rainbow River. Table 8 lists all of the management actions that have been identified by the SCSC to address water quantity issues. These are types of potential actions that would maintain flow in the springs and river if implemented. The lead entity (or entities) that could be primarily responsible for each action have also been identified.

Table 8: Water Quantity Management Actions

Management Action	Lead Entity
Monitoring & Research	
Improve understanding of how rainfall patterns, climate drivers, and sea-level rise affect spring flow	SWFWMD/NOAA/ Universities
Maintain and expand as needed spring flow and aquifer level monitoring programs	SWFWMD/FDEP
Evaluate the influence of hydrologic alterations and their operation on spring flow	SWFWMD/USACE
Better quantify the impacts of land use and resource management activities on recharge rates	SWFWMD/FDACS/ Universities
Continue refinement of surface and groundwater modeling to evaluate water withdrawals and their effects on the springs	SWFWMD/FDEP/USGS/ Universities
Conservation - Public & Self Supply	
Facilitate the retrofit of inefficient water devices in pre-1994 structures	SWFWMD/Local
Promote low-water use landscaping	SWFWMD/UF-IFAS/Local
Promote cost-share programs	SWFWMD/WRWSA/Local
Utilize appropriate guidance documents to promote water conservation	SWFWMD/WRWSA/ Utilities/ Universities
Improve infrastructure efficiency	SWFWMD/WRWSA/ Utilities
Utilize conservation rate structures	Utilities
Conservation - Agriculture	
Implement water quantity based BMPs	FDACS/SWFWMD/NRCS
Promote cost-share programs	SWFWMD/FDACS/NRCS
Promote agriculture water conservation based research	Universities/ UF-IFAS
Conservation - Industry/Commercial	
Improve infrastructure to reduce water loss and increase efficiency	Private
Technology and engineering improvements	Private/ Universities
Promote cost-share programs	SWFWMD/Private
Conservation - Golf Courses	
Implement water quantity based BMPs	FDACS/UF-IFAS/ Private/USGA
Promote and incentivize low-water use landscaping	SWFWMD/UF-IFAS/USGA
Promote cost-share programs	SWFWMD/Private

Management Action	Lead Entity
Alternative Water Supply - Reclaimed Water	
Evaluate areas where the use of reclaimed water could be used to offset groundwater withdrawals	SWFWMD/FDEP/WRWSA/ Utilities
Promote permit incentives	SWFWMD/FDEP/WRWSA/ Utilities
Evaluate and promote where feasible indirect and direct potable reuse	SWFWMD/FDEP
Expand education campaign	SWFWMD/FDEP/WRWSA/ Utilities
Promote cost-share programs	SWFWMD/FDEP/WRWSA/ Utilities
Alternative Water Supply - Surface Water/Desalination	
Continue to evaluate sources and project options	SWFWMD/WRWSA
Continue to evaluate storage & recovery options and desalination	SWFWMD/WRWSA
Alternative Water Supply - Lower Floridan Aquifer	
Determine feasibility, impacts, benefit and cost estimates	SWFWMD/WRWSA
Alternative Water Supply - Stormwater	
Utilize for local and regional storage and reuse	SWFWMD/FDEP/Local
Increase utilization of permeable surfaces	SWFWMD/FDEP/Local
Install rain gardens and other LID components to capture and store stormwater for reuse	SWFWMD/FDEP/Local
Promote cost-share programs	SWFWMD/FDEP/Local
Regional Water Supply Planning	
Support the implementation of the WRWSA's 2014 Regional Water Supply Plan Update where determined to be consistent with the SCSC goals	All
Explore the need to adopt a multi-stakeholder approach	All
Regulatory	
Evaluate springs-specific Water Use Permitting criteria	SWFWMD
Evaluate the need for Water Use Caution Areas	SWFWMD
Develop and utilize inter-District planning and permitting	WMDs/FDEP
Evaluate potential local ordinances	Local
Consider water use when developing comprehensive plans	Local
Minimum Flows and Levels	
Develop and adopt Minimum Flows and Levels	SWFWMD
Continue to explore new approaches for establishing Minimum Flows and Levels	SWFWMD

Natural Systems

The natural systems management actions for Rainbow River directly address fish and wildlife habitat. Habitats include those within a spring system itself (e.g. submerged aquatic vegetation) and those adjacent to a spring system (e.g. wetlands and uplands). The SCSC recognizes that invasive species management and recreation management are the priority natural systems management action categories for the Rainbow River. Table 9 lists all of the management actions that have been identified by the SCSC to address natural systems issues. These are types of potential actions that would improve and maintain fish and wildlife habitat in and along the springs and river if implemented. The lead entity (or entities) that could be primarily responsible for each action have also been identified.

Table 9: Natural Systems Management Actions

Management Action	Lead Entity
Monitoring & Research	
Continue to develop and test restoration techniques for improving fish and wildlife habitat in spring systems	SWFWMD/FFWCC/ Universities
Continue and refine efforts to monitor aquatic plant and animal communities	SWFWMD/FFWCC/FDEP/ Universities
Improve understanding of trophic dynamics (i.e. food webs) and nutrient cycling in spring systems	FFWCC/Universities/SWFWMD
Improve understanding of the effects of sediment characteristics, flow velocities, and other factors on aquatic plants and algae	SWFWMD/FFWCC/ Universities
Habitat Conservation	
Maintain and expand land acquisition programs to purchase land along spring systems and throughout springsheds	SWFWMD/FDEP/Local/ NGO
Develop management and use plans for acquired lands	SWFWMD/FDEP/Local/ NGO
Develop management standards for shoreline disturbance	FDEP/SWFWMD/Local
Improve education and outreach to riparian homeowners and boat/tube rental companies	SWFWMD/Local/ Universities/NGO/ FFWCC/USFWS
Habitat Restoration - Revegetation	
Install and maintain desirable submerged aquatic vegetation where appropriate	SWFWMD/FFWCC/Local/ Residents/NGO
Install and maintain emergent aquatic vegetation where appropriate	SWFWMD/FFWCC/Local/ Residents/NGO
Investigate ways for permit exemptions and for streamlined permitting pathways for appropriate revegetation projects	SWFWMD/FFWCC/FDEP/ USACE
Habitat Restoration - Living Shorelines	
Install living shorelines where appropriate	SWFWMD/FFWCC/Local/ Residents
Install and properly maintain floating wetland systems where appropriate	SWFWMD/FFWCC/Local/ Residents
Develop a homeowners guide to living shorelines	SWFWMD/FFWCC/Local
Investigate ways for permit exemptions and for streamlined permitting pathways for appropriate living shoreline projects	SWFWMD/FFWCC/FDEP/ USACE
Habitat Restoration - Woody Material	
Install woody material where appropriate	SWFWMD/FFWCC
Habitat Restoration - Sediment/Muck Management	
Remove undesirable benthic sediments where appropriate	SWFWMD/Local/FFWCC/NGO

Management Action	Lead Entity
Habitat Restoration - Reforestation	
Install and maintain trees and shrubs along the shoreline where appropriate	SWFWMD/FDACS/FFWCC/ USDA-NRCS/Local/ NGO/Residents
Install and maintain native communities in upland areas within springsheds	SWFWMD/FDACS/FFWCC/ USDA-NRCS/Local/ NGO/Residents
Invasive Species Management	
Manage invasive aquatic plants based on sound scientific research and stakeholder input	SWFWMD/FFWCC/FDEP/ Local/NGO/ Universities
Implement initiatives with local residents to participate in proper invasive plant management	SWFWMD/FFWCC/Local
Implement initiatives with local residents that demonstrate how proper invasive plant management benefits the system	SWFWMD/FFWCC/Local
Encourage new and innovative techniques for invasive plant management through scientifically sound research	SWFWMD/FFWCC/Local/ Universities
Manage invasive animals as necessary	FFWCC/Local
Recreation Management	
Increase the presence of law enforcement to enforce existing ordinances/rules	USFWS/FFWCC/Local
Establish and implement comprehensive recreation management plans	USFWS/FDEP/FFWCC/ Local/NGO
Promote low impact ecotourism activities	Local/FFWCC/FDEP/USFWS

Projects and Initiatives

Projects and initiatives for Rainbow River identified in this plan address specific management actions as outlined in the previous section. Not every management action has a specific project associated with it. The TWG provided ongoing and proposed projects to the SCMC and SCSC for review and approval. All ongoing projects were included within the plan. The proposed projects were reviewed and some were recommended as priority projects by the SCMC and SCSC.

Ongoing Projects and Initiatives

Ongoing projects and initiatives currently exist and have funding secured (if applicable). Tables 10, 11 and 12 list the projects and initiatives that are considered ongoing and will support the overall objective of improving the water quality, water quantity, and natural systems aspects of the Rainbow River.

Water Quality

Table 10: Ongoing Water Quality Projects and Initiatives

Monitoring & Research
Quarterly Springs Water Quality Monitoring Lead Entity: SWFWMD Quarterly to yearly water sample collection and analyses from 70 springs across the District including Rainbow Springs. Springs monitoring tracks and assesses trends in dissolved nitrate and 27 other water quality parameters. Monitoring water quality of spring discharge is critical in evaluating the environmental and ecologic conditions of these rivers. Water-quality monitoring of springs is also the principle means of assessing the overall groundwater quality in the spring basins that recharge the Upper Floridan aquifer and deliver water to the springs. Ongoing monitoring and trend analyses of water quality characteristics at springs are critical to effective management and protection of this vital resource. Springs water quality is directly associated with groundwater resources assessment, including Minimum Flows and Levels, and evaluation of potential impacts from permitted water uses in the District. Long term monitoring of springs will be instrumental in determining effectiveness of BMPs applied to both urban and rural land uses. Annual cost (recurring): $180,000 (cost includes springs outside of Rainbow Group) Status: Ongoing
Stream Water Quality Monitoring Lead Entity: SWFWMD

District-wide monitoring network including eight surface water stations spread throughout the Rainbow River from the headsprings to the mouth.

This project supports key areas including:

- Establishment of baseline water quality conditions
- Biological and water quality studies and evaluation
- Determining loading estimates for basins with available discharge data
- MFL development, evaluation and compliance
- Project planning and performance monitoring
- SWIM plan management strategies
- SWIM recommendations for action and restoration
- Establishment and re-evaluation of Total Maximum Daily Loads
- Environmental Resource permitting and compliance

Annual Cost (Recurring): $365,000 (cost includes streams other than Rainbow River)

Status: Ongoing

Upper Floridan Aquifer Nutrient Monitoring

Lead Entity: SWFWMD

The Upper Floridan Aquifer Nutrient Monitoring Network (UFANMN) currently consists of approximately 100 wells covering springs-groundwater basins across Levy, Marion, Citrus, Hernando and Pasco counties. This project involves yearly water sample collection and analyses from these wells.

Data collected through the UFANMN are instrumental in evaluating groundwater-quality BMPs for dominant land uses in the spring basins. Current strategies for maintaining and improving groundwater quality, and reducing nitrate levels at springs, depends on implementing and assessing effectiveness of BMPs in the basins. The UFANMN data can be used in this process as a means to evaluate changes in groundwater quality where BMP programs are established. Current understanding of groundwater movement from the basins to the springs requires effective monitoring in the basin, as well as monitoring of the springs. Since groundwater moves relatively slow, and can take years to eventually move from sources of nitrate loading to the springs, BMP assessments must include groundwater monitoring near the potential sources.

Annual Cost (Recurring): $120,000

Status: Ongoing

Springs Initiative Monitoring

Lead Entity: SWFWMD

This project is for the collection of water quality and quantity data in our five first-magnitude springs systems, including Rainbow River. This project aims to determine the relationships between nutrient (nitrogen and phosphorus) and chlorophyll concentrations in these spring-fed systems and understand the role that salinity, springs discharge, and velocity are having on their ecology.

Mapping stream velocities will be integral to better understanding nutrient cycling and the distribution of submerged aquatic vegetation. This will provide critical information to drive management actions to address nutrient sources for the springshed.

Cost: $360,000 (FDEP providing full amount through Legislative Appropriation to SWFWMD)

Status: Ongoing

Evaluation of Nitrogen Leaching from Reclaimed Water Applied to Lawns, Spray Fields, and RIBs

Lead Entity: SWFWMD

This multi-year funded project will assess nitrogen leaching from reclaimed water application to lawns, spray fields, and rapid infiltration basins (RIBs). Several different types of soil amendments such as sawdust, tire crumbs, and limestone will also be evaluated to determine their ability to reduce nitrogen leaching from reclaimed water applied to RIBs.

This project will determine typical nitrogen leaching rates from reclaimed water application to lawns, spray fields, and RIBs. This information can be used to refine estimates of nitrogen loading to the aquifer and springs, and identify the best reclaimed water disposal methods to minimize nitrogen loading to groundwater. The nitrogen reduction capabilities of several soil amendments will also be assessed to develop new best management practices (BMPs) to reduced nitrogen loading from RIBs to the groundwater. Implementation of these BMPs has the potential to improve water quality in the aquifer and springs.

Cost: $294,000

Status: Ongoing

Agricultural Operations

Clean Farms Initiative

Lead Entity: Marion County

The Clean Farms Initiative is designed to assist Marion County farm owners and managers with implementation of BMPs for animal waste and nutrient management and to recognize them for their cooperative efforts. The Initiative was begun by passage of Resolution 04-R-384, by the Marion County Board of County Commissioners, which recognizes the importance of agriculture to the county's history and economy, while also recognizing the need to protect water resources.

The Farm Outreach Coordinator educates on water quality, targeting practices such as manure management and fertilization. Education is provided on Best Management Practices (BMPs), science-based and field-tested techniques meant to help protect and preserve the integrity of the ground and surface waters. Events and programs, ranging in size from a few to over a thousand, are developed and produced; tabling/networking at equine events is done regularly. Talks and presentations to various groups are also produced and given. Monthly articles written for trade journals, such as The Florida Horse, further enhance one-on-one farm consultations. Partnerships with government, NGO's and community agencies that share common goals are developed and sustained. The Marion County Soil & Water Commission has also established a program to recognize Farms of Environmental Distinction.

The benefits of continuing this project is to promote the protection of groundwater, surface water, and wetlands from runoff from equine activities.

Cost: $30,000 annually

Status: Ongoing

Central Florida Springs Region Agricultural BMP Cost Share Program

Implementation and Expansion

Lead Entity: Marion Soil & Water Conservation District / FDACS

The Central Florida Springs Region FDACS water quality and water quantity BMP Cost Share Program was established to promote water quality and water quantity BMPs that provide overall water resource benefits to commercial agricultural producers. Through this program, FDACS will reimburse eligible producers, through the Marion Soil and Water Conservation District, for selected agricultural practices that have potential sediment control, water conservation and/or water quality improvement benefits. It is anticipated the program will provide farm managers and owners with economic incentives to facilitate implementation of FDACS-adopted BMPs. FDACS funding levels vary year-to-year dependent upon the State of Florida program allocations and are not currently adequate to keep up with demand. As of February 2015 eight commercial producers were on a waiting list due to a budget shortfall of $51,498.

This is a major program already in place that can significantly benefit the Rainbow River by incentivizing the implementation of BMPs for commercial producers.

Annual Cost (recurring): $350,000

Status: Ongoing

Silviculture BMP Implementation and Compliance

Lead Entity: FDACS Florida Forest Service

This project continues and expands biennial BMP surveys, targeted training, and technical assistance for landowners and forestry professionals engaged in silviculture operations in the Rainbow Springs BMAP area.

BMPs for silviculture are applicable to public and private industrial and non-industrial forest-lands. Silviculture BMPs were first developed in the mid-1970's in response to the Federal Clean Water Act. The first Silviculture BMP Manual was published in 1979; it was most recently revised in 2008. Silviculture BMPs are the minimum standards for protecting and maintaining water quality during ongoing silviculture activities, including forest fertilization.

Cost: TBD

Status: Ongoing

FDACS-adopted Water Quality/Quantity BMP Implementation and Compliance

Lead Entity: Marion County SWCD / FDACS Office of Agricultural Water Policy

Agricultural nonpoint sources in a BMAP area are required by state law (Subsection 403.067[7], F.S.) either to implement FDACS-adopted BMPs or to conduct water quality monitoring prescribed by FDEP or water management district, to demonstrate compliance with water quality standards. Failure either to implement BMPs or conduct monitoring may bring enforcement action by the FDEP or water management district. The implementation of FDACS-adopted, Department-verified BMPs in accordance with FDACS rule provides a presumption of compliance with state water quality standards.

FDACS field staff and technicians (either through Soil and Water Conservation Districts or the University of Florida/IFAS) are continually working to reach agricultural operations to enroll in our FDACS-adopted BMPs Program. Our office is authorized to continually update, develop, adopt, and assists producers in implementing agricultural BMPs to improve water quality and water conservation. Currently there are eight BMP Manuals adopted. These include manuals for cow/calf, citrus, vegetable and agronomic crops, nurseries, equine, specialty fruit and nut, sod, and wildlife. Our office is working to update the vegetable and agronomic crop manual and is developing dairy and poultry manuals to be adopted in the near future. Our office contracts with the Marion SWCD to employee a technician to assist producers/land owners with implementing BMPs and enrolling in our FDACS-adopted BMP Program.

Cost: $80,000

Status: Ongoing

Septic Tanks

Florida Onsite Sewage Nitrogen Reduction

Lead Entity: FDOH

The objectives of this study are to:
Develop cost-effective, passive strategies for nitrogen reduction from onsite sewage

Characterize nitrogen removal in the soil and shallow groundwater

Develop simple models on fate and transport of nitrogen in soil and groundwater

Cost: $4,700,000

Status: Ongoing

Marion County Transfer of Vested Rights

Lead Entity: Marion County

Transfer of Vested Rights (TVR) Program is designed to minimize dense development of vested properties without central water, and sewer systems, and/or other supporting infrastructure, and thereby protect natural resources, encourage and enhance the development of larger parcels, reduce the County's inventory of vested properties, and permit the County to better plan for future growth. The land from which vested rights are transferred is subject to a conservation easement. Article 3 of the Land Development Code defines the TVR program and eligible sending and receiving areas.

Cost: N/A

Status: Ongoing

Urban/Residential Fertilizer

Development of Landscape Fertilizer BMPs

Lead Entity: UF-IFAS / SWFWMD

The objective of this project is to verify the accuracy of the Florida Yards and Neighborhoods (FYN) and Florida Green Industries best management practices (BMPs) fertilizer recommendations across a wide range of common landscape plants. Plant growth, biomass allocation, shoot nutrient status, foliar characteristics and aesthetic quality will be evaluated.

This project represents a significant step to develop and implement accurate, science-based fertilizer BMPs for urban (residential and commercial) landscapes. This study aims to improve the quality of stormwater that leaves an urban landscape by influencing the amount of fertilizer that is applied to these landscapes. The results of the project will be applicable to ornamental plants grown in residential and commercial landscapes. This research will provide scientific data on the fertilizer needs of landscape plants and will improve the accuracy, credibility and long-term viability of statewide BMP programs, such as the FYN program.

Cost: $274,429

Status: Ongoing

Wastewater Treatment Facilities

Developing Tools for Surface Nutrient Loading Attributable to Reclaimed Water

Lead Entity: WateReuse / WMDs / FDEP

The project involves a coordinated study (WateReuse, FDEP, SJRWMD, SFWMD, SWFWMD and other entities) to develop additional indicators to determine the nutrient loading attributable to reclaimed water versus septic tank effluent. The project is the next phase of a prior project which enabled researchers to utilize Sucralose (Splenda sweetener) levels to determine wastewater inputs to water sources.

The project will assist in obtaining a greater understanding of the nutrient sources and impacts from wastewater and reuse related activities. The study will research tools to use other trace compounds as a means to further distinguish between septic tank and reuse nutrient loading to water bodies.

Cost: $379,666

Status: Ongoing

Rainbow Springs Infrastructure Development – Phase 1

Lead Entity: Marion County

This project is a comprehensive effort to eliminate existing and future poor quality wastewater discharges into the Rainbow Springs area surrounding the City of Dunnellon. The project components include construction of a new, expandable wastewater treatment plant and wastewater collection system. Wastewater will be collected from eight existing secondary level package wastewater treatment plants.

This project reduces nutrient loading to Rainbow River and Springs and will also make additional reclaimed water available for agricultural irrigation needs.

Cost: $42,000,000

Status: Ongoing

Juliette Falls WWTP to San Jose WWTP Force Main Connection

Lead Entity: City of Dunnellon

Proposed project to connect the Juliet falls and San Jose WWTPs. The Juliet Falls plant is currently offline due to lack of demand. Wastewater is periodically collected and trucked to San Jose WWTP. The force main will run along SW 180th Avenue Road and

allow three package plants to be taken offline. The septic tank at the State Park tuber exit may also be taken offline. The connection will also allow for the Juliet falls plant to be brought back online for production of reuse water for the Juliet Falls golf course.

This project has multiple benefits include an estimated total nitrogen load reduction of approximately 5,000 lbs/yr. This project also has the benefit of providing reuse water to a nearby golf course.

Cost: TBD

Status: Ongoing

Stormwater

City of Williston Watershed Management Plan

Lead Entity: City of Williston / SWFWMD

This watershed management plan will analyze flooding and water quality issues that exist in the City of Williston watershed, which is contained within the Rainbow Springs springshed. Currently, flood analysis models are not available and the watershed includes regional or intermediate stormwater systems.

The LiDAR data and Watershed Evaluation are necessary to produce the watershed model, floodplain analysis, and alternatives analysis; information that is critical to better identify risk of flood damage, water quality issues, and cost effective alternatives.

Cost: $350,000

Status: Ongoing

Watershed Management Plan for the West Ocala, Lake Stafford East, Priest Prairie Drain and West Marion Watersheds

Lead Entity: Marion County / SWFWMD

This is a multi-year funded project to analyze flooding and water quality issued in the West Ocala, Lake Stafford East, Priest Prairie Drain and the West Marion Watersheds, which include Turner Creek, Lake Stafford South, Bell Branch, and East Bronson watersheds.

Completing elements of the District's Watershed Management Program is one of the District's Strategic Priorities for managing the water resource, and provides information to local governments to manage stormwater quality and flooding within a specific watershed. The information developed provides the science for the District's resource management and Environmental Resource Permitting (ERP) responsibilities.

Cost: $210,974.54

Status: Ongoing

Street Sweeping of Marion County Roads

Lead Entity: Marion County

Sweeping of Marion County–maintained roads. Sweeping of roads with curb and gutter is completed 9 times per year.

This project helps remove debris, sediment, and potential pollutants from streets and prevent entry into storm sewer system. The benefits to the river and springs is that an estimated total nitrogen load reduction of 194 lbs/yr is achieved county wide.

Note: The County recently added all subdivisions with Miami-curb into the street sweeping contract. This has increased the annual mileage swept from 1,375 miles to 1,858 miles (an increase of 483 miles).

Cost: $51,110 per year

Status: Ongoing

Sinkhole Repair Program in County Drainage Retention Areas

Lead Entity: Marion County

This is part of an ongoing stormwater system maintenance program. Performed as needed by County crews or contractors depending on size and scope of repair.

Annual Cost (recurring): $150,000

Status: Ongoing

Rainbow River NW 119 Ave Stormwater Retrofit Project

Lead Entity: Marion County / SWFWMD

The Rainbow River NW 119 Ave Stormwater Retrofit Project consists of construction of a 0.40 acre wet detention system and conveyance system improvements at the intersection of West HWY 316 and NW 119th Avenue on the south side of West HWY 316. The project is located in northwestern Marion County within the Rainbow Springs springshed. The stormwater retrofit project will treat stormwater captured from a 55.6 acre contributing area, made up of suburban residential land use.

Based on modeling performed under the Watershed Management Plan, runoff from the drainage basin crosses West HWY 316 and flows north to a small wetland with associated floodplain. The only water quality treatment currently provided is infiltration within the grassed swales prior to discharge into the small wetland. The proposed wet retention system will reduce total nitrogen (TN) by an estimated 28% (28.5 lbs/yr) and nitrate-nitrogen (NOx) by an estimated 74% (6.5 lbs/yr) prior to discharge to the existing small wetland.

The Resource Benefit of the Water Quality project is the reduction of pollutant loads to Rainbow Springs, a SWIM priority water body, by an estimated 28.5 lbs/ yr TN. The Measurable Benefit is the construction and maintenance of stormwater BMP's to treat approximately 55.6 acres of suburban residential stormwater runoff.

Cost: $54,000

Status: Ongoing

Rainbow River NW Hwy 225 Stormwater Retrofit Project

Lead Entity: Marion County / SWFWMD

The Rainbow River NW Hwy 225 Stormwater Retrofit Project consists of construction of a 1.50 acre wet detention system and conveyance system improvements at the intersection of NW HWY 225 and HWY 316. The project is located in northwestern Marion County within the Rainbow Springs springshed. The stormwater retrofit project will treat a total 31.4 acre contributing area, made up of suburban residential land use.

Based on modeling performed under the Watershed Management Plan, runoff from the drainage basin crosses HWY 225 and flows southwest to a wetland with associated floodplain. The only water quality treatment currently provided is infiltration within the grassed swales prior to discharge into the wetland area. The proposed wet detention system will reduce total nitrogen (TN) by an estimated 33% (67.5 lbs/yr) and nitrate-nitrogen (NOx) by an estimated 80% (19.3 lbs/yr) prior to discharge to the existing wetland.

The Resource Benefit of the Water Quality project is the reduction of pollutant loads to Rainbow Springs, a SWIM priority water body, by an estimated 67.5 lbs/ yr TN. The Measurable Benefit is the construction and maintenance of stormwater BMP's to treat approximately 31.4 acres of suburban residential stormwater runoff.

Cost: $182,000

Status: Ongoing

Rainbow Springshed Stormwater Retrofits Project

Lead Entity: Marion County / SWFWMD

The Rainbow Springshed Stormwater Retrofits Project involves three dry retention areas (DRA 2165, DRA 2167, and DRA 3166) located in southwestern Marion County within the Rainbow Springs springshed and within two miles of Rainbow Springs. The three DRAs have a total 136.7 acre contributing area, made up of medium density residential land use, which drain to existing dry retention ponds. Dry retention ponds provide approximately 5% removal of nitrogen from stormwater runoff as it is being infiltrated. Infiltrated stormwater is a source of nitrogen, in the form of nitrate, to Rainbow Springs.

This project will improve the ability of the existing retention pond to remove nitrogen from stormwater by removing approximately 2 feet of soil from the pond bottom and replacing it with the Bold and Gold soil amendment developed by the University of Central Florida Stormwater Academy. The project is a continuation of implementation of Bold and Gold retrofits to County owned retention ponds in the vicinity of Rainbow Springs. The application of Bold and Gold proposed for this project is the same as in the first full scale pilot application at the SW 85th Street and SW 40th Avenue Stormwater Retrofit. Monitoring of the pilot project has shown that the Bold and Gold has resulted in a treatment efficiency of 70% of total nitrogen from the stormwater infiltrated.

The Resource Benefit of the Water Quality project is the reduction of pollutant loads to Rainbow Springs, a SWIM priority water body, by an estimated 250 lbs/ yr TN. The Measurable Benefit is the construction and maintenance of stormwater BMP's to treat approximately 137 acres of low density residential stormwater runoff.

Cost: $931,510

Status: Ongoing

Other
Springs Protection Outreach Lead Entity: SWFWMD This project is designed to increase the awareness of efforts to restore springs in Marion, Citrus, and Hernando Counties. Annual Cost: $60,000 (recurring) Status: Ongoing
Comprehensive Plan and Land Development Regulations Lead Entity: Marion County Comprehensive Plan, Future Land Use Element, Objective 2.2 establishes specific limited density and specialized design standards for wetland and flood plain areas slated for development. Articles 5 & 6 of the Land Development Code sets forth the specific design and development criteria related to the applicable areas. Cost: TBD Status: Ongoing
Marion County Springs Protection Zones Lead Entity: Marion County Comprehensive Plan, Future Land Use Element, Objective 7.4 establishes the Springs Protection Overlay Zones (SPOZ) and identifies the extent of the Primary and Secondary Zones along with other design and development standards. Articles 5 & 6 of the Land Development Code sets forth the specific design and development criteria related to the applicable SPOZ. SPOZ and LDC criteria are the result of Springs Protection Resolution 05-R-106. Cost: TBD Status: Ongoing
FDOT Public Education Lead Entity: FDOT FDOT conducts inspections and provides annual illicit discharge, spill prevention and erosion & sediment control training to staff and contractors. Cost: TBD Status: Ongoing

Water Quantity

Table 11: Ongoing Water Quantity Projects and Initiatives

Monitoring & Research
USGS MFL Surface Water Data Collection Sites Lead: USGS / SWFWMD This project is to keep in operation hydrologic gages that are necessary to establish minimum flows in the District. This initiative is to establish and maintain the District's gaging network needed to establish/re-evaluate minimum flows and levels (MFLs) on priority waterbodies throughout the District. Beginning in FY2004, data collection associated with MFLs was funded under a separate agreement with the U.S. Geological Survey (USGS). While the USGS (with cooperative funding from the District in recent years) has long maintained a stream gaging network in the state, coverage is not adequate for establishing the most defensible MFLs. It is envisioned that gage sites will routinely be established along rivers to estimate flow at various distances along the river's length. Coupled with information from long-term gage sites, a few years' records at these short-term gages can be used to establish more accurate flows in the vicinity of biological monitoring sites used to evaluate and establish MFLs. Based on empirical relationships to be established with long-term gages and using hydraulic modeling results, flow records can be re-created at short-term sites using flow records at long-term sites. In addition, while the flow regimes of many of the District's rivers have been historically monitored along their freshwater reaches, flow data for rivers where they enter their respective estuarine areas is often lacking or has not adequately been monitored. The influence of tide and the braided nature of some of the rivers in their estuarine reaches make discharge measurements difficult and costly. In addition to stage and flow data, monitoring in tidal areas involves increased instrumentation to allow for salinity and sometimes dissolved oxygen measurements to be made. Flows can greatly affect the distribution of salinity and low dissolved oxygen zones in estuarine river reaches. Annual Cost: $491,950 (Recurring) Status: Ongoing
Managing Forests for Increased Regional Water Supply Lead Entity: FDACS / SWFWMD This four-year University of Florida research project, with funding support provided by the five water management districts and FDACS, will measure forest water use via groundwater and soil moisture monitoring in differently managed stands (e.g., thinning, understory management, typical silviculture). This information will be used to develop relationships between forest management techniques and water supply benefits, with broad application to regional water availability. This project will quantify the water supply benefits of several forest management practices that could be implemented on District lands and other public and private lands within the District. Cost: $637,725 Status: Ongoing
USGS Evapotranspiration Data Collection Lead: USGS / SWFWMD

This project allows for the operation of one mixed-forest wetland evapotranspiration (ET) station that directly measures actual ET. Funding also provides for District participation in a cooperative effort between the USGS and all five Florida Water Management Districts to map state-wide potential and reference ET using data measured from the Geostationary Operational Environmental Satellites (GOES). Data are available back to 1995 and are provided on the same grid system as the RADAR rainfall data, making them suitable to calibrate District groundwater and surface water models and improve permitting efforts.

The cooperative data program between the District and the United States Geological Survey (USGS) provides data collection to support District regulatory and resource management initiatives. The costs for this data collection program are split between the District and the USGS. The data collected by the USGS complement the data from the District's data collection program, and provide independent verification of District data collection efforts. USGS data site locations are coordinated with District data site locations to ensure optimum data coverage. These USGS data are being made available to District staff through the Water Management Information System (WMIS), and to the public through the USGS Hydrologic Data Web Portal.

ET constitutes the largest water loss component in most water budgets for Florida watersheds. In Florida, approximately 50 percent of mean annual precipitation is returned to the atmosphere as ET. Lakes have been measured to return up to 110 percent of mean annual precipitation. The statewide ET project was initiated to quantify actual, not potential, ET to improve the accuracy of a wide range of hydrologic analyses. The intention of this project was to install eddy-correlation equipment in a variety of settings to develop reasonable estimations of ET that can be tied to land use/land cover information, thereby increasing the detailed input for watershed modeling purposes. Equipment would remain on-site for a few seasons to ensure the ET is quantified sufficiently, and then the equipment would be moved to another location to obtain information from a different land use. In this fashion, a dataset could be developed to improve model results.

The GOES ET program was initiated to develop a better tool for watershed modeling by developing a dataset of ET estimates using the same grid system utilized by the RADAR rainfall project. This provides both an estimated monthly rainfall value and estimated monthly ET value for every 2-kilometer-by-2-kilometer grid cell in the state. Datasets for the period 1995-2012 have been compiled and processed into computed values of evapotranspiration. They are available through WMIS.

ET data support integrated surface water and groundwater modeling, water use and environmental resource permitting and compliance, Minimum Flows and Levels development, evaluation and compliance, the Southern Water Use Caution Area recovery plan, and water shortage implementation and evaluation.

Annual Cost: $50,700 (Recurring)

Status: Ongoing

USGS Groundwater Data Collection

Lead: USGS / SWFWMD

This agreement includes data collection at 16 groundwater monitor wells, which complements the data from the District's 1,553 groundwater level monitor wells. The cooperative data program between the District and the United States Geological Survey (USGS) provides data collection to support District regulatory and resource management initiatives. Costs are split between the District and the USGS. The USGS data are available to District staff through the Water Management Information System (WMIS), and to the public through the USGS Florida Water Science Center Web Portal. USGS data site locations are

coordinated with District data site locations to ensure optimum data coverage and prevent redundancy.

Groundwater level data provide critical support for integrated surface water and groundwater modeling, water use and environmental resource permitting and compliance, Minimum Flows and Levels development, evaluation, and compliance, the Southern Water Use Caution Area recovery plan, water shortage implementation and evaluation, and many resource evaluations and reports, including the Hydrologic Conditions Report. Most of these groundwater monitoring sites have extensive historical records, with some dating back to the 1930's. The length and completeness of the data records provide a necessary regional framework for scientifically evaluating impacts to water supplies in response to changes in climate and development.

Annual Cost: $100,000

Status: Ongoing

USGS Surface Water Data Collection

Lead: USGS / SWFWMD

This agreement includes continuous and periodic discharge and water-level data collection at 126 river, stream and canal sites, which complements the data from the District's 776 surface water level gauging sites. The cooperative data program between the District and the United States Geological Survey (USGS) provides data collection to support District regulatory and resource management initiatives. Costs are split between the District and the USGS. The USGS data are available to District staff through the Water Management Information System (WMIS), and to the public through the USGS Florida Water Science Center Web Portal. USGS data site locations are coordinated with District data site locations to ensure optimum data coverage and prevent redundancy.

The USGS is the recognized international expert on streamflow gauging and monitoring, a complicated and labor-intensive process. Surface water flow data provide critical support for watershed studies for proper drainage and water control, integrated surface water and groundwater modeling, biological monitoring, water use and environmental resource permitting and compliance, operations of the District's water conservation and control structures, Minimum Flows and Levels development, evaluation and compliance, water shortage implementation and evaluation, the Southern Water Use Caution Area recovery plan and many resource evaluations and reports, including the Hydrologic Conditions Report. Most of these groundwater monitoring sites have extensive historical records, with some dating back to the 1930's. The length and completeness of the data records provide a necessary regional framework for scientifically evaluating impacts to water supplies in response to changes in climate and development.

Annual Cost (Recurring): $1,089,400 (District-wide)

Status: Ongoing

RADAR Rainfall Data Services

Lead Entity: SWFWMD

This project provides high-resolution rainfall data for modeling purposes. This is a cooperative effort between the five Water Management Districts. The RADAR rainfall estimate dataset is derived from the National Weather Service's NexRad RADAR imagery calibrated by point rainfall data. A contractor uses 15-minute rainfall data collected by the District to calibrate the mathematical model used to translate RADAR images to 15-minute estimates of rainfall accumulation for each 2-kilometer x 2-kilometer grid cell across the entire District.

Data are available through the Water Management Information System back to February 1994 in 15-minute, hourly, daily and monthly total estimates for each 2 km x 2 km grid cell across the entire District.

Annual Cost: $40,000 (SWFWMD Portion Only)

Status: Ongoing

Conservation

Analysis of Utility Water Rates for Planning & Regulatory Support and Water Rate Model Workshops

Lead Entity: SWFWMD

This project explores the use of rate structures through research and a series of rate workshops.

Cost: TBD

Status: Ongoing

District Utility Services Program

Lead Entity: SWFWMD

The District's Utility Outreach Program involves proactively coordinating with the public water supply utilities throughout the District's boundaries in a systematic manner to achieve the water supply planning and water conservation goals; this would be in addition to the ongoing support provided to Regulation as part of the Water Use Permitting process (see IOP/WUP- 053.00, dated October 19, 2009). This activity was designed to account for general work that is not assigned to any specific project. As such, there are no critical project milestones and staff time is budgeted each year.

The District's Utility Outreach Program (UOP) is intended to improve water supply planning, water conservation, and relations with the 170 public water supply utilities within the District. The key program goals are to: reach agreement with utilities on population and demand projections; achieve a Districtwide goal of 150 gallons per capita per day (gpcd) or less of water use; enhance support to the District's Division of Regulation to accomplish District goals; improve communication and coordination with utilities; achieve 75% utilization of reclaimed water and 75% offset efficiency of traditional water supply; and better align District resources to achieve water supply planning and water conservation goals.

Annual Cost: $134,016 (District-wide)

Status: Ongoing

Hotel/Motel/Restaurant Water Conservation Education

Lead Entity: SWFWMD

This project reduces water use in the lodging industry. The District provides free educational materials for Water CHAMP properties that agree to implement a towel and linen reuse program. Based on prior audit results and average occupancy rates, this project will save an estimated 149 million gallons of water per year at a cost benefit of $0.47 per thousand gallons of water using the total cost amortized over five years. Currently, Water CHAMP has 365 participants.

Cost: TBD

Status: Ongoing

Water Loss Reduction Program

Lead Entity: SWFWMD

The Water Loss Reduction Program is an ongoing program which provides assistance to public supply water utilities and water use permit holders in conserving water and in documenting and reducing water loss. Among the services provided upon request are comprehensive leak detection surveys (systematic or point), meter accuracy testing (source and service), and water audit guidance and evaluation. The ongoing program (formerly referred to as the Leak Detection Program and historically known as the Urban Mobile Lab) has been very successful since it was started in the early 1990s, completing 103 leak surveys that has helped to prevent the unnecessary real water loss of an estimated 5.8 million gallons per day throughout the District. It has been calculated that the project and resulting water savings is one of the most cost-effective methods of water conservation currently employed by the District.

During recent years, and especially since the inception of the Utility Services program, there has been a significant increase in requests for leak detection as well as meter accuracy testing activities. The ten leak detection surveys conducted in 2013 resulted in a total of 101 leaks located/repaired that equated to an estimated 172,440 gallons per day of water saved (62,940,600 gallons/year). Considering the cost of staff time and equipment to perform services during 2013, the estimated cost to realize the conserved water is $0.15 per thousand gallons (using a three-year District budget average of $39,952 amortized at 8% over five years and not including the costs by the utility to repair the leak). This is a very cost-effective water conservation method considering the cost of alternative water supplies which, per thousand gallons, are in the $10.00 to $15.00 range.

Annual Cost: $39,901 (recurring)

Status: Ongoing

Center Pivot Mobile Irrigation Lab (CPMIL)

Lead Entity: SWFWMD

The predominant type of irrigation in the Rainbow Springshed is center pivot. This project provides a mobile irrigation lab that specializes in center pivot irrigation systems to service the northern District.

MILs are highly regarded tools for improving water use efficiency on agricultural lands. The water savings generated by implementing efficiency improvements identified by the MILs are substantial and represent one of the best methods of water conservation. Additionally, these savings are tracked in the Florida Department of Agriculture and Consumer Services (FDACS) MIL web portal thus allowing the water savings to be quantified on an annual basis.

There are approximately 65 center pivot systems permitted in the SWFWMD. The budgeted amount of $25,000 per year will allow a continual rotation of about 12 system evaluations per year (pre and post evaluations) to cover all systems once every 5 years which is the industry recommendation to maintain optimal efficiency.

Annual Cost: $25,000 (recurring)

Status: Ongoing

Florida Water Star Certification and Builder Education

Lead Entity: SWFWMD

This project reduces water use and helps to improve water quality by reduced stormwater runoff in the building industry. Florida Water Star[SM] (FWS) is a statewide water conservation certification program for new and existing homes and commercial developments. The program educates the building industry about water efficient building practices and provides incentives to make these practices common to the marketplace.

Based on estimates, a home meeting Florida Water Star indoor and outdoor criteria uses approximately 54,287 gallons of water less per year compared to a home with non-Energy Star rated appliances indoors and 100 percent high-volume irrigation outdoors, which is traditionally seen in Florida homes.

Quantified results illustrate program benefits includes On Top of the World Communities in Marion County where a FWS certified home uses about one-third the amount of water as a comparable property in the same community.

Annual Cost: $65,169 (District-wide)

Status: Ongoing

FARMS Program: Facilitating Agricultural Resource Management Systems

Lead Entity: SWFWMD / FDACS

Agricultural BMPs provide important water resource benefits, and the District's FARMS Program, as an agricultural BMP cost-share reimbursement program, provides incentives to the agricultural community for implementation of approved water quantity and water quality BMPs. BMPs can promote improved water quality in spring systems through reduction of nutrients. BMPs can also impact groundwater resources by reducing groundwater withdrawals from the Floridan aquifer through conservation measures. While FARMS has largely focused on reducing groundwater withdrawals in the District's southern region, the program is expanding its role in the northern region to include a focus on reducing nutrient loading to groundwater. FARMS can cost-share proposals from 50 percent up to 75 percent of total project costs, and can partner with other federal, state and local agencies such as the U.S. Department of Agriculture - Natural Resources Conservation Service (USDA-NRCS) Environmental Quality Incentives Program (EQIP), FDACS, and FDEP. Total annual fiscal year funding available for these projects is upwards of approximately $6.0 million. Potential projects may include approved precision nutrient application technologies or conservation practices. The agricultural community is highly encouraged to contact FARMS staff to discuss and develop potential projects. The SWFWMD and FDACS have worked cooperatively to help fund FARMS projects and are looking to expand their partnership within the Springs Coast area.

The SWFWMD and FDACS also work cooperatively with the Mini-FARMS Program, which is a scaled down version of the FARMS Program for growers that are 100 irrigated acres or less to implement water quantity BMPs. The program cost shares at a rate of 75% up to a maximum reimbursement of $5,000. Examples of projects include irrigation conversions and soil moisture probes.

Annual Cost: TBD

Status: Ongoing

My Florida Farm Weather Program

Lead Entity: FDACS / University of Florida IFAS – FAWN

This Program was developed by FDACS in partnership with the University of Florida Automated Weather Network (FAWN) to assist producers on when to irrigate during frost-freeze conditions or when to apply nutrients or pesticides during wet months. This program reimburses producers for implementing an on-farm weather station. Information from these on-farm weather stations is displayed on FAWN's website to create a weather station network for producers looking to be more accurate on irrigating for freeze protection or timing of fertilizer or pesticides, which includes graphical information that allows users to view real-time data. The FDACS is currently trying to expand the program more into the Springs Coast areas, such as Marion County.

Cost: $500,000 (statewide)

Status: Ongoing

WRWSA Regional Landscape and Irrigation Evaluation Program: Phase 3
Lead Entity: WRWSA / SWFWMD

This conservation project will provide approximately 140 irrigation system evaluations to high-water use, single family residential customers. These evaluations will come with recommendations for optimizing the use of water outdoors through Florida-Friendly Landscaping TM practices and other efficient irrigation best management practices. Rain sensor devices will be provided and installed for project participants who do not have a functioning device.

This project aims to conserve approximately 58,800 gallons per day.

Cost: $71,000

Status: Ongoing

Marion County Toilet Rebate Program: Phase 3

Lead Entity: Marion County / SWFWMD

This is the continuation of a project started in 2011 offering financial incentives to water customers within the Marion County Utilities' service area for replacement of existing high-volume toilets (3.5 gallons per flush (gpf) or greater with 1.28 gpf or lower). Approximately 6,140 of Marion County Utilities' 14,000 accounts within SWFWMD were built or improved before 1995, making them eligible for the toilet rebate retrofit incentive. In FY2014/15, Marion County Utilities expects to distribute 400 rebates to qualified homes and commercial facilities through an outside contracted consultant. Single-family residences will be offered up to two toilet rebates per home while multi-family and commercial dwellings will be encouraged to replace all devices at one time. The contracted consultant will ensure 90 percent inspection of retrofitted toilets. Educational information about water conservation will also be distributed to rebate participants and a follow-up survey will be used to assess customer satisfaction and water savings. This program will be marketed through billing inserts, direct mailing and fliers that will be posted at the utility office. The program will also be promoted at water conservation workshops and events that the Water Resource Coordinator attends. Special attention will be given to buildings improved after 1980, to focus on retrofits that would not otherwise be reaching the endpoint of the expected life of the toilet. This program aligns itself with the Southwest Florida Water Management District's strategic initiative of water conservation. This program will show an estimated savings of

5,095 gallons per day. The cost per 1,000 gallons is $1.64, well under the estimated costs of alternative water supply.

Cost: $30,000

Status: Ongoing

Regional Water Supply Planning

Development of 2015 to 2035 Districtwide Regional Water Supply Plan (RWSP)

Lead Entity: SWFWMD

The Regional Water Supply Plan (RWSP) assesses the projected water demands and potential sources of water to meet the demands in the Southwest Florida Water Management District (District) for the 20 year period from 2015 through 2035. The Plan is updated every five years, in accordance with Section 373.709, Florida Statutes. The RWSP consists of an executive summary and four geographically-based volumes that correspond to the District's four designated water supply planning regions (Northern, Tampa Bay, Heartland and Southern). The RWSP provides a framework for future water management decisions in the District and demonstrates how water demands can be met through a combination of alternative water sources, fresh groundwater and water conservation measures. The District's first RWSP was published in 2001 and is updated every five years. The District updates the RWSP with significant public comment to ensure all stakeholders with the opportunity for input. For the 2015 RWSP, the District will hold public workshops, with live webcasting, to provide status updates, answer questions and solicit public comment. The District has also developed this webpage to provide public drafts of the documents, advertise public workshops, and solicit comments from all interested stakeholders including the public. This process will help shape the final draft of the RWSP, scheduled to be completed in December 2015.

Cost: $150,000

Status: Ongoing

Regulatory / Minimum Flows and Levels

Water Use Permitting Program

Lead Entity: SWFWMD

The purpose of this program is to implement the provisions of Part II of Chapter 373, F.S., and the Water Resource Implementation Rule set forth in Chapter 62-40, F.A.C. Additional rules relating to water use are found in Chapter 40D-3, F.A.C., entitled Regulation of Wells, Chapter 40D-8, F.A.C., entitled Water Levels and Rates of Flow, Chapter 40D-80, F.A.C., entitled Prevention and Recovery Strategies For Minimum Flows and Levels, Chapter 40D-21, F.A.C., entitled Water Shortage Plan, and Chapter 40D-22, F.A.C., entitled Year-Round Water Conservation Measures. In addition to permitting, the Water Use Program engages in a comprehensive compliance program that checks and verifies critical information such as monthly pumpage quantities and over pumpage.

Annual Cost: $3,208,319 (District-wide)

Status: Ongoing

Rainbow River MFL Establishment

Lead Entity: SWFWMD

Florida statute 373.042 requires that the District establish minimum flows and levels (MFLs) for water bodies on a priority list. The Rainbow River Freshwater system is a designated priority water body and this project is to provide technical information to support the adoption of MFLs for the system. The establishment of minimum flows for rivers requires the collection of extensive physical, chemical, and biological data to evaluate potential impacts to the ecological characteristics of the resource. This project provides funding for the collection and evaluation of this information.

Cost: $224,692

Status: Ongoing

Natural Systems

Table 12: Ongoing Natural Systems Projects and Initiatives

Monitoring & Research
Rainbow River Aquatic Vegetation Coverage Lead: SWFWMD This project involves mapping, monitoring, and evaluating submerged aquatic vegetation (SAV), studying sources of chlorophyll and how nutrients influence chlorophyll production in the Rainbow River. Collection of this information is necessary to evaluate the success of applied management strategies within Rainbow River. Mapping of submerged aquatic vegetation is conducted every four to five years in order to detect changes in the health of these vital resources and to act as an indicator for overall ecological health. Also, knowing the types of plants and/or algae responsible for chlorophyll production, in addition to knowing how nutrients influence algae will greatly enhance the effectiveness of management strategies targeted at maintaining and improving current water clarity levels. Cost: $98,000 Status: Ongoing
Rainbow River Algae and Sediment Assessment Project Lead: SWFWMD / University of Florida In the Rainbow River various types of algae (filamentous macroalgae, epiphytes, and phytoplankton) are increasing in abundance and causing ecological degradation. Algal overgrowth is most evident in the lower portions of the river, where physical alterations have affected hydrology and water quality. Algal overgrowth can alter sediment characteristics and biogeochemical cycling, leading to reductions in native aquatic plant abundance, wildlife habitat, nutrient attenuation, and aesthetic value. Information is needed to understand the factors that lead to algal overgrowth. This information will support management decisions regarding control of algae and restoration of the aquatic plant community. The Rainbow River Algae and Sediment Assessment Project will determine the factors leading to ecological instability in the Rainbow River. The District is the lead entity on this three year research project to be conducted by the University of Florida. The University of Florida will measure algae and plant communities, sediment characteristics, and biogeochemical cycling rates throughout the river. The University of Florida will also evaluate the influence of historic phosphate mining pits and their hydraulic exchange with

the river. This information will support management decisions regarding control of algae and restoration of aquatic plant communities, with application to the Rainbow River and other spring systems in the region.

This is a multi-year project spanning 2014 to 2016. A final report summarizing the project will be delivered no later than August 1, 2017. The final report will contain an executive summary as well as an overview and synthesis of key findings as they relate to the management of Rainbow River and other spring-fed systems in the area. All data generated as a result of this project will be included in the appendices to the report.

Cost: $375,000

Status: Ongoing

Springs Coast Fish Community Assessment

Lead Entity: FFWCC

The FFWCC is conducting a series of fish sampling events to document fish abundance, diversity, richness, and fish species composition in portions of the Rainbow, Weeki Wachee, Homosassa, and Chassahowitzka rivers and Kings Bay. The project will also evaluate fish species associated with quantified habitats and flows within in these spring systems. A total of 40 sampling events will be completed with the findings and data collected included the final report.

Cost: $185,620 (SWFWMD funded)

Status: Ongoing

Habitat Conservation

River Protection Corridors

Lead Entity: City of Dunnellon

The City of Dunnellon River Protection Corridor Areas for both the Rainbow and Withlacoochee River extends 150 feet from the ordinary high water line and implements specific development standards for new development and for construction on existing lots with vested development rights.

Cost: TBD

Status: Ongoing

Rainbow River Corridors

Lead Entity: FDEP Division of Lands

The Rainbow River Corridor project is designed to protect most of the undeveloped or minimally developed private land remaining along the Rainbow River. The southern parcels (ex. Rainbow River Ranch) would bring a remaining large portion of undeveloped shoreline along the eastern side of the river into state ownership, and provide a connection to the southern end of the Rainbow Springs State Park. Several parcels above the headwaters and below State Road 40 would provide a significant connection on the north side of the state park. Other potential properties include the Cool Springs Ranch and various identified wildlife corridor gaps.

Public acquisition of these lands will prevent further development and conflicting land uses

that could further degrade the ecological value of this area. In addition, the potential restoration of altered habitats would help restore and maintain water quality and habitat along one of Florida's largest spring-run streams. 1,140 acres still remain for acquisition and will continue as funds and sales agreements allow. 32.44 acres were acquired for Blue Run of Dunnellon Park (R013) in 2008.

Cost: TBD

Status: Ongoing

Implementation of the District's Land Acquisition Play Book

Lead Entity: SWFWMD

Section 373.139, Florida Statutes, authorizes the Governing Boards of the water management districts to acquire lands necessary for conservation and protection of water resources. The District's Land Acquisition Playbook represents a list of lands the District is or will be actively attempting to acquire. For Rainbow Springs, three tracts totaling 390 acres have been identified. This playbook is updated annually and other properties can be added as identified.

Cost: TBD

Status: Ongoing

Invasive Species Management

Cooperative Aquatic Plant Control Program

Lead Entity: FFWCC / SWFWMD

The District cooperates with the Florida Fish and Wildlife Conservation Commission (FFWCC) pursuant to an existing ten-year agreement to manage troublesome aquatic plant populations on twenty-five public waters (lakes and rivers) within the District.

Annual Cost: $9,000 (recurring)

Status: Ongoing

Recreation Management

Rainbow River Recreation Brochures

Lead Entity: Rainbow River Conservation (RRC)

Recognizing that recreation on the Rainbow River has become very intense and is not restricted, RRC developed a Rainbow River Recreational Guidelines brochure to educate river users in safe and enjoyable practices while avoiding harm to the natural systems of the river. This 17 x 22 inch multi-fold brochure is of souvenir quality made of biodegradable paper. RRC has distributed approximately 20,000 copies of the brochure. RRC is seeking funding for a second printing of 25,000 brochures.

Annual Cost: $15,000 (recurring)

Status: Ongoing

Proposed Priority Projects and Initiatives

Proposed priority projects and initiatives have been reviewed and approved by the SCMC and SCSC. Shown below in Tables 13, 14 and 15 are the projects and initiatives that, if implemented, will support the overall objective of improving the water quality, water quantity, and natural systems aspects of the Rainbow River.

Water Quality

Table 13: Proposed Priority Water Quality Projects and Initiatives

Agricultural Operations
Implementation of the Small Equine BMP Manual in Areas of the Rainbow Springshed where not already Ongoing Lead Entity: UF-IFAS Extension Service / FDEP This project will develop a plan to implement the various Best Management Practices for small equine operations where not already being implemented. This will be accomplished through the promotion of (1) education, (2) outreach, and (3) cost-share programs. In October 2013, the FDEP published a manual intended for use by horse and pony owners who do not typically operate as a business and are characterized as "non-commercial." It is an educational tool to provide guidance to small-scale, noncommercial horse owners on equine management practices that will help minimize nonpoint source pollution and protect Florida's water resources. Part of the implementation of BMPs will be to establish a monitoring plan to quantify benefits of the various BMPs to water quality. The implementation program will consist of identification of key agencies with existing public education activities where the BMP manual can be incorporated, development or modification of existing recognition programs to provide measureable goals for both participants and also types of BMPs implemented, and identification of existing cost share programs that may assist non-commercial operations in BMP implementation including, but not limited to (a) manure storage, (b) manure composting, (c) pasture management, and (d) erosion control. Cost: TBD Status: Proposed
Septic Tanks
Onsite Sewage Treatment and Disposal Systems (OSTDS) Initiative: Demonstration Sites and Trade-Off with Sewerage Lead Entity: FDOH / FDEP OSTDS are one of the more difficult sources of nitrogen loading to the Upper Florida Aquifer to address. The FDEP, with representation from FDOH, private and public utilities, local governments, community development districts, homeowners, businesses, and other vested interests will develop a comprehensive and sustainable plan with nitrogen reducing projects that focus on OSTDS sources. Specific goals of this project include: 1. Identify spatially in the Rainbow Springshed the tradeoffs between conventional sewerage and OSTDS including cost/benefit analysis for each option. In addition to capital and operation and maintenance costs, effort will be placed at capturing

intangible benefits for each option (e.g. groundwater recharge, economic opportunity).

2. Test water quality effluent from three OSTDS sites with passive biological nitrogen removal to demonstrate (a) effectiveness for different loading rates, and (b) scalability to the unique soil and hydrologic conditions in Marion and Levy Counties.

3. Develop public outreach activities to promote OSTDS through the EPA-funded USF National Research Center for Reinventing Infrastructure for Nutrient Management.

The overall objective of the OSTDS Initiative is to identify effective, financially feasible strategies to reduce existing, and prevent future, nutrient loads from OSTDS sources. The plan will identify options for addressing OSTDS loading, identify effective management and engineering strategies to reduce loading from OSTDS for the Rainbow River system, establish education and outreach programs that provide area residents with information about OSTDS systems and their effect on the system, determine responsibilities, and identify funding sources and an implementation schedule for the management strategies and facility construction.

Cost: TBD

Status: Proposed

Wastewater Treatment Facilities

Rainbow Springs Infrastructure Development: Subsequent Phases

Lead Entity: Marion County

This project is a comprehensive effort to eliminate existing and future poor quality wastewater discharges into the Rainbow Springs area surrounding the City of Dunnellon. The project components include construction of a new, expandable wastewater treatment plant and wastewater collection system. Wastewater will be collected from eight existing secondary level package wastewater treatment plants.

This project reduces nutrient loading to Rainbow River and Springs and will also make additional reclaimed water available for agricultural irrigation needs.

Cost: $110,000,000-$120,000,000

Status: Proposed

Stormwater

Rainbow River Acres Stormwater Retrofit

Lead Entity: City of Dunnellon

This project is near the corner of Oak Street and Palmetto Way in the Rainbow River Acres subdivision and will construct a stormwater pond to address flooding and improve water quality for stormwater runoff that currently sheet flows untreated into the Rainbow River.

This project will benefit the river by treating stormwater that currently discharges directly into the river from only 250 feet away.

Cost: TBD

Status: Proposed

Bold and Gold Stormwater Retrofits in Rainbow Springs BMAP Area

Lead Entity: Marion County

This project proposes $2,800,000 through Fiscal Year 2019 for the retrofit of County owned drainage retention areas (DRAs) in both the Rainbow and Silver Springs BMAP areas. The number and location of DRAs retrofitted will depend on several factors including potential load reductions, land availability and location in priority focus areas identified in the BMAP. In general the funding will be evenly split, but may vary slightly from year to year depending on the aforementioned factors. A project, Rainbow Springshed Stormwater Retrofits ($932K total) is currently in the design phase and is identified in the adopted 2014 Stormwater Implementation Plan.

Stormwater retrofit projects are measurable actions that can be taken to help reduce nutrient loading, either as direct inputs to the river or indirectly through infiltration in the springshed.

Cost: $2,800,000 through 2019

Status: Proposed

Other

Blue Run Park Restroom Facility and the Evaluation of Additional Restroom Facilities Along the Rainbow River

Lead: Marion County / City of Dunnellon

There is a significant need for public restroom facilities along the lower Rainbow River and especially at Blue Run Park. Portable facilities are no longer sufficient to accommodate the large numbers of visitors that frequent this park. The number of visitors continues to increase including a growing number of large groups. The Blue Run of Dunnellon Management Plan approved by FCT, Marion County, and Dunnellon includes a requirement to provide a public facility within five years. The estimated cost of this project would include installation of a flush toilet facility connected to sanitary sewer with electric service, permits, design, ADA accessibility and site work.

Additionally this project will evaluate other potential locations along the publically owned reaches of the river for additional restroom facilities which could further reduce a direct source of pollution to the river.

Cost: TBD

Status: Proposed

Creation of Public Education Coordination Team

Lead Entity: Marion County / SWFWMD

Formation of a public education coordination team consisting of representatives from local government, state agencies, water management districts and local interest groups. The purpose of the groups would be to ensure consistent and accurate information on pollution prevention is provided to citizens and to maximize efforts among coordination team members. This proposed initiative covers all three focus areas of Water Quality, Water Quantity, and Natural Systems.

Cost: TBD
Status: Proposed

Water Quantity

Table 14: Proposed Priority Water Quantity Projects and Initiatives

Monitoring & Research
Evaluate Effects of the Inglis Lock and Dam System on Flows and Levels in the Lower Rainbow River Lead Entity: SWFWMD This project will determine the effects of operating the Inglis lock and dam system on the flows and levels in the lower Rainbow River and will investigate the feasibility of utilizing the system to increase water velocities during certain times of year as a means to reduce the amount of filamentous algal growth and water column residence times in the lower Rainbow River. The lower Rainbow River is in a degraded state and this project could have a significant beneficial effect on the lower Rainbow River. Cost: TBD Status: Proposed
Evaluate Effect of Aquatic Vegetation on Flows and Levels in the Rainbow River Lead Entity: SWFWMD This project will assess the effects of aquatic vegetation on stage and flow in the Rainbow River. Changes in stage/flow relationships in the Rainbow River have occurred since 2000, which may be due to effects of vegetation on the hydrology of the river as hypothesized in other spring-fed rivers in Florida. The study will measure SAV biomass, flow velocities, and other parameters to assess how vegetation influences the hydrology of Rainbow River. Cost: TBD Status: Proposed

Natural Systems

Table 15: Proposed Priority Natural Systems Projects and Initiatives

Habitat Conservation
Rainbow River Ranch Acquisition Project Lead Entities: FDEP / SWFWMD This is a subset of the Rainbow River Corridor Project. The Rainbow River Ranch consists of 258 acres of undeveloped land on the east shore of the Rainbow River with 1.3 miles of river frontage which is approximately 23% of the whole eastern river frontage. This land, which is sandwiched between the river on the north and west sides, the Rainbow Springs State Park on the east side, and CR 484 on the south side, is planned for development including 311 residential units, a clubhouse, a boat storage site, and 100,000 square feet of commercial space. The land is largely upland pasture with heavily foliated wetlands adjacent to the river where many listed species of birds and freshwater turtles nest and forage. This land is connected to the Florida National Scenic Trail, the Withlacoochee State Trail, the Dunnellon Trail, the Blue Run Park Trails, the Gum Slough Canoe Trail, and the Great Florida Birding Trail. A trail on this land along the old Seaboard Railway bed adjacent to the river could connect the Blue Run Park to the State Park and the existing Office of Greenways and Trails easement across the river, through Cool Springs and the Goethe Forest, to the Gulf Coast. Instead of being developed this land should be kept in its natural state for the benefit of protecting the Rainbow River and its wildlife. The uplands should be planted in long leaf pine. Because of its river related natural features and its connection to several trails the Rainbow River Ranch property can serve as an integral part of a tourist driven economic engine for the local community. Every effort should be made for state acquisition of this property. Cost: TBD Status: Proposed
Recreation Management
Rainbow River Carrying Capacity Study and Visitor Survey Lead Entities: FDEP / Marion County / City of Dunnellon This proposed project will define the carrying capacity of Rainbow River with respect to recreation by establishing an appropriate balance between recreation and resource protection and determining ways management agencies, together with commercial and other interests, can meet that balance. The study will require a visitor survey, analysis of vegetation and wildlife impacts, analysis of techniques utilized in other similar locations, and discussion of the legal, cultural, and resource issues in determining the appropriate balance between public use and resource protection. The visitor survey is an important component of this project and is a tool to be used by professional managers and elected officials to make difficult decisions involving a variety of stakeholders, often with conflicting interests. Visitors' responses are often surprising when they are asked questions that deal with vegetation impacts, wildlife impacts, user conflicts, and visitor experience. This project will design, implement, collate, and interpret a visitor survey that will include many areas of policy dealing with management of the Rainbow River. Cost: TBD Status: Proposed

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Appendix A: Technical Working Group Membership List

Name	Title	Organization
Andrew Gude	Refuge Manager, Lower Suwannee and Cedar Keys	USFWS
Ana Gibbs	External Affairs Manager	FDEP, Southwest District
Anne Birch	Marine Conservation Director	The Nature Conservancy
Anthony Andrade	Reuse Coordinator	SWFWMD
Art Jones	One Rake at a Time	Rotary
Bill Vibbert	Board of Directors Member	Rainbow River Conservation, Inc.
BJ Jarvis	Citrus County Extension Agent	UF IFAS Citrus County Extension
Bob Bonde	Research Biologist	USGS
Bob Knight	Director	Florida Springs Institute
Bob Mercer	Board of Directors Member	Save Crystal River, Inc.
Bobby Lue	Utility Services Program Manager	SWFWMD
Brian Nelson	Vegetation Management Manager	SWFWMD
Burt Eno	Board of Directors President	Rainbow River Conservation, Inc.
Carter Henne	Project Scientist	Sea & Shoreline, Inc.
Chris Anastasiou	Chief Scientist	SWFWMD
Chris Zajac	Senior Government Affairs Program Manager	SWFWMD
Chuck Jacoby	Supervising Environmental Scientist	SJRWMD
Cliff Ondercin	Environmental Compliance Manager	SWFWMD
Colleen Kruk	Lead Land Use Specialist	SWFWMD
Dan Hilliard	President	W.A.R., Inc.
Danielle Rogers	Environmental Science Project Lead	SWFWMD
Dave DeWitt	Chief Professional Geologist	SWFWMD
Dawn Velsor	Lead Environmental Planner	Hernando County
Debra Burden	Dept. of Water Resources	Citrus County
Doug Leeper	Chief Advisory Environmental Scientist	SWFWMD
Earnie Olsen	Supervisor, Marine Science Station	Citrus County Schools
Eberhard Roeder	Professional Engineer	FDOH
Ed Call	Environmental Manager	Ash Group Inc.
Ed Jennings	Regional Specialized Agent - Livestock	UF IFAS - Central Florida Livestock Agents' Group
Elke Ursin	Environmental Health Program Consultant, Bureau of Onsite Sewage Programs	FDOH
Emma Lopez	Graduate Student	USF Civil & Environmental Engineering
Eric Latimer	Duke Energy Mariculture Center Director	Duke Energy Corporation
Erin Rasnake	Program Administrator, Watershed Evaluation and TMDL Section	FDEP

Name	Title	Organization
Harley Means	Assistant State Geologist, Geologic Investigations Section	Florida Geological Survey
Jackie Gorman	Director Planning & Community Development	City of Crystal River
Jamie Cohen	Program Extension Agent I, Farm Management	UF IFAS Marion County Extension Office
Jamie Letendre	Environmental Specialist I	FDEP CAMA
Jason Mickel	Water Supply Manager	SWFWMD
Jeff Rogers	Citrus County Public Works Director	Citrus County
Jeff Sowards	Environmental Specialist III, Rainbow Springs Aquatic Preserve	FDEP CAMA
John Emery	Regulation Program Manager	SWFWMD
John Kunzer	FWCC Aquatic Plant Management	FFWCC
John M. (Mark) Shuffitt	Extension Agent III, Livestock, Marion County	UF IFAS
Jon Brucker	Environmental Specialist, Office of Coastal and Aquatic Managed Areas	FDEP, CAMA
Jonael H. Bosques	Small Farms Agent	Marion County
Josh Madden	Environmental Scientist	SWFWMD
Joyce Kleen	Wildlife Biologist	USFWS
Jewel Lamb	Board Member	Save Crystal River, Inc.
Katie Tripp	Director of Science and Conservation	Save the Manatee Club
Ken Nash	Director, Physical Sciences and Climatology	Gulf Archaeological Research Institute
Kent Smith	Marine and Estuarine Habitat Leader, Habitat Species Conservation	FFWCC
Kevin Grimsley	Supervisory Hydrologist	USGS
Kimberley Sykes	Deputy Manager	Crystal River NWR Complex
Laura Digruttolo	Fish and Wildlife Biologist, Office of Conservation Planning Services	FFWCC
Laura Rankin	Graduate Student	USF
Laura Rodriguez-Gonzalez	Graduate Student	USF Civil & Environmental Engineering
Lauren Greenfield	Environmental Manager, ERP	FDEP
Lisa Moore	Marketing Manager	Gulf Atlantic Industrial Equipment Inc.
Lou Kneip	Director Public Works	City of Crystal River
Maria Merrill	Biological Scientist	FWCC, Marine & Estuarine Subsection
Mariben Anderson	Natural Resources Technical Manager	Michael Baker International
Mark Fulkerson	Senior Professional Engineer	SWFWMD

Name	Title	Organization
Matt Warren	Environmental Scientist III, Cow/Calf BMP, Office of Agricultural Water Policy	FDACS
Megan Keserauskis	Biological Scientist III, Aquatic Habitat Restoration/Enhancement (AHRE) Subsection	FFWCC
Michael Birns	President	Manatee ECO-Tourism Association, META
Michael Czerwinski	President	Michael G. Czerwinski Environmental Consultants
Nick Makris	Water Supply Specialist	SWFWMD
Patricia Robertshaw	Environmental Scientist	SWFWMD
Phillis Rosetti-Mercer	Board Member	City of Crystal River, Waterfront Advisory Board
Randal Ethridge	Staff Engineer	SWFWMD
Robbie Lovestrand	FFWCC Invasive Plant Manager, Southwest Florida Field Office	FFWCC
Ron Basso	Chief Hydrologist	SWFWMD
Ron Mezich	Biologist, Habitat Species Conservation	FFWCC
Samantha Whitcraft	Biologist, Crystal River National Wildlife Refuge	USFWS
Sarina Ergas	Professor and Graduate Student Coordinator	USF Civil & Environmental Engineering
Scott McBride	Hydrologist	USGS
Sean King	Staff Engineer	SWFWMD
Siobhan Gorham	Research Associate, FWRI	FFWCC
Sky Notestein	Senior Environmental Scientist	SWFWMD
Steve Lamb	Board Member	Save Crystal River, Inc.
Steven Davis	Citrus County Florida Yards and Neighborhoods	Citrus County
Tammy Hinkle	Staff Environmental Scientist	SWFWMD
Tammy Plazak	Staff Hydrologist	SWFWMD
Terri Calleson	Co-Team leader, Project Consultations, Coastal and Marine	USFWS
Terry Hanson	Environmental Consultant	FDEP
Thomas LaRoue	Staff II Engineer	HSW Engineering, Inc.
Tim Jones	Environmental Specialist III, Office of Coastal and Aquatic Managed Areas	FDEP CAMA
Tom Burke	Chief Professional Engineer	SWFWMD
Tom Lynn	Graduate Student	USF Civil & Environmental Engineering
Tracy Straub	Office of the County Engineer	Marion County
Will Vangelder	Land Management Supervisor	SWFWMD
Yilin Zhuang	Community Resource Efficiency Agent	UF/IFAS Marion County
Yonas Ghile	Senior Environmental Scientist	SWFWMD

Appendix B: Permitted Point Sources within Rainbow River Springshed

This appendix lists point sources and water use permits within the Rainbow River watershed and springshed.

Point source permit information was obtained from the Northeast and Central District offices of the FDEP. Based on correspondence received from the FDEP in May 2015, no facilities were operating without a permit, with a temporary permit or known to be violating effluent limits or standards or data was insufficient to make the determination, therefore, no timetable is provided to bring the facilities into compliance with FDEP Regulations. There are no permitted power plants or dry cleaners listed on the FDEP website within the Rainbow River watershed and springshed boundaries as of May 7, 2015.

Table 16: Wastewater Permits as of 04/29/2015

FACILITY ID	NAME	FACILITY TYPE	PERMITTED CAPACITY (MGD)
FLA010672	Reddick-Collier Elem School	Domestic WWTP	0.01
FLA010690	Sportsman Cove MHP	Domestic WWTP	0.015
FLA010737	Ocala Jai Alai WWTF	Domestic WWTP	0.01
FLA010770	Grand Lake RV Resort WWTF	Domestic WWTP	0.065
FLA011317	The Welcome Inn WWTF (fka Micanopy Inn WWTF)	Domestic WWTP	0.015
FLA012612	Williston WWTF	Domestic WWTP	0.45
FLA012657	Romeo Elementary School	Domestic WWTP	0.01
FLA012658	Dunnellon High School WWTF	Domestic WWTP	0.036
FLA012660	Reddick RV WWTF	Domestic WWTP	0.025
FLA012662	Crystal Springs MHP	Domestic WWTP	0.01
FLA012674	Rio Vista WWTF	Domestic WWTP	0.01
FLA012682	Sateke Village WWTP	Domestic WWTP	0.01
FLA012683	On Top of The World South WWTF	Domestic WWTP	0.75
FLA012686	Ocala Jockey Club WWTF	Domestic WWTP	0.01
FLA012687	103rd Street Square Center WWTF	Domestic WWTP	0.01
FLA012693	Rainbow Springs Fifth Replat WWTF	Domestic WWTP	0.23
FLA012696	Golden Hills MHP WWTF	Domestic WWTP	0.036
FLA012698	Falls of Ocala MHP WWTF	Domestic WWTP	0.04
FLA012699	Marion Landing WWTF	Domestic WWTP	0.11
FLA012707	Circle Square Shopping Center WWTF	Domestic WWTP	0.015
FLA012717	Rainbow Springs State Campground WWTP	Domestic WWTP	0.015

FACILITY ID	NAME	FACILITY TYPE	PERMITTED CAPACITY (MGD)
FLA016154	Petro PSC Truck Stop WWTF	Domestic WWTP	0.05
FLA126594	City of Dunnellon	Domestic WWTP	0.25
FLA180190	Williston Raf	Residuals Application Facility	0.0139
FLA190268	Ocala WRF #3	Domestic WWTP	4
FLA272060	Marion County - Northwest Regional WWTF	Domestic WWTP	0.015
FLA330728	Circle Square Woods	Residuals Application Facility	Not provided by FDEP
FLA490415	Juliette Falls WWTF	Domestic WWTP	0.1
FLA012711	Palmer Resources Limerock Mine	Industrial Wastewater	Not provided by FDEP
FLA687723	CIC Inc (328 Pit)	Industrial Wastewater	Not provided by FDEP
FLG110088	Argos USA- Ocala Plant	Concrete Batch GP	Not provided by FDEP
FLG110337	Argos Ready Mix - Williston CBP	Concrete Batch GP	Not provided by FDEP
FLG110371	A Materials Group Inc. Plant #14	Concrete Batch GP	Not provided by FDEP
FLG110475	Evans Septic Tank Airport Plant	Concrete Batch GP	Not provided by FDEP

Table 17: Petroleum Sites as of 04/29/2015

FACILITY NAME	FACILITY ID
TEXACO #549-MICANOPY	8500028
DIXIE #515	8500036
MICANOPY GAS STATION	8500065
FASPAS INC	8500113
CROSS CREEK OUTPOST	8500155
MICANOPY COUNTRY STORE	8500163
MICANOPY CHEVRON	8500221
THE PANTRY #3914	8500246
FINA #6627	8500297
FRANKLIN CRATES INC	8518285
THRASHER BUILDING	8736416
CAMP FARM	8837365
SAVEWAY STATION	8839736
SCOTTISH INNS	8841699
HARE WELL DRILLING	8842536
TWIN LAKES FISH CAMP	8944834
CARLTONS DAIRY FARM	9045829
WEAVER PROPERTY	9600845
GROVE PARK SITE	9701135

FACILITY NAME	FACILITY ID
WILLISTONE ONE LLC	8510497
JOY FOOD STORE #424	8510521
BP STATION-BERRYS AUTO CARE	8510534
LIL CHAMP FOOD STORE #1182	8510557
LIL FOOD RANCH	8510559
CHEVRON-WILLISTON #171	8510574
SUWANNEE SWIFTY FOOD STORE #331	8510595
V E WHITEHURST & SON INC	8520387
QUICK KING #17	8520389
WILLSTON CO	8838475
WILLISTON CORNER MARKET	8839698
RADACKY PROPERTY	8841363
LEVY REALTY	9101021
CENTRAL MOTOR SUPPLY OF WILLISTON	9101701
GULF-W MAR	9201423
DOCTOR JAYS AUTOMOTIVE SERVICE	9202334
KNAUFF FUNERAL HOME	9800833
JOBE TRUCKING 03-4I-0214	9805996
AMOCO #86	8511015
CIRCLE K #00210	8511038
IRVINE SERVICE - FLORIDA CITRUS CTR 40	8511043
JOY FOOD STORE #432	8511076
BP ONE STOP (FORMER)	8511120
Y WAY #2318	8511139
CELEBRITY RESORTS INC	8511146
SHYAM GAS & FOOD	8511180
BP-ORANGE LAKE	8511220
CITGO-ORANGE LAKE #198	8511291
OLD TIME GARAGE	8511342
MAYNARDS SRVC	8511346
THE PANTRY #6177	8518683
ACTICARB TAILORED PRODUCTS	8518799
MARION CNTY SCHOOL BD-MIDDLE SCHOOL	8518837
BP-MCINTOSH	8622643
OCALA MANUFACTURING CO	8630349
SHELL-AVENUE	8630395
ALLSTAR SUPPLY	8630446
FOXMOOR ARABIANS INC	8630456
FORD EQUINE HOSPITAL INC	8630458
FARNSWORTH FARMS INC	8733965
LIN-DRAKE FARM	8735966
TRIPI PROPERTY	8839436

FACILITY NAME	FACILITY ID
QUICK KING #21	8840193
SUN 2 LLC	8840979
RIC-DEG FARM	8841925
SORTED OAKS FARM	9045813
JIMS BBQ INC	9046043
HUFF PROPERTIES	9046191
SUPER DUPER	9063905
SYLVAN CREST STUD	9100180
ORANGE HILL STATION	9100517
POSSE INC	9100615
SHEARER PROPERTY	9100987
HOBEAU FARMS	9101211
BERYLENES BEAUTY SALON	9101213
NEALS DRY CLEANING	9101215
FREEDOM HILLS FARM	9101585
MARY LOU FARMS	9101811
BAZEMORE PROPERTY	9102455
ZETROUERS CASH STORE	9103388
CLASSIC ACRES	9200449
FLAMINGO HILL FARM	9202328
HAYLO FARMS	9202333
ROMAC PAVING CO	9202398
SANDY ACRES FARM	9202428
RISING STAR FARM	9402045
OLD FLOWER SHOP	9502474
PALMOUR PROPERTY	9502718
MINIACI PROPERTY	9601359
MARION CNTY FIRE RESCUE STAT #12-MEADOWOOD FARMS	9813260

Table 18: Solid Waste Facilities as of 5/7/2015

FACILITY NAME	FACILITY ID	FACILITY STATUS
MARTEL LANDFILL	20897	Inactive
DUNNELLON LANDFILL	20898	Closed, No Gw Monitoring
H & B EXCAVATING (C & D)	21490	Inactive
ORANGE LAKE LANDFILL	20903	Closed, No Gw Monitoring
DUNNELLON TRANSFER STATION	20907	Inactive
ALACHUA COUNTY SE	29654	Closed, No Gw Monitoring
PLANET EARTH RECYCLING (FMR ERI TIRE PYROLYSIS)WTP	29968	Closed, No Gw Monitoring
WILLISTON LANDFILL	36905	Closed, With Gw Monitoring
INGLIS-YANKEETOWN LANDFILL	36906	Closed, With Gw Monitoring
BECKER ROAD DUMP (COUNTY DATA)	94268	Closed, No Gw Monitoring
DUNNELLON DUMP #1 (COUNTY DATA)	94272	Closed, No Gw Monitoring
DUNNELLON DUMP #2 (COUNTY DATA)	94273	Closed, No Gw Monitoring
FELLOWSHIP DUMP (COUNTY DATA)	94274	Closed, No Gw Monitoring
MCINTOSH DUMP (COUNTY DATA)	94279	Closed, No Gw Monitoring
ROMEO DUMP AND CARBON PILE (COUNTY DATA)	94286	Closed, No Gw Monitoring
OAK RIDGE EQUINE, INC.	94960	Nfa,No Further Action
FANT FARM	99082	Exempt From Sw Permitting/Registration
LOVE FARMS, INC.	99083	Nfa,No Further Action
REDDICK PIT	99919	Inactive
NW 110TH AVE AND 120TH STREET-SW CORNER DEBRIS STAGING AREA	98036	Inactive
ORANGE LAKE DEBRIS STAGING AREA	98215	Inactive
JUST FOR FUN STABLE	101524	Complaint Under Investigation
CHARLES W. EDWARDS PROPERTY	100669	Closed, No Gw Monitoring
WILLISTON ACRES	101831	Not Yet Determined
WILLISTON FARM SERVICES	101890	Not Yet Determined

Table 19: Water Use Permits as of 05/15/2015

Permit Number	Permitted Quantity (avg annual gpd)	Project Name
1156.12	2,555,000	Bay Laurel Center Public Water Supply System
2697.6	1,027,651	Charlotte Weber
2824.3	19,200	EDDIE WOODS STABLES
2999.5	126,000	Rainbow Lakes Estates
3580.5	1,200	Ocala Farm
3646.2	2,000	RAINBOW LAKES ESTATES MUNICIPAL
3753.3	125,700	BGH Farms
3957.3	24,300	BRIDLEWOOD FARM
4390.6	381,400	Barber Peanut Farm
4495.2	391,500	Annette G Barron
5095.9	2,057,000	Needmore Farms, LLC
5109.4	209,200	Sonja Brooks
5111.2	58,100	MILDRED B MIKELL & DIANE M PRICE
5115.5	299,000	Fugate Farm 1
5117.3	150,000	Woodroe Fugate and Sons Inc
5122.7	2,670,500	Whitehurst Cattle Company
5160.4	1,123,300	SANDLIN FARMS
5169.4	65,700	AEG Associates III, LLC
5424.10	1,225,900	Flying P Ranch
5550.2	93,090	DALE WRIGHT
5606.4	8,600	Glen Robinson
5607.2	58,000	JOHN M. DEAN
5619.4	7,400	Benton Murray
5640.6	827,000	City of Williston
5642.5	222,800	GOLDEN HILLS GOLF & TURF CLUB
5643.7	277,000	Utilities Inc of Florida - Golden Hills
6151.11	6,091,800	Marion County Utilities Consolidated WUP
6282.4	138,200	ROBERT KILLIAN
6405.1	81,700	RONALD C. GILLMAN
6423.4	335,400	Salmon's Wholesale Nursery
6585.2	39,100	Valhalla Estates dba Ocala Jockey Club
6586.6	653,800	B & G SEED PROCESSORS INC
6619.3	60,400	SUN COUNTRY ESTATES/PADDOCK DOWNS
6623.3	78,200	J C PENDRAY & SONS
6659.3	86,000	HELDON RANCH
6674.6	448,800	GOLDEN OCALA GC
6703.6	45,000	CECIL N AND JANE F BENTON
6760.6	404,000	Freddie Bell
6888.8	87,500	DUNNELLON HIGH SCHOOL & ELEM SCHOOL J

Permit Number	Permitted Quantity (avg annual gpd)	Project Name
6935.2	18,400	Niall Brennan Stables, Inc.
6989.2	68,100	Golden Cross Farm
7167.2	36,500	Rogers Ranch
7414.3	89,800	K5G, LLC
7445.3	79,600	SHARON MILLS
7487.3	19,000	Robert R. Hilger
7664.3	14,300	NEW EPISODE TRAINING CENTER
7709.1	4,400	JOSEPH B. GREELEY
7777.1	6,900	MARION CO SCHOOL BOARD
7825.1	5,300	OAK AVENUE WATER SYSTEM, INC.
7847.1	7,300	ELLIS M. & A.A. GILLUM (ALICE
8020.7	179,400	Marion Landing
8034.1	95,500	RAINBOW RIVER RANCH
8053.3	41,800	Red White and Blueberries LLC
8075.4	46,300	Classic Mile Park
8139.1	40,000	FALLS OF OCALA
8189.2	1,100	HAMIC ESTATES
8219.1	463,100	DAMON W SANDLIN
8255.2	314,200	JIMMIE E MARKHAM
8339.7	1,117,100	City Of Dunnellon
8828.1	55,400	DEWEY W BREWTON II
8992.3	61,400	FREDDY ARLENE & VIRGINIA BELL
9136.1	68,300	TAYLOR BRISTOW
9610.2	3,300	Solera Farms
10023.7	677,370	AEG Property-Levy County, Florida
10120.1	96,100	Thomas Overstreet, Jr
10148.1	8,700	Ernest and Colleen Guido
10266.3	369,000	STONE CREEK GOLF COURSE
10285.2	59,900	Roderick and Jennifer Cox
10419.1	16,800	JAJOLO (FKA OCALA MARKETING INC)
10502.2	29,100	Romeo Elementary School
10657.2	27,900	Williston Elementary School "B"
10685.2	29,600	Rainbow Springs State Park
10996.2	188,800	Edward F and Shirley A Williams
11002.2	68,100	Caldwell Property
11003.2	78,200	J C Pendray & Sons, Inc.
11005.2	148,700	Sampson Farm
11008.2	496,100	Twin Lakes
11009.3	407,700	Brown Farm
11026.3	1,484,800	#35 FARM
11084.0	58,300	PHYLLIS MCCOY
11088.0	54,600	RUBY NOBLES
11090.0	244,200	PHYLLIS V ALBRITTON

Permit Number	Permitted Quantity (avg annual gpd)	Project Name
11093.0	82,400	J.N. & ELVIRA HALE, JR.
11098.2	80,300	David Redeker
11211.2	141,900	Guest Place
11274.2	407,700	Bluebird Farm
11322.1	10,000	GEOFFREY P & PAMELA J BERNARD
11579.2	98,500	Cool Springs Ranch
11581.3	294,000	WILLISTON HIGHLANDS
11621.0	91,000	REUBEN & MARIA HERNANDEZ
11716.1	55,200	NEAL O & BILLIE JO SCHERER
11765.5	92,760	Hits Property
11783.1	17,300	GM-1 Partnership
11873.1	9,400	FARNSWORTH FARMS
11998.1	9,000	Penta B
12040.2	78,300	ROY R LANE SR & TODD LANE
12041.1	36,400	RONALD TABER
12090.1	240	ROBERT A BAKER
12159.1	323,740	KENNETH R & TERESA P CARROLL
12262.1	41,800	HARRELL H & DEBBIE K PHILLIPS JR
12263.2	97,500	Harrell H. and Debbie K. Phillips, Jr.
12303.1	83,000	James E & Terry Jean Hiers
12306.1	6,120	William J. and Colin D. Morrow
12380.1	86,000	SANDLIN FARMS
12420.1	97,600	Benton Farm
12549.3	85,800	Adena Springs South
12553.1	480,900	Williams 464 Property
12560.1	151,900	Robert J. Nealy Jr.
12573.2	62,300	John P. & Jennie C. Meade
12579.1	1,139,900	Thomas Farm
12583.1	116,800	Etheridge Sod Farm
12642.1	34,400	Adrienne Bell Agricultural Operation
12741.3	433,300	Northeast 20th to Northeast 30th Bell, BGH & Barle
12774.1	91,000	Remeta Sky
12843.2	310,520	JULIETTE FALLS
12880.0	69,000	BEN F & ROSE M FANT
12910.0	71,000	ROSS HARDWARE
12930.0	55,200	RANDALL & REBECCA JONES
12966.1	205,300	Stone Creek Community Association
13001.0	68,200	DONNA C PHILLIPS
13030.0	336,070	RONALD D & SARAH F CANNON
13050.0	1,000	SCHOOL BOARD OF LEVY CO
13058.0	15,100	ALDEN & PATRICIA A POOLE
13083.2	119,100	Palmer Resources, LLC
13157.0	76,700	WC & BARBARA P WEEKS
13197.0	202,500	SHADE TREE FARM
13206.1	38,400	Jess S. Jackson
13261.2	58,900	Vince Dean
13339.1	2,436,000	Marshall Tree Farm
13364.0	498,180	JOHN RUDNIANYN ET AL
20049.1	105,200	Berry Blue Farm
20050.0	40,200	Kotrba Blueberry Farm
20080.0	62,900	Mills/Cooter Farm
20098.0	14,400	Sateke Village

Permit Number	Permitted Quantity (avg annual gpd)	Project Name
20120.0	192,440	Rainbow Springs Golf & Country Club
20121.0	108,140	Rainbow's End Golf Course
20152.0	217,800	HT Ranch LLC
20167.0	2,000	CCW of Marion County
20173.2	522,400	Candler Hills, North Course, and South Course
20174.0	663,640	Circle Square Ranch
20175.0	21,700	Master Homeowner Association
20176.0	12,800	Sholom Park
20210.0	426,380	Roberts Quarter Horse Farm
20213.0	17,000	Juliette Falls Public Water Supply
20217.0	39,300	Jackson Farm
20255.0	791,800	Hiers Farm
20267.0	60,300	Baxter Peanut Farm
20319.2	887,800	Sleepy Creek Lands, LLC
20355.0	54,400	J and J Farms
20356.0	76,200	Brewington Property Melon Field
20398.0	236,100	Uncle Buds Ranch
20400.0	318,700	Rivers Farm Property
20419.0	98,900	Stephens Farm
20420.0	82,500	Walsh Family Farm

Appendix C: Jurisdictional Authority within the Rainbow River Springshed

FEDERAL

Federal jurisdiction in Rainbow River involves the regulatory responsibilities of the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Coast Guard, and the U.S. Fish and Wildlife Service. Their main regulatory functions include overseeing dredge and fill activities, maintaining navigability of the waters of the U.S., overseeing cleanups following pollution spills, protecting endangered species, and protecting overall environmental quality. These agencies, in conjunction with the U.S. Geological Survey, also contribute to the collection of technical data concerning the Rainbow River and its watershed. Land based conservation measures within the springshed may be addressed by the U.S. Department of Agriculture, Natural Resources Conservation Service (USDA / NRCS) which provides farmers and ranchers with financial and technical assistance to voluntarily apply conservation measures which benefit the environment and agricultural operations.

U.S. Army Corps of Engineers (USACE)

The U.S. Army Corps of Engineers (USACE) received jurisdiction over Inland Waters of the United States, for navigation purposes, in Section 9 and 10 of the Rivers and Harbors Act of 1899. A revision of the Rivers and Harbors Act in 1968 extended USACE jurisdiction allowing them to consider the fish and wildlife, conservation, pollution, aesthetics, ecology and other relevant factors of a project. The USACE regulatory program was further expanded in 1972 with the passage of the Federal Water Pollution Control Act Amendments, also known as the Clean Water Act (CWA). The discharge of dredge and fill into United States waters is regulated by the USACE under Section 404 of this act. The USACE jurisdiction was extended to wetlands due to a Supreme Court order in 1975 and Amendments to the CWA in 1977. The USACE also contributes 50% of the funds reimbursed to SWFWMD by FDEP for exotic aquatic plant control on Rainbow River.

Projects constructed by the USACE for local flood protection are subject to regulations prescribed to cover operation and maintenance. These regulations are contained in Sections 208.10 and 208.11, Title 33 of the Code of Federal Regulations.

U.S. Environmental Protection Agency (EPA)

The Environmental Protection Agency (Southeast Regional Office, Region IV, Atlanta, Georgia) has jurisdiction over surface waters in the state. Enforcement authority was given under the Clean Water

Act of 1972 and broadened under its revision in 1977. Key activities include the issuance of National Pollution Discharge Elimination System (NPDES) permits and restoration of surface and groundwater. The agency also reviews Corps of Engineers permit activities, sets minimum quality standards, and sets guidelines for state environmental 64 programs. The EPA also funds sewerage facilities' studies through the Southwest Florida Regional Planning Council (SWFRPC) and the Tampa Bay Regional Planning Council (TBRPC), and system improvements through the Florida Department of Environmental Protection. Authority regarding the discharge of oil or hazardous substances into surface water is divided between the EPA and the U.S. Coast Guard.

U.S. Coast Guard

In inland waters the Coast Guard Auxiliary performs boating safety inspections and search and rescue missions. The Auxiliary is a volunteer group reimbursed expenses when assigned missions by the U.S. Coast Guard.

U.S. Department of Agriculture (USDA)

The primary environmental related functions of the USDA are to preserve and conserve natural resources through restored forests, improved watersheds, and healthy private working lands. These broad objectives are facilitated by three USDA agencies: Farm Service Agency, the U.S. Forest Service, and the Natural Resources Conservation Service.

The Natural Resources Conservation Service (NRCS) is an agency of the U.S. Department of Agriculture (USDA) which provides financial and technical assistance to farmers, ranchers, and forest landowners. The NRCS administers multiple programs: Farm Bill conservation programs, Landscape Conservation Initiatives, small-scale farm fact sheets, and resources. All NRCS programs are voluntary science-based solutions. The NRCS was established by Congress under Public Law 74-46 in 1935.

U.S. Department of the Interior (DOI)

The primary water-related functions performed by this agency involve the review of proposed activities which may impact threatened or endangered species, review of U.S. Army Corps of Engineers permits for potential effects on fish and wildlife, and management of all federally-owned public lands. Within the DOI, the U.S. Geological Survey conducts investigations concerning hydrology, hydrogeology, water use, and ground and surface water quality. The U.S. Fish and Wildlife Service manages and restores fish and wildlife populations and conducts research on the effects of pollution on those resources. The National Park Service maintains federal parks and sanctuaries, regulating multiple uses on these lands to achieve a balance of benefits for both man and wildlife. The

DOI also oversees those requests and offshore activities associated with exploration and development on the outer continental shelf.

The U.S. Fish and Wildlife Service (USFWS) is responsible for oversight of the federal program for fish and wildlife as authorized in the Coastal Resources Barrier Act, National Environmental Protection Act, Migratory Bird Act, Endangered Species Act, and Fish and Wildlife Coordination Act. Under provisions of the Fish and Wildlife Coordination Act, the Fish and Wildlife Service must be consulted before the Corps of Engineers can submit a plan for Congressional approval. The Fish and Wildlife Service comments on the impacts of proposed projects on endangered species, migratory birds and other fish and wildlife and their habitats. The USFWS is directed to prepare environmental impacts assessments or statements for proposed Corps projects under provisions of the National Environmental Protection Act, and the USFWS is authorized under the Endangered Species Act to issue "Jeopardy Opinion" against any proposed project which will negatively affect an endangered species.

The U.S. Geological Survey (USGS) is the nation's largest water, earth, and biological science and civilian mapping agency. The USGS collects, monitors, analyzes, and provides scientific understanding about natural resource conditions, issues, and problems. Of particular relevance are the surface and ground water quality monitoring, stream flow measurements, water use reporting, and ground water recharge and contamination research.

STATE AGENCIES

Many state agencies are involved in environmental regulation and resource management in the Rainbow River watershed. The Florida Department of Environmental Protection is the lead agency in the protection and management of Rainbow River. Other relevant entities include the Florida Department of Agriculture and Consumer Services, the Florida Department of Community Affairs, the Florida Fish and Wildlife Conservation Commission, the Florida Department of Health, and the Florida Department of Transportation.

Florida Department of Agriculture and Consumer Services (FDACS)

The Department, through its Division of Agriculture Environmental Services (AES) regulates the registration and use of pesticides, including the purchase of restricted pesticides, maintains registration and quality control of fertilizers, regulates pest control operations, mosquito control, and evaluates and manages environmental impacts associated with agrochemicals.

The Office of Agricultural Water Policy (OAWP) facilitates communications among federal, state and local agencies and the agricultural industry on water quantity and water quality issues involving agriculture. The OAWP has developed Best Management Practices (BMPs) addressing both water quality and water conservation on a site-specific, regional and watershed basis for commercial agricultural operations. The office is directly involved with statewide programs to implement the Federal Clean Water Act's Total Maximum Daily Load (TMDL) requirements for agriculture. The OAWP works cooperatively with agricultural producers and industry groups, the Florida Department of Environmental Protection, the university system, the Water Management Districts, and other interested parties to develop and implement BMP programs that are economically and technically feasible. The office facilitates the participation of Soil and Water Conservation Districts in water-related issues at the County or watershed level.

Through the Florida Forest Service (FFS), the FDACS is responsible for developing, implementing, and monitoring BMP's through the Silviculture BMP Program to control forestry-related non-point source pollution. The FFS manages Florida's 34 State Forests and several other parcels of public land. The Division of Plant Industry is responsible for, among other duties, regulation of the movement of noxious weeds, and, with input from the Endangered Plant Advisory Council, protecting endangered, threatened or commercially exploited plant species.

Florida Department of Environmental Protection (FDEP)

This agency has three management jurisdictions along the Rainbow River:

Office of Coastal and Aquatic Managed Areas

The entire length of the Rainbow River was designated an Aquatic Preserve in 1986 (FS 258.39(32)). This management area represents all sovereign submerged state-owned lands along the river's length. The managerial intent of the designation is for these areas to be set aside and maintained in their natural or existing condition. Management efforts by this office focus on resource management and study of the ecological communities, and community environmental education.

Division of Recreation and Parks

Approximately 1000 acres of upland property adjacent to the river were purchased by the state in 1990, and are now managed as Rainbow Springs State Park. The park is divided into three management units. The headsprings are mainly managed for the swimming area, canoe dock, ornamental gardens and picnicking pavilions. A second area, one mile downstream, has 60 camping sites. The third area, further downstream, is a mixture of undeveloped sandhill and floodplain forest community and a new seasonal float facility for tubing down the river.

Division of Water Resource Management

The Southwest District Office in Tampa has responsibility for proprietary and regulatory permitting issues in the Rainbow River area.

Florida Department of Health (FDOH)

The primary environmental directive of the Florida Department of Health (FDOH) is to prevent disease of environmental origin. Environmental health activities focus on prevention, preparedness, and education and are implemented through routine monitoring, education, surveillance and sampling of facilities and conditions that may contribute to the occurrence or transmission of disease. Department of Health responsibilities include the public health functions of water supplies (primarily small to medium supplies), onsite sewage treatment and disposal systems permitting and inspection, septic tank cleaning and waste disposal (in conjunction with FDEP), and solid waste control (secondary role). The Onsite Sewage Program is administered by the Environmental Health Section of the FDOH office in each county.

The primary statutes providing FDOH authority are to be found in Chapter 154, 381 and 386 of the Florida Statutes and the 64E Series of the Florida Administrative Code, known as the "Sanitary Code". Each county has a FDOH Office responsible for jurisdiction within the county.

Florida Fish and Wildlife Conservation Commission (FFWCC)

Florida voters elected in 1998 to replace The Florida Game and Fresh Water Fish Commission (GFC) and the Marine Fisheries Commission (MFC) with the Florida Fish and Wildlife Conservation Commission (FFWCC) - effective July 1, 1999. The result is that Florida has placed responsibility for conserving the state's freshwater aquatic life, marine life and wild animal life all under a single agency.

The new FFWCC basically encompasses all the programs of the old GFC and MFC, plus some employees and programs from the Florida Department of Environmental Protection. FDEP's Bureau of Coastal and Aquatic Managed Areas and some other elements stayed with FDEP's Division of Marine Resources. The Florida Marine Research Institute (FMRI), the Office of Fisheries Management and Assistance Services (OFMAS) and the Bureau of Protected Species Management were transferred to the new agency. OFMAS, with some MFC staff, will be the new agency's Division of Marine Fisheries.

All employees from FDEP's Division of Law Enforcement, except for the Park Patrol, the Bureau of Emergency Response, the Office of Environmental and Resource Crimes Investigations and some field investigators now are part of the FFWCC.

Former Marine Patrol officers will continue to concentrate on enforcing saltwater laws, and former wildlife officers will continue to focus on freshwater and wildlife laws. However, when there is a need to reallocate law enforcement officers to deal with an emergency, the agency can do so. The Marine Patrol serves as an enforcement agency for the Florida Endangered and Threatened Species Act and the Oil Spill Prevention and Pollution Control Act. The Florida Marine Patrol also enforces state motorboat laws and the saltwater fisheries regulations of the Commission.

The FDEP Bureau of Protected Species Management, with responsibility for managing imperiled marine life, is now part of the FFWCC's Office of Environmental. The old GFC's Endangered Species Section is part of the new agency's Division of Wildlife.

Meanwhile, the Bureau of Marine Resource Regulation and Development which has jurisdiction over processing plants and shellfish management, is now part of the Florida Department of Agriculture and Consumer Services.

The Commission's efforts within the SWIM plan area primarily involve freshwater sport and commercial fishing, fisheries and habitat management, fish stocking, fisheries research, wildlife monitoring, enforcement of fisheries/wildlife regulations, listed species protection, wildlife research, development review, and regional planning. The Commission is directed by law to review SWIM plans to determine if the plan has adverse effects on wild animal life and fresh water aquatic life and their habitats

REGIONAL AGENCIES

Three sub-state agencies exist that would be involved in the implementation of the SWIM plan. These are the Southwest Florida Water Management District, the North Central Florida Regional Planning Council, and the Withlacoochee Regional Water Supply Authority.

Southwest Florida Water Management District (SWFWMD)

The Southwest Florida Water Management District is responsible for performing duties assigned under Ch. 373, F.S., as well as duties delegated through FDEP for Ch. 253 and 403, F.S., and for local plan review (Ch. 163, F.S.). It performs those duties for the entire Rainbow River watershed.

North Central Florida Regional Planning Council

Historically, the Withlacoochee Regional Planning Council (WRPC, encompassing Citrus, Hernando, Levy, Marion, and Sumter counties) was the Regional Planning Agency representing Rainbow Springs and River. State legislation in 2015 disbanded the WRPC and consolidated member counties into surrounding Regional Planning Councils (Levy and Marion to North Central Florida RPC, Citrus and Hernando to Tampa Bay RPC, and Sumter to East Central Florida RPC). The mission of the North Central Florida Regional Planning Council is to improve the quality of life of the Region's citizens, by coordinating growth management, protecting regional resources, promoting economic development and providing technical services to local governments. Regional planning council powers and duties are designated in Section 186.505 of the Florida Statutes.

Withlacoochee Regional Water Supply Authority

The Withlacoochee Regional Water Supply Authority (WRWSA) is a multi-county (Marion, Citrus, Hernando, and Sumter) special district of the State of Florida charged with planning for and developing cost-efficient, high-quality water supplies for its member governments. The Authority promotes environmental stewardship through its water conservation programs and will develop alternative water sources when necessary to augment traditional water supplies to meet the region's long-term needs. The WRWSA was created in 1977 by interlocal agreement among its member counties and this agreement was revised in 2014. The WRWSA operates under the authority of Florida Statute, Section 120.54 and Florida Administrative Code, Chapter 28-101.

LOCAL GOVERNMENTS

There are primarily two local governments within the Rainbow River watershed, the City of Dunnellon and Marion County which play a role in management of Rainbow River through daily management of their communities, the planning, zoning and other land use decisions, and the implementation and enforcement of local codes.

Marion County

The following ordinances have been adopted by Marion County for the protection/ preservation of Rainbow River:

(1) Ordinance No. 09-17 established Springs Protection Overlay Zones within the Land Development Code. Various land use prohibitions were established, as well as implementation of best management practices concerning karst feature protection and manure management; additional design

requirements were put in place concerning landscaping, stormwater, and wastewater systems. In 2013, the design requirements were incorporated throughout the code, recognizing that wherever you are in Marion County, the land use will impact groundwater and a springshed.

(2) Ordinance No. 73-4 - An emergency ordinance prohibiting dredging, filling, earth moving, and land clearing ... for a distance of 500 feet from the water's edge upon either side of Rainbow River or Blue Run in Marion County, Florida, between Rainbow Springs and the northern city limits of the City of Dunnellon. (Adopted June 14, 1973).

(3) Ordinance No. 73-9 - An ordinance regulating development in the unincorporated area of Marion County along and 500 ft upland of the Rainbow River. Establishes the need for a permit and the conditions of a permit for land clearing between the ordinary high water line and the 25 year flood plain; and for construction, land clearing, and septic tank placement between the 25 year flood plain elevation and the 100 year flood plain elevation. (Adopted November 13, 1973).

(4) Ordinance No. 85-17 - Section III: Prohibits food and non-alcoholic beverages in disposable containers on Rainbow River. Section IV: Makes possession of alcoholic beverages on Rainbow River unlawful. Section V: Established a twenty (20) miles per hour speed limit between October 16 of each year and April 14 of 69 the following year. Section VI: Establishes a no wake-idle zone on Rainbow River from April 15 to October 15 of each calendar year. Section VII: Establishes a five miles per hour speed limit and a no wake-idle speed only zone for motor boats upon the headwaters of the Rainbow River and KP Hole at all times during the year. Section VIII: Prohibits the operation of motors on motorboats and other craft in designated environmentally sensitive areas. Ordinance adopted October 22, 1985.

(5) Ordinance No. 86-10 - Prohibits SCUBA diving in the headwaters of Rainbow River.

(6) Resolution No. 85-R-279 - A resolution creating a Rainbow River Advisory Committee to make recommendations to the Marion Board of County Commissioners on safety and environmental issues relevant to the Rainbow River.

(7) Ordinance No. 88-4 - An ordinance amending the zoning code of Marion County affecting waterfront properties along designated water bodies (including Rainbow River). The ordinance established the waterfront side of the lot as the front yard. This in effect causes accessory structures with the exception of swimming pools, septic drain-fields and wells to be placed in either the side or back yards.

(8) Ordinance No. 88-7 - Because of recent sightings of manatee in the Rainbow River, this ordinance establishes a no wake-idle speed only limit on the Rainbow River for the entire year.

(9) Ordinance No. 08-35 - Florida Friendly Fertilizer Use on Urban Landscapes. This Ordinance regulates the proper use of fertilizers by any applicator; requires proper training of commercial and institutional fertilizer applicators; establishes training and licensing requirements; specifies allowable fertilizer application rates and methods, fertilizer-free zones, low maintenance zones, and exemptions. It requires the use of best management practices which provide specific management guidelines to minimize negative secondary and cumulative environmental effects associated with the misuse of fertilizers. 2008 ordinance has now been included in the latest Land Development Code.

City of Dunnellon

(1) Ordinance 85-8 - Similar in part to County Ordinance 85-17. Makes possession and consumption of alcohol illegal. This ordinance also prohibits food and non-alcoholic beverages in disposable containers on Rainbow River.
(2) Ordinance 85-9 - Similar in part to County Ordinance 85-17, and establishes seasonal speed limits identical to those for the unincorporated County.

Appendix D: List of Acronyms

Abbreviation	Description
AES	Agriculture Environmental Services
BMAP	Best Management Action Plan
BMP	Best Management Practices
CAMA	Office of Coastal and Aquatic Managed Areas (of FDEP)
CWA	Clean Water Act
DMR	Discharge Monitoring Reports
DOI	Department of Interior
EPA	United States Environmental Protection Agency
FARMS	Facilitating Agricultural Resource Management Systems
FAVA	Florida Aquifer Vulnerability Assessment
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
FDOH	Florida Department of Health
FDOT	Florida Department of Transportation
FFB	Florida Farm Bureau
FFS	Florida Forest Service
FFWCC	Florida Fish and Wildlife Conservation Commission
FGTS	Florida Greenways and Trails System
FMRI	Florida Marine Research Institute
FGS	Florida Geological Survey
FSI	Florida Springs Institute
GFC	Florida Game and Freshwater Fish Commission
HSC	Division of Habitat and Species Conservation
MFC	Marine Fisheries Commission
MFL	Minimum Flows and Levels
MOA	Memorandum of Understanding
NEP	National Estuary Program
NGO	Non-Governmental Organization
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service

Abbreviation	Description
NSILT	Nitrogen Source Inventory and Loading Tool
OAWP	Office of Agricultural Water Policy
OFMAS	Office of Fisheries Management and Assistance Services
OCE	Office of the County Engineer
OSTDS	onsite sewage treatment and disposal systems
SAV	Submerged Aquatic Vegetation
SCMC	Springs Coast Management Committee
SCSC	Springs Coast Steering Committee
SLER	Submerged Lands and Environmental Resources
SWCD	Marion Soil and Water Conservation District
SWFRPC	Southwest Florida Regional Planning Council
SWFWMD	Southwest Florida Water Management District
SWIM	Surface Water Improvement Management
TBRPC	Tampa Bay Regional Planning Council
TMDL	Total Maximum Daily Load
TWG	Technical Working Group
UF-IFAS	University of Florida - Institute of Food and Agriculture Sciences
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USDW	underground sources of drinking water
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WBID	Water Body Identification
WCAP	Water Compliance Assurance Program
WMD	Water Management District
WMIS	Water Management Information System
WRPC	Withlacoochee Regional Planning Council
WRWSA	Withlacoochee Regional Water Supply Authority
WWTF	Waste Water Treatment Facility
WWTP	Waste Water Treatment Plant

Appendix E: Partners and Programs

A central focus of this plan, and of the Springs Coast Steering and Management Committees, is to bring together the various public and private entities, and their respective programs, to achieve the common goal of restoring, protecting, and managing our spring-fed systems. This section highlights some of the programs and organizations that are key to the successful implementation of this plan.

Southwest Florida Water Management District (SWFWMD)

The mission of the Southwest Florida Water Management District is to manage water and related natural resources to ensure their continued availability while maximizing the benefits to the public.

District Springs Team

The District put together a team of spring experts whose knowledge is based on decades of research, pilot projects and complex groundwater models. Since each spring system is different, the team uses a variety of techniques such as regulation, monitoring, research and development, restoration and education to address each system's individual challenges.

Surface Water Improvement and Monitoring Program (SWIM)

The District's SWIM Program is responsible for many of the District's water quality and natural systems initiatives. With the help of state agencies, local governments and other organizations, the SWIM Program focuses on water quality and habitat restoration projects to accomplish these department initiatives.

Minimum Flows and Levels

Florida law (Chapter 373.042, Florida Statutes) requires the state water management districts or the Department of Environmental Protection to establish minimum flows and levels (MFLs) for aquifers, surface watercourses, and other surface water bodies to identify the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area. Rivers, streams, estuaries and springs require minimum flows, while minimum levels are developed for lakes, wetlands and aquifers. Minimum flows and levels are adopted into Southwest Florida Water Management District (District) rules (Chapter 40D-8, Florida Administrative Code) and used in the District's water use permitting program to ensure that withdrawals do not cause significant harm to water resources or the environment. Minimum Flows and Levels for Rainbow River and Springs are scheduled for adoption in late 2016.

Facilitating Agricultural Resource Management Systems (FARMS)

Implement agricultural BMPs in the Springs Coast springsheds—Weeki Wachee, Chassahowitzka, Homosassa, Crystal River/Kings Bay and Rainbow—that will reduce groundwater withdrawals and/or reduce nutrient impacts to groundwater and spring systems. BMP implementation within the Springs Coast project area will focus on both a reduction in groundwater use and/or a reduction in nutrient loadings to spring systems.

Utility Services Program

The District's Utility Services Program is a unique program that strengthens communication and improves water use efficiency. The Utility Services Program enhances cooperation by communicating key programs that the District offers to help utilities conserve water as well as allowing the District to learn about specific challenges that utilities face in meeting their customers' demand for potable water supply. This manual identifies the key contacts, conservation program tools, resources and documents that are available from the District, and provides links to additional information.

Florida Department of Agriculture and Consumer Services (FDACS)

The Florida Department of Agriculture and Consumer Services supports and promotes Florida agriculture, protects the environment, safeguards consumers, and ensures the safety and wholesomeness of food.

Division of Agricultural Environmental Services

The Division of Agricultural Environmental Services administers various state and federal regulatory programs concerning environmental and consumer protection issues. These include state mosquito control program coordination; agricultural pesticide registration, testing and regulation; pest control regulation; and feed, seed and fertilizer production inspection and testing. The Division of Agricultural Environmental Services, through its four bureaus, ensures that: pesticides are properly registered and used in accordance with federal and state requirements; mosquito control programs are effectively conducted; and feed, seed and fertilizer products are safe and effective. Estimates of the quantity of agricultural fertilizer applied are collected by the Division.

Florida Forest Service

The Florida Forest Service has a mission to protect and manage the forest resources of Florida, ensuring that they are available for future generations. The Florida Forest Service's forestry programs are implemented by its Field Operations staff within 15 field units across the state. Field personnel and equipment provide a more responsive and comprehensive approach to land management and wildfire control statewide. The Forest Hydrology Section provides specialized technical services and information to Florida's private and public forest landowners and to other interested parties, for the protection of the state's water resources in association with Silviculture activities. The core of this area of service is Florida's Silviculture Best Management Practices (BMP) program, which originated in 1979.

Florida Department of Environmental Protection (FDEP)

The Florida Department of Environmental Protection (FDEP), the lead agency for environmental management and stewardship, is one of the more diverse agencies in state government - protecting our air, water and land. FDEP is divided into three primary areas: Regulatory Programs, Land and Recreation, and Water Policy and Ecosystem Restoration.

Florida Green Lodging Program

The Florida Green Lodging Program is a voluntary initiative that designates and recognizes lodging facilities that make a commitment to conserve and protect Florida's natural resources. The program's environmental guidelines allow the hospitality industry to evaluate its operations, set goals and take specific actions to continuously improve environmental performance. Currently there are no Green Lodges within the Rainbow River Springshed or Watershed areas.

Florida Forever

Florida's premier conservation and recreation lands acquisition program, a blueprint for conserving natural resources and renewing Florida's commitment to conserve the state's natural and cultural heritage. Florida Forever replaces Preservation 2000 (P2000), the largest public land acquisition program of its kind in the United States. With approximately 9.9 million acres managed for conservation in Florida, more than 2.5 million acres were purchased under the Florida Forever and P2000 programs.

Office of Greenways & Trails

The Office of Greenways & Trails within the Division of Recreation & Parks provides statewide leadership and coordination to establish, expand and promote the Florida Greenways and Trails System (FGTS) pursuant to the Florida Greenways and Trails Act (Ch. 260, FS).

Bureau of Laboratories

The Department's Bureau of Laboratories specializes in providing scientific information to assess the nature and extent of human disturbances on Florida's environment. The Bureau provides a full range of environmental services, including a diverse array of chemical and biological laboratory analyses, field sampling, technical review and interpretations of the data.

Office of Legislative Affairs

The legislative program includes developing legislation and support information, and finding sponsors for legislation. The Office also serves as the central point of contact for legislators and their staffs for information about the Department's programs.

Water Resource Management/Environmental Assessment & Restoration

The Department's Water Programs are responsible for protecting the quality of Florida's drinking water as well as its rivers, lakes and wetlands, and for reclaiming lands after they have been mined for phosphate and other minerals. The Programs establish the technical basis for setting the State's surface water and ground water quality standards. They also implement a variety of programs to monitor the quality of those water resources.

Division of Air Resource Management

The Division of Air Resource Management is charged with regulation of Florida's air resource, including air monitoring, permitting and compliance of emission sources, and implementing the Siting Acts. Through a variety of services for our customers—the public and industry—the Division of Air Resource Management regulates Florida's air resource fairly, consistently, and efficiently to enable

economic opportunities for the state, while implementing state, federal Clean Air Act, and U.S. Environmental Protection Agency requirements.

Division of State Lands

The Division of State Lands acquires and manages lands as directed by the Board of Trustees of the Internal Improvement Trust Fund. The Division provides oversight for approximately 12 million acres of public lands, including islands and 700 freshwater springs. The Division also provides upland leases for state parks, forests, wildlife management areas, historic sites, educational facilities, vegetable farming, and mineral, oil and gas exploration.

Division of Recreation and Parks

Florida's 171 award-winning state park and trail properties, including Rainbow Springs State Park, have inspired residents and visitors with recreation opportunities and scenic beauty that helps to strengthen families, educate children, expand local economies and foster community pride. With 161 parks, 10 state trails, nearly 800,000 acres, 100 miles of beaches and more than 1,500 miles of multi-use trails, visit soon and often to enjoy Florida's natural treasures.

Aquifer Protection Program

The Aquifer Protection program consists of a team of geologists and engineers dedicated to protecting Florida's underground sources of drinking water (USDW) while maintaining the lawful option of disposal of appropriately treated fluids via underground injection wells.

Wastewater Management Program

The Wastewater Program is divided into three areas:

- *The Water Compliance Assurance Program (WCAP)*

The Water Compliance Assurance Program in Tallahassee serves to facilitate statewide coordination of compliance and enforcement activities relating to the development of policy, guidance and training materials to ensure consistency among the six District Offices for the state's Industrial and Domestic Wastewater Programs. WCAP administers the compliance and enforcement components of the National Pollutant Discharge Elimination System (NPDES) Stormwater program; which includes conducting inspections, handling compliance and enforcement activities and processing stormwater Discharge Monitoring Reports (DMRs).

- *Domestic Wastewater Program*

The Domestic Wastewater Section in Tallahassee is responsible for the development and administration of rules and policy for proper treatment of wastewater from domestic facilities. Other responsibilities include such activities as industrial pretreatment, biosolids management, reuse of reclaimed water, wastewater to wetlands and coordination of on-site sewage treatment and disposal activities with the Department of Health.

- *Industrial Wastewater Program*

The Industrial Wastewater Program issues permits to facilities and activities that discharge to surface waters and ground waters of the state. Industrial wastewater that discharges to domestic wastewater treatment facilities, however, is regulated under the Industrial Pretreatment component of the Department's Domestic Wastewater Program.

Submerged Lands and Environmental Resources (SLER)

The Office of Submerged Lands and Environmental Resources addresses the dredging, filling and construction in wetlands. The Office also ensures that activities in uplands, wetlands or other surface waters do not degrade water quality or the habitat for wetland dependent wildlife.

Office of the Florida Geological Survey (FGS)

The FGS specializes in geoscience research and assessments to provide objective quality data and interpretations. Environmental, conservation and public-welfare issues are addressed through applied field and laboratory investigations supported by our geologic sample and research libraries as well as collaborative efforts within the Florida Department of Environmental Protection and with other regulatory or policy-making entities.

Office of Environmental Education

The Office of Environmental Education seeks to promote and support environmental citizenship by building awareness, understanding and appreciation of Florida's environment. Together with other government agencies, non-profits, the academic and the private sector, the Office contributes structure and funding for environmental education in Florida.

Florida Coastal Office

The Florida Coastal Office (formerly: Office of Coastal and Aquatic Managed Areas) manages more than 4 million acres of the most valuable submerged lands and select coastal uplands. The Office manages 41 aquatic preserves, including the Rainbow Springs Aquatic Preserve, and, in coordination with the National Oceanic and Atmospheric Administration, three National Estuarine Research Reserves and the Florida Keys National Marine Sanctuary.

Florida Department of Health (FDOH)

The Florida Department of Health (FDOH) has responsibility and authority to prevent disease of environmental origin. Environmental health activities focus on prevention, preparedness, and education and are implemented through routine monitoring, education, surveillance and sampling of facilities and conditions that may contribute to the occurrence or transmission of disease produced by blue-green algae (cyanobacteria) are monitored by and under the purvue of the FDOH.

Onsite Sewage Program

Of particular relevance to springs protection is the role that FDOH has regarding the permitting and inspection of onsite sewage treatment and disposal systems (OSTDS). The FDOH office in each county.

Other related FDOH roles include septic waste collection and disposal (in conjunction with FDEP), and solid waste control (secondary role).

Passive Nitrogen Reduction Study

In 2008 as part of the state wide effort to reduce nitrogen delivery to the environment, the legislature directed the FDOH to conduct the Florida Onsite Sewage Nitrogen Reduction Strategies Project of life-cycle costs and cost-effectiveness of passive nitrogen reduction treatment technologies in comparison to more active technologies and to convention treatment systems; 2) characterization of nitrogen removal from effluent in the soil underneath the drainfield and in shallow groundwater; and 3) development of simple models to describe the fate and transport of nitrogen from onsite sewage treatment and disposal systems. The project findings to date and completed tasks can be found at the FDOH onsite sewage research website.

Florida Fish and Wildlife Conservation Commission (FFWCC)

The Florida Fish and Wildlife Conservation Commission (FFWCC) manages the wildlife and wildlife habitats for their long-term well-being and the benefit of people and endangered species protection, fishing activities, wildlife harvesting, and aquatic vegetation management are all conducted under FFWCC rules and regulations. FFWCC Division of Law Enforcement is a lead agency in the enforcement of environmental, fisheries, and wildlife laws.

Division of Habitat and Species Conservation

The Division of Habitat and Species Conservation (HSC) integrates scientific data with applied habitat management to maintain stable or increasing populations of fish and wildlife. Integration efforts focus on the ecosystem or landscape scale to provide the greatest benefits to the widest possible array of fish and wildlife species through extensive collaboration and partnering with local, state and federal agencies.

Aquatic Habitat Conservation and Restoration Section

This section uses a multidisciplinary approach to develop and implement comprehensive management programs to improve the ecological health of freshwater, estuarine and marine habitats. Its primary focus is identifying high-priority water bodies and implementing a variety of management treatments to maintain quality habitat for wetland-dependent fish and wildlife. Working with other agencies and user groups, this section builds cooperative relationships to address various issues affecting aquatic resources, including nutrient enrichment, water-use policy, and protection of rare and imperiled fish and wildlife.

Conservation Planning Services Section

Working with private and public sector landowners, this section develops and helps implement comprehensive, habitat-based management plans and incentive programs for landowners. Conservation Planning Services also provides managers of publicly owned lands with technical assistance to implement land-use plans that reduce negative impacts on fish and wildlife. This section

uses scientific data to review and comment on FFWCC-regulated activities that may affect wildlife habitat.

Species Conservation Planning Section

Conserving Florida's native wildlife diversity is the mission of this section. It develops and implements high-priority conservation activities for native wildlife, with an emphasis on threatened species. Partnerships with other governmental agencies (local, state and federal), nongovernmental organizations and individuals help achieve conservation goals for wildlife. This section manages most of the state's threatened species and coordinates activities relating to Florida's listing process and permitting of human activities that may affect listed species.

Imperiled Species Management Section

This section is responsible for conservation of manatees, sea turtles, panthers and black bears through implementation of federal recovery plans and state management plans. Other key section tasks include development of rules and regulations that provide needed protections, providing technical assistance to local governments and other state agencies for planning purposes and permit reviews, and addressing human-wildlife conflicts. The section coordinates with the Fish and Wildlife Research Institute's researchers to identify information needs that will assist in making management decisions. The section conducts outreach activities to encourage the public to become watchful stewards over Florida's threatened species.

Exotic Species Coordination Section

This section works with the FWC's Division of Law Enforcement's Captive Wildlife staff to prevent nonnative species from harming native fish and wildlife and develop science-based regulations to prevent the release and establishment of nonnative species. Partnerships with other local, state and federal groups promote responsible pet ownership and increase awareness of the problems of introduced species, while also managing nonnative species present in Florida.

Invasive Plant Management Section

This section is responsible for directing, coordinating and funding two statewide programs controlling invasive upland plants on public conservation lands and invasive aquatic plants in public waterways. This section regulates, through a permitting program, projects for control of aquatic plants that do not meet the eligibility requirements for state funding. The FFWCC protects Florida's native plant and wildlife diversity with controls to manage invasive plants on public lands and waterways, dissemination of information, public education efforts, contractual research, and surveillance of plant communities on public lands and waterways. This section's goal is to protect native fish and wildlife habitat by reducing existing populations of invasive plants and preventing new invasive plant populations from becoming established.

Marion County

Marion County UF/IFAS Extension Service

Marion County UF/IFAS Extension Service is a cooperation between (and funded by both) the Marion County Board of County Commissioners and the University of Florida. Extension agents who are experts in their fields compose the staff and work to "extend" the research and resources of the university to Marion County residents through educational programs and services.

Office of the County Engineer

The Marion County Office of the County Engineer (OCE) provides efficient, economical and quality transportation and stormwater systems to satisfy diverse mobility needs, while ensuring the safety and welfare of the general public and the preservation of the environment.

Office of Public Information

The Office of Public Information provides accurate, relevant and timely information to the public about Marion County events, news, programs, projects and services. Public Information uses a multimedia approach to disseminate information that includes electronic publications, media releases, photography, printed handouts and publications, social media and video.

Parks and Recreation

The Parks and recreation Department serves Marion County residents and visitors by providing park facilities, recreation services, park planning and protection of the counties natural resources.

Marion County Utilities

Marion County Utilities provides water and wastewater services to nearly 30,000 water customers in Marion County.

City of Dunnellon

Community Development Department

The Community Development Department provides long-term strategies for the City's growth ensuring compliance with the City's Comprehensive Plan, including preservation of our natural environment, and the enhancement of neighborhoods and businesses through a Community Redevelopment program.

Public Services Department

Department responsibilities include support of all citizens and departments related to animal control, cemetery, fiber utility, parks and recreation, roads and streets, sanitation, stormwater, water, wastewater, and utility billing.

Levy County

Agriculture Center - Extension Office

The Agriculture Center Extension Service offers information and services vital to the commercial agriculture producer as well as to the hobby farmer and homeowner relating to the culture of all plants and domesticated farm animals. Services are provided by Extension Agents in partnerships with Levy County and the UF/IFAS Extension Service.

Planning Department

The Planning Department maintains and administers the Levy County Comprehensive Plan. The department conducts research and analysis to assess and promote, in the public interest, the best use of the County's natural and physical resources and to develop policies, plans and ordinances to that end. The department also functions as a review agency to ensure that current development occurs in a manner that is consistent with the county's land use, economic and environmental policy.

Soil and Water Conservation Board

The Levy County Soil and Water Conservation Board's mission is to deliver natural resources conservation technology and education to local land users and to promote the best land use and management practices that will conserve, improve, and sustain the natural environment of Levy County. The Board also works with the schools throughout the county with various projects such as land judging, speaking, and poster contests. The Soil and Water Conservation Board office is located in the USDA Service Center in Bronson.

Water Utilities

The Water Utilities Department has annual water quality reports available for the four County waste water treatment facilities. This department could be tasked with advancing waste water treatment, providing reclaimed water for appropriate uses, and expanding service networks to existing septic systems.

Withlacoochee Regional Water Supply Authority

The Withlacoochee Regional Water Supply Authority (WRWSA or "Authority") is a multi-county special district of the State of Florida charged with planning for and developing cost-efficient, high-quality water supplies for its member governments. The Authority promotes environmental stewardship through its water conservation programs and will develop alternative water sources when necessary to augment traditional water supplies to meet the region's long-term needs.

Marion Soil and Water Conservation District

The Marion SWCD is a local government agency that works to protect, enhance, and improve the natural resources in Marion County through education, technical assistance and grants.

Florida Farm Bureau

The Florida Farm Bureau Federation's mission is "to increase the net income of farmers and ranchers, and to improve the quality of rural life." The vision of the FFBF is "Florida Farm Bureau will be the most effective, influential and respected Farm Bureau in the nation. To truly be recognized as Florida's Voice of Agriculture.

Audubon Florida

Audubon's mission is to conserve and restore natural ecosystems, focusing on birds, other wildlife, and their habitats for the benefit of humanity and the earth's biological diversity.

Rainbow River Conservation, Inc.

The mission of the Rainbow River Conservation, Inc. is to protect and preserve the water quality, the natural beauty, the riverbed, and the flood plains of the Rainbow River through education, conservation, stewardship, and advocacy.

The Howard T. Odom Florida Springs Institute, Inc.

The mission of the Florida Springs Institute is to provide a focal point for improving the understanding of springs ecology and to foster the development of science-based education and management actions needed to restore and protect springs throughout Florida.

Appendix F: Draft Potential Projects and Initiatives to Support Management Actions

Draft potential projects and initiatives were provided by members of the TWG for review by the SCMC and SCSC. Tables 20, 21 and 22 list the projects and initiatives provided by members of the TWG that were not approved by the SCMC or SCSC to be included as a priority project or initiative.

Water Quality

Table 20: Draft Potential Water Quality Projects and Initiatives

Septic Tanks
Florida Water Management Inventory Lead Entity: FDOH The goal of the Florida Water Management Inventory project is to provide a centralized tool, using a data map, linking each built property in the state to information about the corresponding drinking water source (Public Water or Private Well) and the wastewater treatment method (Central Sewer or Onsite Septic). A comprehensive drinking water and wastewater inventory of the approximate 6.5 million developed parcels in Florida will provide many benefits including: • Enhanced customer service, permitting, development review, and planning activities for state agencies, local government, utilities, citizens, and other interested parties through data sharing. It will also identify redundancies and information gaps for future work. • Improved disaster preparedness and response activities resulting in accurate estimates of impacts on public health and infrastructure during disasters. • Aggregated data resource that researchers can use to help evaluate connections between various public health, environmental, or socio-economic factors. • Enhanced resource for homeowners, home-buyers, realtors and other entities interested in potable water and wastewater services. Centralized web portal of maps and data, consolidated project results, all accessible to the public Cost: $756,500 (statewide) Status: Proposed
Wastewater Treatment Facilities
Upgrade of Rainbow Springs WWTP to AWT Lead Entity: City of Dunnellon This project will upgrade the existing Rainbow Springs WWTP to Advanced Wastewater Treatment standards. Cost: TBD Status: Proposed
Upgrade of San Jose WWTP to AWT Lead Entity: City of Dunnellon

This project will upgrade the existing San Jose WWTP to Advanced Wastewater Treatment standards.

Cost: TBD

Status: Proposed

Septage

Collection Center for Septic System Pumpage

Lead Entity: Private Entity

Proposed project to construct a centralized collection center for septic tank pumpage in lieu of land application which is the current practice. The collection center would process the pumpage and discharge into a municipal collection system.

At the time this plan was printed, no municipal wastewater system was available to accept septage therefore, an independent pre-treatment facility would also have to be constructed as part of the overall design.

Cost: TBD

Status: Proposed

Water Quantity

Table 21: Draft Potential Water Quantity Projects and Initiatives

Alternative Water Supply
Rainbow Springs Reuse Project Lead Entity: City of Dunnellon This is a companion project to the upgrade of the Rainbow Springs WWTP and is contingent upon the successful completion of the conversion of the Rainbow Springs WWTP to Advance Wastewater Treatment (AWT). This project would provide up to 0.1 MGD of reuse water to the Rainbow Springs golf course. *Note: The Rainbow Springs Golf Club closed as of the first of the year and is looking for a buyer.* Cost: TBD Status: Proposed

Natural Systems

Table 22: Draft Potential Natural Systems Projects and Initiatives

Habitat Restoration
Living Shorelines Habitat Enhancement Pilot Project Lead Entity: FDEP Rainbow Springs Aquatic Preserve / SWFWMD This is a pilot project that will provide opportunities for residents to participate in a living shoreline program that will transform bare hardened seawalls into emergent vegetative habitat without the necessity to remove the existing seawall. There is a direct correlation between habitat disturbance and invasive species. This project will help restore altered shorelines thus reducing disturbance through recreation and other human activities while enhancing the ability of native vegetation to re-establish. Living shorelines can also provide significant water quality benefit by capturing runoff from adjacent yards and removing nutrients that would otherwise flow directly into the river. Cost: $75,000 Status: Proposed
Invasive Species Management
Vacuum Method of Filamentous Algae Control Pilot Project Lead Entity: FDEP Rainbow Springs Aquatic Preserve / SWFWMD This project will test various methods of using a portable suction pump to vacuum filamentous algae off the bottom as a means to control excessive algal growth in the lower river. Emphasis will be placed on algae collection and removal methods. Cost: $75,000 Status: Proposed

Appendix G: Results of Project Identification Exercises at the Technical Working Group Meetings

This appendix summarizes the results of the two Rainbow River Technical Working Group meetings. These meetings were focused on developing projects for the Rainbow River SWIM plan. The projects identified were considered for inclusion in the SWIM plan, in addition to other projects from stakeholders.

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Rainbow River Technical Working Group Meeting 1 Announcement

RAINBOW SPRINGS TECHNICAL WORKING GROUP MEETING

Rainbow Springs and River

This is the first of two meetings of the Springs Coast Steering Committee's Technical Working Group to review management actions and discuss proposed projects for the following focus areas:

- Water Quality
- Water Quantity
- Natural Systems

Results from this first meeting (and the second follow-up meeting) will be crucial in completing the Rainbow River SWIM Plan, the SCSC's Comprehensive Conservation and Management Plan to be completed this spring.

January 28, 2015

8:00am – 3:00pm

Rainbow Springs State Park
Conference Center
19158 SW 81st Place Rd
Dunnellon, FL 34432

* An optional boat tour of the Rainbow River is scheduled for the afternoon of Tuesday, January 27th, 2015 @ 1pm.

If interested in the boat tour, please RSVP no later than Friday, January 23 to: (chris.anastasiou@watermatters.org).

Southwest Florida
Water Management District
WATERMATTERS.ORG · 1-800-423-1476

Rainbow River Technical Working Group Meeting 1 Water Quality and Water Quantity Project Suggestions, January 28, 2015

WATER QUALITY GROUP 1
BMP Improvement Create Education Programs BMP Monitoring Expand IFAS Programs
Septic Tanks Amendment 1 Funds – to get connection to sewers
Row Crop Fertilizer Directly Support (Funding / Staff) Cost Sharing
Public Education for Anti-Microwave Funding Manage expectations long term investment
Cattle Horse Farm Manure composting program – fund Funding monitoring
Map nutrient loading hot spots

WATER QUALITY GROUP 2
Identify existing disposal sites (septic and sludge), quantify N load, assess effects of prohibition
Cattle & Horse Farms FARMS Project-expand northern exposure, identify potential projects Feasibility of regional manure disposal/recovery facility
Septic Tanks FDOH Update inventory FDOH Nitrogen study review Develop WW master plan based on political boundaries (Marion County does have a program, needs funding: Rainbow River Marion County Force Main project, east of river) Develop cost share program for septic upgrades and/or sewer connections Prioritize septic to sewer project in higher density areas

WATER QUALITY GROUP 3
WQ Monitoring Encourage info sharing, nutrient source studies, expand continuous nutrient/NOR monitoring Light/particulate export studies
Cattle & Horse Farms Biofuel projects BMP verification/evaluation develop advanced programs Nutrient budgets
Septic Tanks Nitrogen Study Florida Water Management Inventory (Marion & Levy)-per parcel, where does drinking water come from and where does waste water go.
Row Crops BMPS Effectiveness and verification/advanced Right crop/right place (education outreach)
Waste Water Treatment Assess the I &I (infrastructure)

WATER QUALITY GROUP 4
AG BMP implementation, cost share
Find use for animal waste and incentives
Hobby farms outreach
Pilot incentives for compost reuse
Sensitive areas first
Septic tanks Sewer projects FDOH study Amendment 1 land acquisition (converting timberlands and row crops)Rainbow River ranch and cool springs ranch
Control runoff along the river: swale and living shorelines along river
Fertilizer ordinance/education

WATER QUALITY GROUP 5
Land acquisition: near springhead
Fertilizer: incentive for slow release, additional research for crop benefit of slow release
Research nitrification inhibitors
Septic Take offline, focus on west side of river Mandate connections, needs state interest Improve WWTP discharge standards(FDEP/local) Pump Inspect program (FDOH) Address Pump Out Disposal (FDEP)
Cattle Horse Farms WQ monitoring on site to validate/verify effectiveness (FDACS) Improve composting incentives (FDEP/FDACS) Review Composting site regulations (FDEP) Cover manure piles (FDACS/IFAS) Staff farm outreach efforts, small hobby farms, having a rep (FDACS/IFAS)

WATER QUALITY GROUP 6
Cattle Farms/Horse Farms Fertilizer Education and more staff Certification program for BMAP awareness and nitrogen issues (existing program) FDACS cost sharing program
Septic Tanks Marion County project (ongoing) Soil amendments
Golf Courses Verifying BMPs are used
WWTF Get up to advanced standards

WATER QUANTITY GROUP 1
R&D Monitoring – modeling conduits – code Fund tracer tests to find conduits Springshed boundary shifts – monitor Effect of Inglis Lock / Withlacoochee dam on lower river
Voluntary Monitoring for domestic self-supply
Conservation Education on Irrigation & other uses Outreach for heavy water users Utility coordination to send info out
Alternative Water Supply Incentivize home irrigation alternatives

WATER QUANTITY GROUP 2
R&D Evaluate Inglis lock/dam structure effects on flow and stage Evaluate effects of forest management practices on aquifer recharge
Conservation Ongoing programs: FL Water Star, toilet rebates, irrigation audits-continuing and expanding Identify potential FARMS projects Increased outreach and funding to implement BMPs Meet the enhanced water conservation rule (per capita goals) Establish regional water conservation program Incentivize automatic meter readers (AMRs) Identify residences that need improved water devices (pre 1994 structures)
Reclaimed Water Ongoing: JB Ranch Require stormwater harvesting for landscape irrigation for new developments Lower Floridan aquifer potential assessment for Rainbow area Set Rainbow MFL(2016)

WATER QUANTITY GROUP 3
R&D Develop models/water budgets (water balance) Update groundwater availability assessment/inventory
Conservation Expand and promote incentives/rebates to reduce per capita use Encourage automated smart sensor technology
REG/MFL Expedite adoption Feasibility of water reservations for springs (prairie creek) Establish cap on ground water withdrawals

WATER QUANTITY GROUP 4
Conservation Land Acquisition Removing potential future withdrawals
Water Reuse Projects Tie into mast plans
R&D Determine well level nitrates prior to extraction (this is Water quality), allows you to adjust irrigation rates Require dual system at development land code

Water conservation Enhance the new technology for water use, require flow monitoring Soil Moisture Meter Use Replace center pivot irrigation with drop head Tiered rate structure, other conservation measures/education Rain sensors, low flow toilets/showers Florida friendly yards – utilize UF for free landscape service and yard plan, more demonstration projects. Pilot projects in neighborhoods to show it.
MFLs Encourage better regional ground water model More effective monitoring of drawdowns for permitted users Develop economic model and cultural of dollar values associated with water that results in the largest use extraction fee associated with outside of the basin. (don't give water away for free, i.e. bottled water plant permit fee)-understand the economic model to understand the cost/benefit of ground water extraction and use. A natural resource management plan. Determine an appropriate fee for water. Surface water retention Recharge enhancement

WATER QUANTITY GROUP 5
Conservation Targeted land acquisition Rebate programs (toilets, low flow) Educate/incentivized landscape retrofits (St. Augustine) Land regulations (new development) Educate owners on BMP licensure requirements
AWS Incentivize reclaim use on non-edible ag: storage/reservoir or expand pilot project/promote Regional Water Supply-this group didn't get to review this even though it pulls water from the Rainbow.

WATER QUANTITY GROUP 6
R&D Models, more consistent
Conservation Toilet rebate, WRWSA irrigation evaluation program, Florida water star New Development requirement to have Florida Water Star Tiered rate structures Leak detection expanded program and collaborative between utilities Ag: cost share for weather stations, reclaimed water Commercial: leak detection, increase water storage Golf course: co fund irrigation efficiency projects Williston example, has no reuse just spray fields. Expanding regional system.

Rainbow River Technical Working Group Meeting 2 Announcement

Springs Coast Steering Committee

RAINBOW SPRINGS TECHNCIAL WORKING GROUP MEETING – PART II

This is the SECOND meeting of the Springs Coast Steering Committee's Technical Working Group to discuss management actions and proposed projects for:

- NATURAL SYSTEMS (Habitat)

Results from this meeting will be crucial in completing the Rainbow River SWIM Plan, the SCSC's Comprehensive Conservation and Management Plan to be completed this spring. The focus of this meeting will be to:

- Recap the results from the first meeting held January 28, 2015 which focused on Water Quality and Water Quantity
- Identify specific project ideas for the NATURAL SYSTEMS focus area

February 27, 2015 9am – 3pm

Rainbow Springs State Park
Conference Center
19158 SW 81st Place Rd
Dunnellon, FL 34432

Southwest Florida
Water Management District
WATERMATTERS.ORG · 1-800-423-1476

Rainbow River Technical Working Group Meeting 2 Natural Systems Project Suggestions, February 27, 2015

NATURAL SYSTEMS GROUP 1
R&D Study to map index velocities in relation to natural systems.
Habitat Conservation Purchase lands identified by the Rainbow River Corridor project -Rainbow River Ranch property -Properties north of Hwy 40 -Properties north of headsprings -Acquire Cool Springs Ranch for conservation Purchase identified wildlife corridor gaps Protect/create/enforce shoreline protection ordinance -AP status exists for river – needs enforcement -OFW
Habitat Restoration Require living shorelines be planted for all docks Restore historic vegetation types in springshed (long leaf pine/wiregrass) Create a diversity of habitats (fish beds, etc.)
Invasive Plant Management Condition individual aquatic plant control permits to require living shoreline replacement Targeted mechanical removal of filamentous algae in mid/lower river
Recreation Management Create mooring buoy sites (below preserve, at popular dive locations) Create/enforce recreational management plant (zones-tubes, boats, all, none) -Identify/designate lead entity (FDEP, County, City) Education/Outreach (rec guide exists)-print more RRC guides

NATURAL SYSTEMS GROUP 2
• Evaluate historical plant management activity effects on changes to the native, exotic, and macroalgae populations(p) • Improve education and outreach to riparian homeowners (a) o Land management, i.e. leaf blowing o Ecology (native vs exotic species) benefits of wetland plants o Homeowners associations (rules to protect river) – see Rainbow River Conservation group for specific examples of current works • Include species diversity in monitoring efforts for understanding trophic interactions/food webs (a) • Acquire land for wetland restoration and treatment wetlands (a) • Blue Cove Restoration (p) o Aerators o Floating wetlands o Partially fill (decrease residence time) • Invasive animal control, i.e. armored catfish (a) • Educate operators/rental outfits about best practices.(a) o Permit program to require operator education(p) • Evaluate effects of users (tubers, boats) at low water levels(p) o Create restrictions at low water level threshold (big motor type)
• Assess the potential to restore to top-predators(p) o Top-down effects on ecosystems

- Gar
- Evaluate potential to restore access by anadromous species (p)
  - Mullet, sturgeon, manatees

NATURAL SYSTEMS GROUP 3-
R&D • Encourage streamline permitting process (USACE) (a and p)   o Fed Legislation: nationwide 27 to include underwater habitat • Statewide library/database: info sharing/website (p)

Habitat Conservation
• Develop criteria for Land Acquisition for SPGS Protection (p)
  o Measurable benefit
• Habitat benefit for conservation easements (p)
  o Nail down measurable benefit
• Purchase cool SPS and River Ranch (p)
• Develop Management & use plans for purchased lands(a)

Habitat Restoration
• Re-vegetation experiment/demo (p)
  o Downstream: RS swim area
  o State Park Tuber Exit
• ID Additional locations (p)
• Public education – develop living shoreline homeowner guide (determine interest)(p)
• ID a demo site for living shoreline(p)
• Determine impact/benefit of Blue Cove Restoration (p)
• ID muck/sediment removal locations in coordination with re-vegetation (p)

Invasive Aquatic Plant Management • ID areas to test suction vacuum method for Lyngbya removal in coordination with re-vegetation (p) • One-stop shop for public info (website links)-where does the public go to find out if they need a permit(p) Recreation • Promote unified approach to law enforcement presence (a) • Better manage/protect high use areas (a)

NATURAL SYSTEMS GROUP 4
R & D Establish baseline for Flora & Fauna (p)
BMPs for management of Hydrilla (not eradication) (p)
Living Shorelines - Survey of homeowner interest (p) - Education / outreach program (p) - Incentivize program (p) – Marion County Landscape Irrigation Retrofit Program
Develop Model Ordinances & Comp plans (p) – Marion County
Carrying Capacity - Visitor experience survey (p)
Recreational Management - Establish TWG tasked with establishing the resource impact from users (p) – state/county coordinated effort to reduce/manage impact from users – Cumulative impact assessment with strategies - Establish MOA between State & County for Recreational Use facilities specific to tubing
Land Acquisition

- Prioritize Pieces to acquire & evaluate funding - Rainbow River Ranch - Property around headspring
Habitat Restoration - Identify Funding sources for all management actions - Implement a tiered finding match for CFI - ID areas to use coconut fiber mats for restoration
Rainbow River Turtle brochure - What to do to protect habitat
Species Specific evaluations to establish buffer widths