



**RAINBOW SPRINGS  
STATE PARK**  
Park Chapter

GULF COAST REGION

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Rainbow Springs State Park

Park Chapter

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## Rainbow Springs State Park

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**Planning Region:** Gulf Coast

**County:** Marion

**Lease/Management Agreement Number:** 3900

**Overview:** Rainbow Springs State Park is home to Florida's 4<sup>th</sup> largest 1<sup>st</sup> Magnitude Spring and one of the most productive spring systems in the state. Rainbow Springs State Park was once a private roadside tourist attraction prior to state acquisition in 1990. Today visitors come to enjoy many activities such as swimming, snorkeling, tubing, canoeing, camping, and hiking.

**Total Acreage:** 1,584.43

<b>Natural Communities</b>	<b>Acres</b>
Basin Swamp	35.13
Depression Marsh	5.09
Floodplain Swamp	4.99
Hydric Hammock	141.63
Mesic Flatwoods	145.45
Scrubby Flatwoods	7.15
Sandhill	531.02
Spring-Run Stream	13.64

<b>Altered Land Cover</b>	<b>Acres</b>
Altered Landcovers	702.80

**Acquisition:** Rainbow Springs State Park was initially acquired on October 20, 1990 with funds from the Conservation and Recreational Lands (CARL) program. Currently the park comprises 1,584.34 acres.

### Resource Management Component

#### Hydrology

- Conduct/obtain an assessment of the park's hydrological restoration needs.
- Monitor and evaluate the natural hydrological conditions and functions within the headspring and improve approximately 0.1 discontinuous acres of spring-run stream natural community.
- Monitor and evaluate impacts associated with soil erosion at Rainbow Springs State Park

#### Natural Communities

- Within 10 years, 950 acres of the park have been maintained within the optimum fire return interval.
- Conduct habitat/natural community restoration activities on 244 acres of sandhill community
- Conduct habitat/natural community restoration activities on 75 acres of sandhill and flatwoods natural communities on the Rainbow River Ranch parcel.

## Rainbow Springs State Park

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- Conduct natural community/habitat improvement activities on at least 10 acres of sandhill community and successional hardwood forest

### **Imperiled Species**

- Update baseline imperiled species occurrence inventory lists for plants and animals
- Monitor and document 7 selected imperiled animal species in the park (SE Kestrel, Indigo snake, striped newt, gopher frog, gopher tortoise, Suwannee cooter, and Bachman's sparrow will be monitored).
- Monitor and document 1 selected imperiled plant species in the park (Giant orchid).

### **Invasive and Nuisance Species**

- Annually treat 200 acres of invasive plant species in the park.
- Develop and implement measures to prevent the accidental introduction or further spread of invasive plants in the park including written guidelines provided to park staff.
- Implement control measures on 3 nuisance and invasive animal species in the park (feral cats, dogs, and hogs).

### **Cultural Resources**

- Assess and evaluate 55 of 55 recorded cultural resources in the park.
- Compile reliable documentation for all recorded historic and archaeological resources.
- Bring 11 of 55 recorded cultural resources into good condition including Gift Shop, Rainbow Falls, and developing plan for submarine boats and Sandhill Cistern

## Land Use Component

### **Conceptual Land Use**

#### *Park Entrance*

- Complete new entrance station.

#### *Parking Area*

- Redesign parking area.
- Develop wayfinding elements.

#### *Springs Day Use Area*

- Provide convenient paddle craft drop off and pedestrian walkway.
- Plan and implement aquatic habitat protection measures and supporting interpretation in the swimming area.
- Re-naturalize the ornamental gardens.

#### *Primitive Group Camp*

- Construct a small semi-primitive group camp.



## Rainbow Springs State Park

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### *Campground*

- Connect to municipal sewer system.
- Improve organization and flow at the entrance.

### *Tube Concessions/Exit Area*

- Install RV hookup.
- Redesign entrance area.

### *Griffitts Addition*

- Remove infrastructure that is underutilized and in poor condition.

### **Optimum Boundary**

There are roughly 40 parcels in the Park's Optimum Boundary that total 1,274 acres. They are divided into 4 groupings based on their location relative to the park: Northwest, Northeast, Central, and South.

The Northwest group totals approximately 394 acres spread across 11 parcels. 375 acres are within the Rainbow River Corridor Florida Forever Project.

The Northeast group totals approximately 674 acres spread across 18 parcels. 178 of these acres are within the Rainbow River Florida Forever Project. These would connect inland areas between the northern and southern tracts. Protection would be offered to Sandhill communities and the Gissy Spring/spring-run, which flows directly into the Rainbow River.

The Central Group consists of approximately 17 acres separated across 4 parcels. 14 of these acres are found within the Rainbow River Florida Forever Project. These properties would connect shoreline between the northern and southern tracts.

The South Group is composed of approximately 190 acres divided across 7 parcels. All of the 190 acres are within the Rainbow River Florida Forever Project. These properties would provide greater springhead protection.





# RAINBOW SPRINGS STATE PARK

MARION COUNTY, FLORIDA

0 750 1,500 Feet

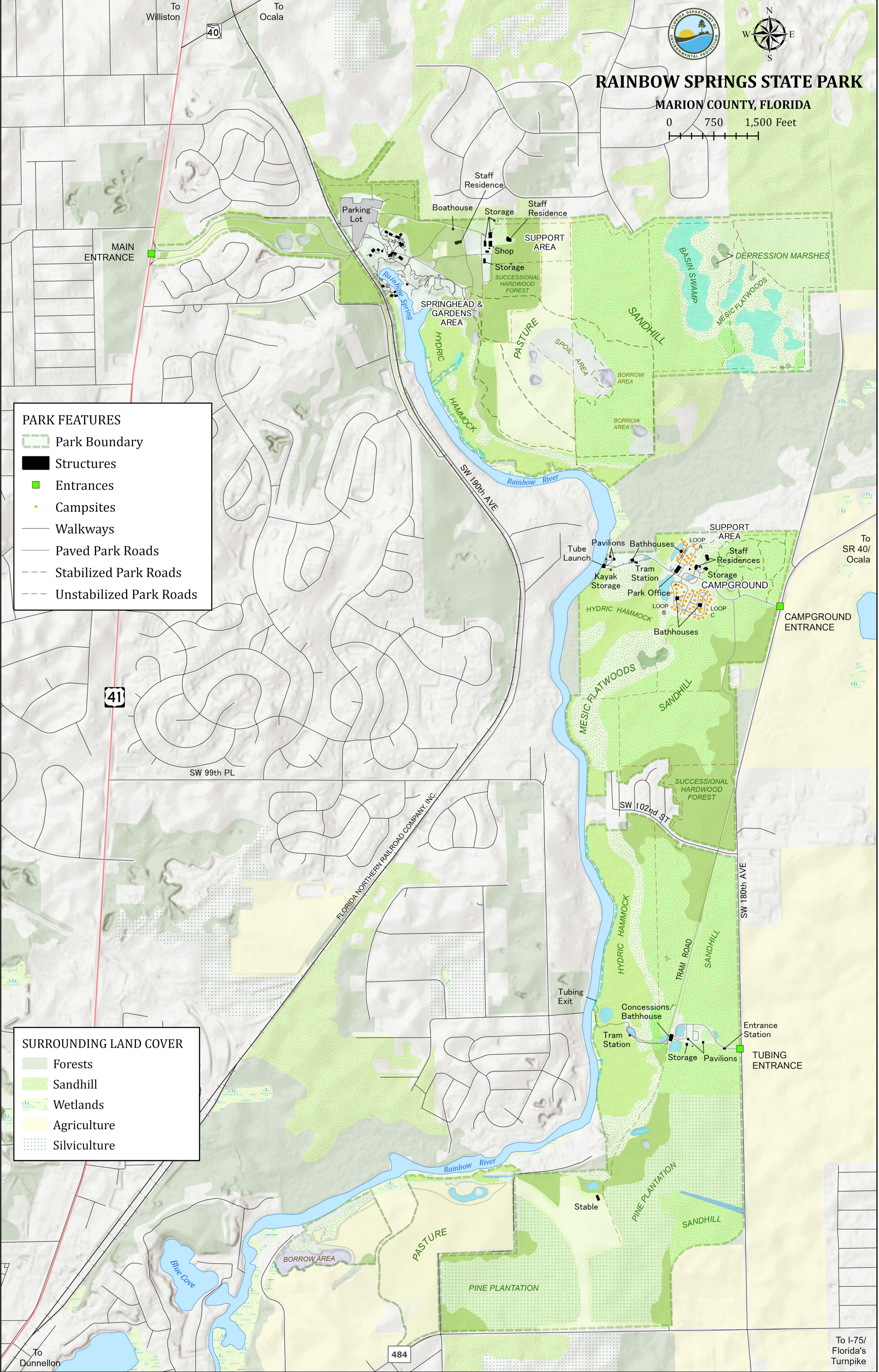


### PARK FEATURES

- Park Boundary
- Structures
- Entrances
- Campsites
- Walkways
- Paved Park Roads
- Stabilized Park Roads
- Unstabilized Park Roads

### SURROUNDING LAND COVER

- Forests
- Sandhill
- Wetlands
- Agriculture
- Silviculture

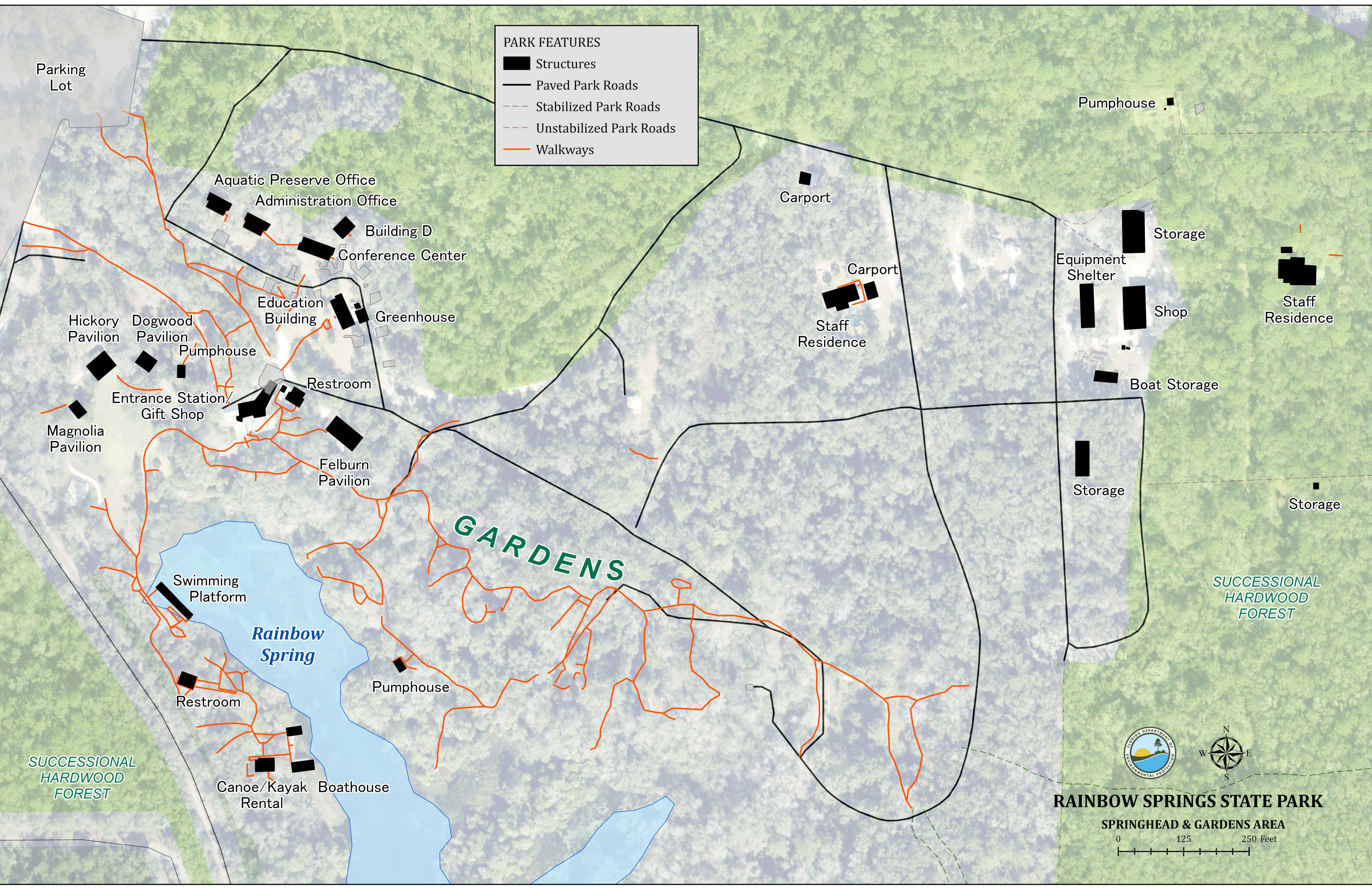


To I-75/  
Florida's  
Turnpike



**PARK FEATURES**

- Structures
- Paved Park Roads
- - - Stabilized Park Roads
- - - Unstabilized Park Roads
- Walkways



Parking Lot

Aquatic Preserve Office  
Administration Office  
Building D  
Conference Center

Hickory Pavilion  
Dogwood Pavilion  
Pumphouse  
Entrance Station/  
Gift Shop  
Magnolia Pavilion

Education Building  
Greenhouse

Restroom

Felburn Pavilion

Swimming Platform  
**Rainbow Spring**

Restroom

Canoe/Kayak Rental  
Boathouse

**GARDENS**

Pumphouse

Carport

Carport  
Staff Residence

Pumphouse

Storage  
Equipment Shelter  
Shop

Staff Residence

Boat Storage

Storage

Storage

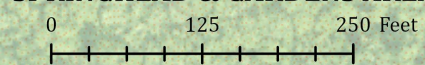
*SUCCESSIONAL  
HARDWOOD  
FOREST*

*SUCCESSIONAL  
HARDWOOD  
FOREST*



**RAINBOW SPRINGS STATE PARK**

SPRINGHEAD & GARDENS AREA





# **INTRODUCTION**

## **LOCATION AND ACQUISITION HISTORY**

Rainbow Springs State Park is located in Marion County. Access to the main park entrance is from U.S. Highway 41. The Gulf Coast Region Map also reflects significant land and water resources existing near the park.

Rainbow Springs State Park was initially acquired on Oct. 20, 1990, with funds from the Conservation and Recreational Lands (CARL) program. Currently, the park comprises 1,584.34 acres. The Board of Trustees of the Internal Improvement Trust Fund (Trustees) hold fee simple title to the park and on March 19, 1990, the Trustees leased (Lease No. 3900) the property to the Division of Recreation and Parks (DRP) under a 50-year lease. The current lease will expire on March 19, 2041.

Rainbow Springs State Park is designated single-use to provide public outdoor recreation and conservation. There are no legislative or executive directives that constrain the use of this property (see appendix). A legal description of the park property can be made available upon request to the Florida Department of Environmental Protection (DEP).

## **SECONDARY AND INCOMPATIBLE USES**

In accordance with 253.034(5) F.S., the potential of the park to accommodate secondary management purposes was analyzed. These secondary purposes were considered within the context of DRP's statutory responsibilities and resource values. This analysis considered the park's natural and cultural resources, management needs, aesthetic values, visitation, and visitor experiences. It was determined that no secondary management purposes could be accommodated in a manner that would be compatible and not interfere with the primary purpose of resource-based outdoor recreation and conservation.

DRP has determined that uses such as water resource development projects, water supply projects, stormwater management projects, linear facilities and sustainable agriculture and forestry (other than those management activities specifically identified in this plan) would not be consistent with the management purposes of the park.

In accordance with 253.034(5) F.S., the potential for generating revenue to enhance management was also analyzed. Visitor fees and charges are the principal source of revenue generated by the park. It was determined that no additional revenue generating activities are appropriate during this planning cycle. Generating revenue from consumptive uses or from activities that are not expressly related to resource management and conservation is not under consideration.

## **PURPOSE AND SIGNIFICANCE OF THE PARK**

### **Park Purpose**

The purpose of Rainbow Springs State Park is to conserve and protect the natural value of Rainbow Springs and the Rainbow River for the benefit of the people of Florida. The park was acquired to protect

the spring and river system by restricting development around the springhead and river and to use this exceptionally scenic area for active and passive public recreation.

### **Park Significance**

- The park protects Rainbow Springs, Florida's fourth-largest first magnitude spring group, which consists of at least 87 spring vents and a portion of the Rainbow River.
- The sandhill and other uplands in the park provide habitat for a variety of imperiled wildlife and plant species, including gopher tortoise, indigo snake, Florida mouse, southern fox squirrel, Florida pine snake and the giant orchid.
- The park contains an abundance of cultural sites including prehistoric periods, phosphate mining and the roadside attraction era of the 20<sup>th</sup> century that occurred throughout Florida prior to the arrival of large-scale theme parks.

### **Central Park Theme**

A former roadside attraction, Rainbow Springs State Park's historic walkways and cascading waterfalls give way to the natural beauty of a first magnitude spring.

Rainbow Springs State Park is classified as a state park in the DRP's unit classification system. In the management of a state park: a balance is sought between the goals of maintaining and enhancing natural conditions and providing various recreational opportunities. Natural resource management activities are aimed at the management of natural systems. Development in the park is directed toward providing public access to and within the park, and to providing recreational facilities, in a reasonable balance, that are both convenient and safe. Program emphasis is on interpretation of the park's natural, aesthetic, and educational attributes.

### **OTHER DESIGNATIONS**

The unit is not within an Area of Critical State Concern as defined in section 380.05; Florida Statutes and is not presently under study for such designation. The park is a component of the Florida Greenways and Trails System, administered by the DEP Office of Greenways and Trails.

All waters within the park have been designated as Outstanding Florida Waters, pursuant to Chapter 62-302, Florida Administrative Code. Surface waters in this park are also classified as Class III waters by DEP. The park is adjacent to the Rainbow Springs Aquatic Preserve as designated under the Florida Aquatic Preserve Act of 1975 (Section 258.35, Florida Statutes).

### **PARK ACCOMPLISHMENTS**

- Renovated gift shop roof.
- Installed new flooring in gift shop.
- Friends of Rainbow Springs State Park citizens support organization has purchased more than \$474,000 of necessary equipment and tools needed by park staff to accomplish renovations, repairs, and on-going maintenance.

- Initiated wastewater improvement plan to convert campground to municipal sewer.
- Developed plan to introduce prescribed fire into pyric habitats of management zones 5B and 5C.
- Upgraded half of the campground electrical pedestals.
- Continued treatment of invasive exotics plants, treating 419 acres from 2020-2022.



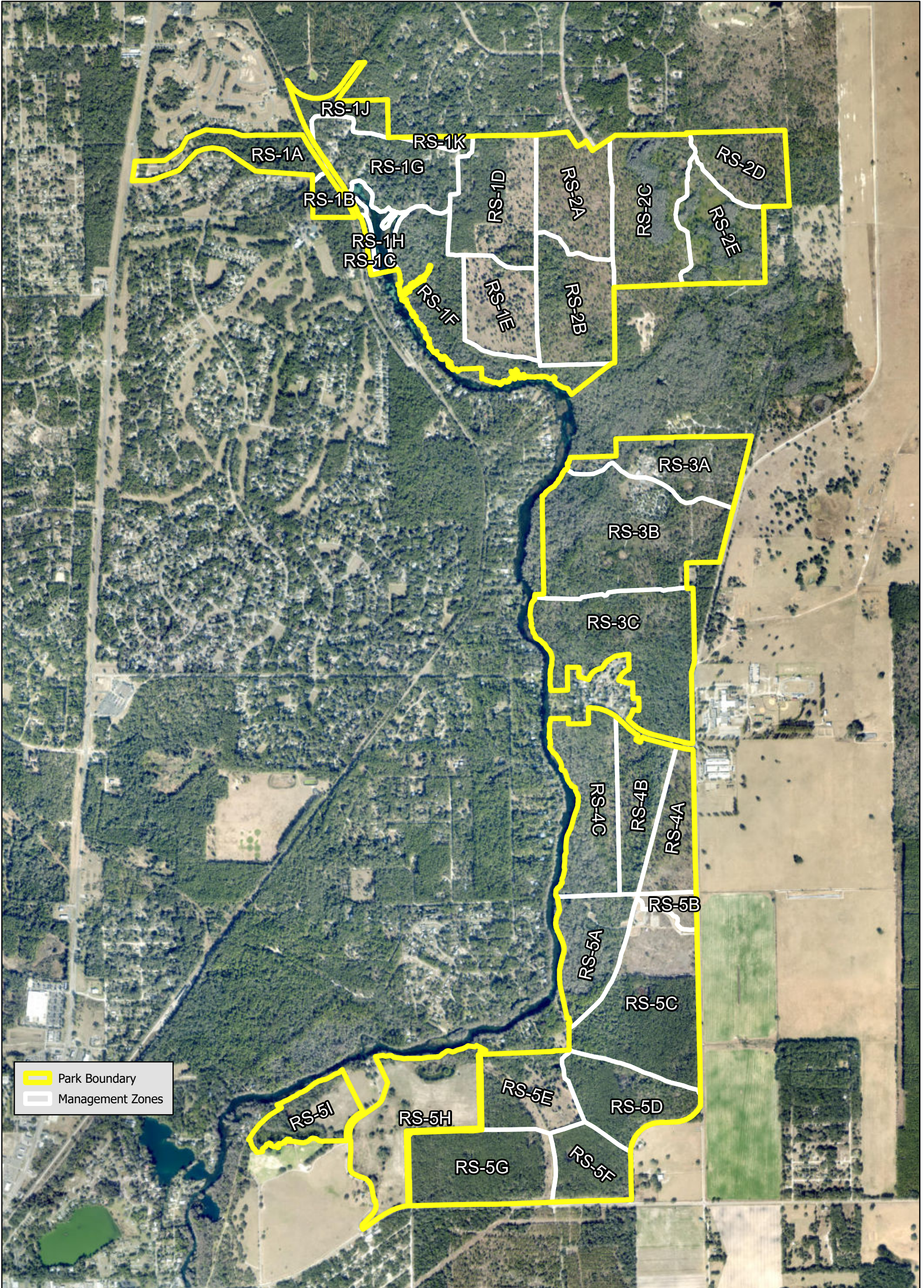
## RESOURCE MANAGEMENT COMPONENT



Rainbow Springs State Park Management Zones			
Management Zone	Acreage	Managed with Prescribed Fire	Contains Known Cultural Resources
RS-1A	33.33	Y	Y
RS-1B	8.99	Y	N
RS-1C	2.55	Y	N
RS-1D	70.91	Y	Y
RS-1E	46.75	Y	N
RS-1F	71.58	Y	Y
RS-1G	66.2	Y	Y
RS-1H	12.56	N	Y
RS-1J	19.17	Y	N
RS-1K	3.47	Y	N
RS-2A	58.14	Y	N
RS-2B	63	Y	Y
RS-2C	79.25	Y	N
RS-2D	41.86	Y	N
RS-2E	53.91	Y	N
RS-3A	53.39	Y	Y
RS-3B	133.64	Y	Y
RS-3C	113.25	Y	Y
RS-4A	38.13	Y	N
RS-4B	44.92	Y	Y
RS-4C	68.4	Y	Y
RS-5A	49.98	Y	N
RS-5B	9.5	Y	N
RS-5C	107.32	Y	N
RS-5D	53.01	Y	N
RS-5E	49.46	Y	N
RS-5F	37.07	Y	N
RS-5G	75.3	Y	N
RS-5H	78.39	Y	Y
RS-5I	34.14	Y	Y

### TOPOGRAPHY

Rainbow Springs State Park lies within a region of the state known as the Central or Mid-peninsular Physiographic Zone, specifically within the Western Valley between the Brooksville Ridge and the Cotton Plant Ridge. This geomorphic zone is characterized by karst terrain, developed from solution of the underlying limestone. The area exhibits discontinuous highlands, forming nearly parallel ridges or terraces that are separated by broad valleys. The Withlacoochee River is the primary drainage basin in this region. This water body is one of only three major rivers in Florida that flow from south to north. Uniquely, it also abruptly turns westward through a large topographic valley called Dunnellon Gap as it joins the Rainbow River (Faulkner 1973). The Withlacoochee drainage subsequently passes through Lake Rousseau and empties into the Gulf of Mexico near Yankeetown.





 Park Boundary  
 Management Zones

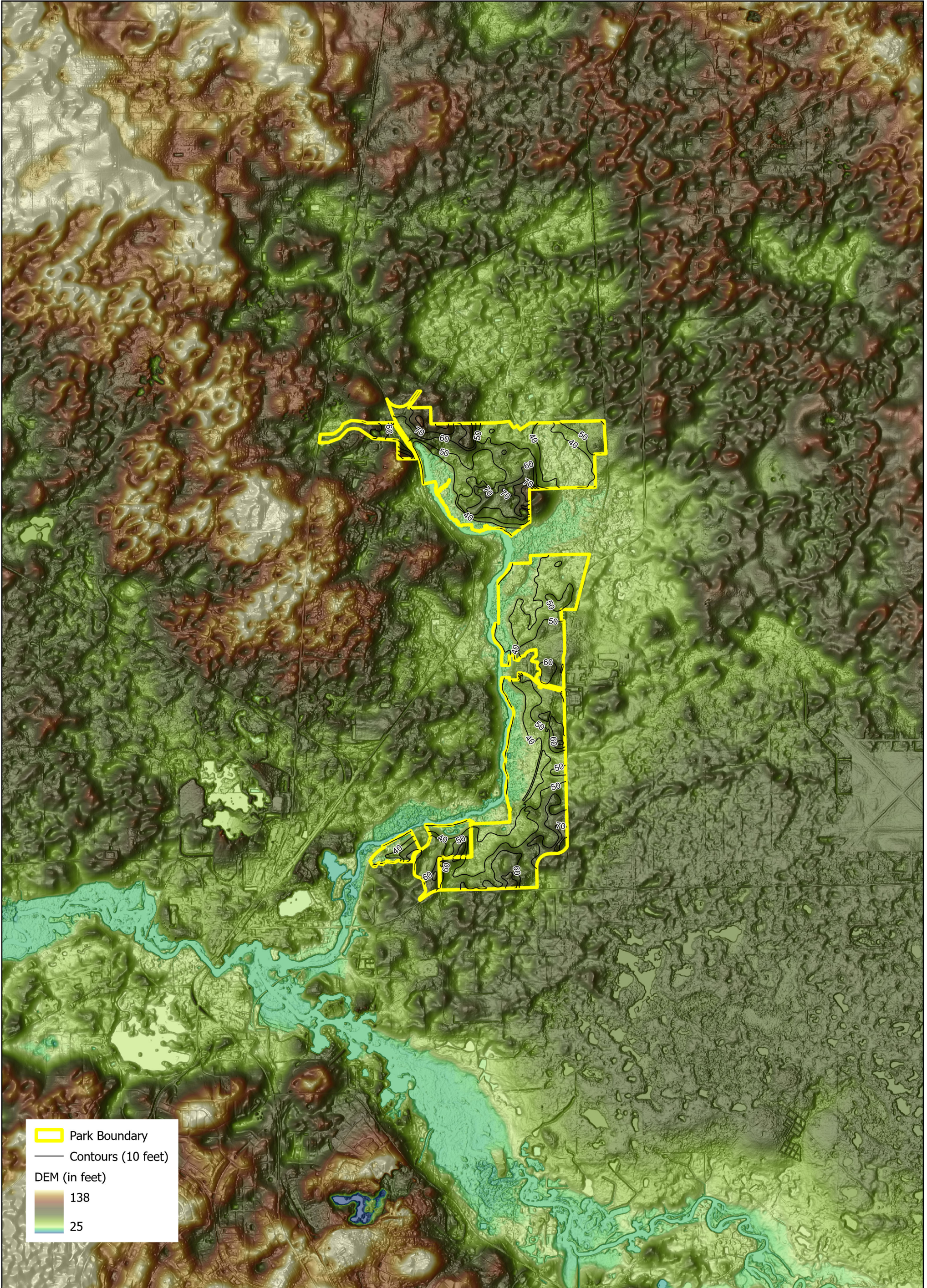



**RAINBOW SPRINGS STATE PARK**  
Management Zones




This graphical representation is provided for informational purposes and should not be considered authoritative for navigational, engineering, legal, and other uses.







 Park Boundary

 Contours (10 feet)

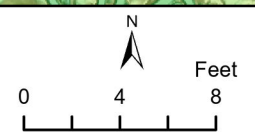
DEM (in feet)

 138

 25



# RAINBOW SPRINGS STATE PARK Topography



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Surface topography and subsurface fractures within the Rainbow Springs region are known as fracture traces (Faulkner 1973; Jones et. al., 1996). Fracture traces are important to understanding the primary paths of flow in a karst topography (Jones et.al., 1996).

Within the park, relatively flattened uplands gradually slope downward to a narrow zone of hydric soils along the eastern side of the Rainbow River. A broad corridor of interconnected forested wetlands in the northeast portion of the park drains gradually southward into the privately owned Indian Creek bottomlands. Park elevations range from about 100 feet above mean sea level (msl) in the uplands west of the headsprings to less than 30 feet in the river floodplain, with the headsprings situated between 30 to 40 feet above msl (see Topographic Map).

Significant topographic alterations occur in the park. Extensive alterations remain from the historic mining of hard rock phosphate, including several deep pits and large spoil piles. The development of the headsprings area as a tourist attraction in the mid-1900s also changed the topography considerably. Facilities at the attraction that had the greatest topographic impact include sidewalks, parking lots, artificial waterfalls, an artificial stream, and waterfront docks and buildings. Other alterations include a former railroad line and associated bed and old fire plow scars through the flatwoods. Several of the scars impact wetlands.

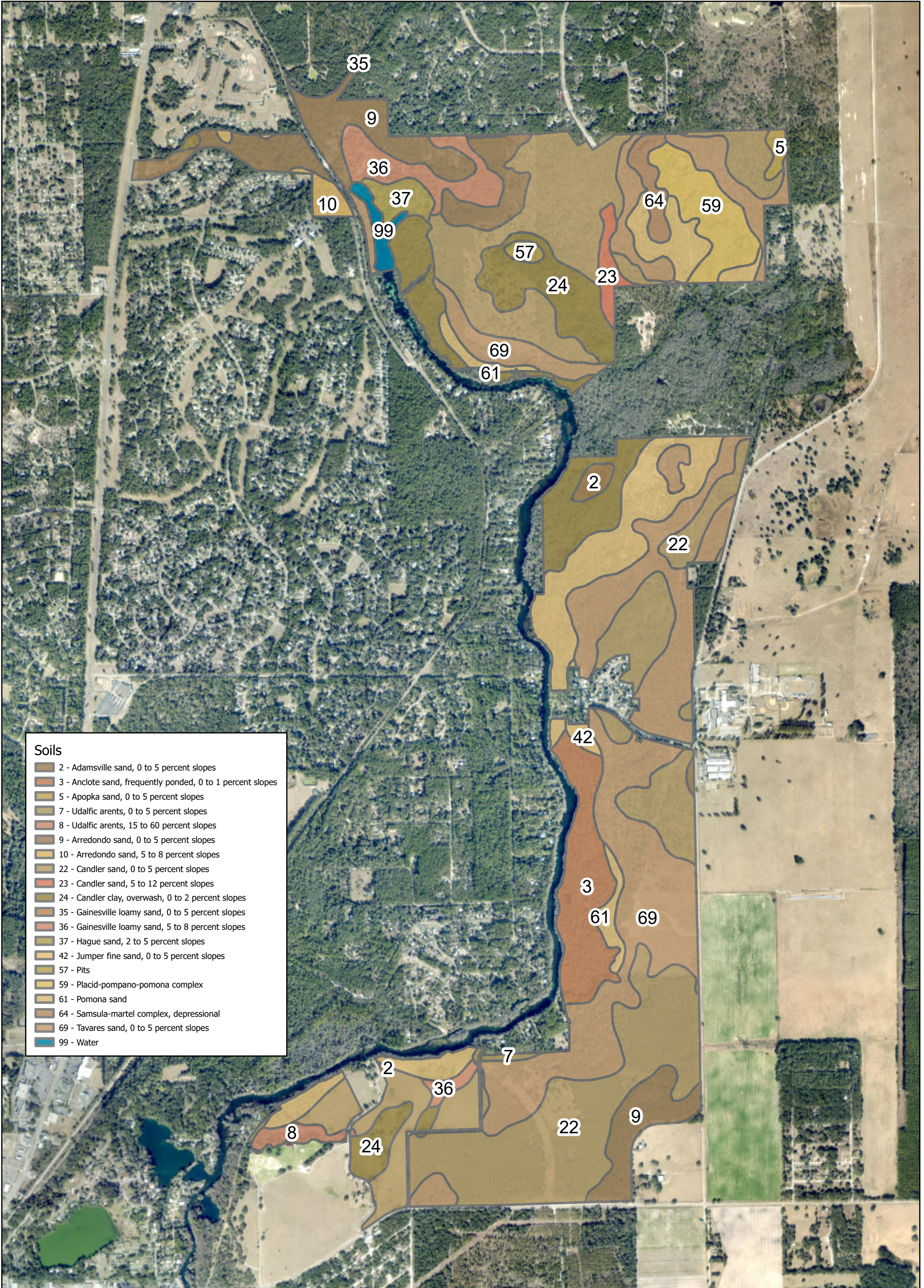
## **SOILS**

Nineteen soil types (see Soils Map) have been identified within Rainbow Springs State Park (Thomas et al 1979). Soils range from the well-drained sands of xeric uplands to the frequently inundated soils of basin swamps and hydric hammocks. Complete descriptions of these soils are contained in appendix.

The importance of soil characteristics in determining native vegetative cover is well illustrated at Rainbow Springs State Park, where the soils have undergone drastic disturbances. The Candler Clay, Overwash soil (CwA) consists of mine tailings and spoil from phosphate mining in the area. These tailings were dumped in a continuous layer over a large area southeast of an old tailings pond. The original soil in the area was probably Candler Sand, which would have naturally supported sandhill vegetation. However, few sandhill species remain in the area overlain by Overwash soil. At present, the vegetative cover there consists of mesophytic oaks, non-native pasture grasses and other invader species able to benefit from the rich phosphate and clays in the tailings. Restoration of the site to the natural sandhill community will be difficult at best. All park management activities will follow the guidance of best management practices to prevent further soil erosion and conserve soil and water resources on site.

Stormwater runoff from roads within the portion of the former campground that abuts the Rainbow River has been a long-standing problem that may need additional attention. The main issue prior to removal of that section of old campground and relocation of its campsites to a new campground farther away from the river was that sediments were being transported down slope directly into the spring run with virtually no treatment or attenuation. In addition, the main access road into the campground area was directing runoff into a band of hydric hammock that paralleled the river. By constructing several vegetated terraces within the footprint of the old campground, the park was successful in redirecting most of that runoff into adjacent non-wetland areas to achieve a more natural infiltration. To treat runoff from the new campground, which is located in uplands further from the river, the park is using retention basins that are strategically designed to catch the excess runoff generated by strong storm events.





**Soils**

2	- Adamsville sand, 0 to 5 percent slopes
3	- Anclote sand, frequently ponded, 0 to 1 percent slopes
5	- Apopka sand, 0 to 5 percent slopes
7	- Udalfic arents, 0 to 5 percent slopes
8	- Udalfic arents, 15 to 60 percent slopes
9	- Arredondo sand, 0 to 5 percent slopes
10	- Arredondo sand, 5 to 8 percent slopes
22	- Candler sand, 0 to 5 percent slopes
23	- Candler sand, 5 to 12 percent slopes
24	- Candler clay, overflow, 0 to 2 percent slopes
35	- Gainesville loamy sand, 0 to 5 percent slopes
36	- Gainesville loamy sand, 5 to 8 percent slopes
37	- Hague sand, 2 to 5 percent slopes
42	- Jumper fine sand, 0 to 5 percent slopes
57	- Pits
59	- Placid-pompano-pomona complex
61	- Pomona sand
64	- Samsula-martel complex, depressional
69	- Tavares sand, 0 to 5 percent slopes
99	- Water



**RAINBOW SPRINGS STATE PARK**  
Soils



This graphical representation is provided for informational purposes and should not be considered authoritative for navigational, engineering, legal, and other uses.



Historically, there have also been some erosion and stormwater issues along the shoreline of the headsprings. Stormwater runoff has tended to flow down slope from the parking and other impervious surfaces into the main headspring, causing sedimentation and water quality issues. Runoff continues to be problematic on some of the steep slopes above the north and east areas of the headsprings. Partial mitigation of direct runoff has been achieved through the installation of shoreline access structures and catchment basins. Removal of excess parking and associated impervious surfaces will improve water infiltration and further reduce runoff. Measures to reduce erosion on the slopes could include the planting of vegetation barriers as well as the construction of additional strategically placed terraces, which could be seeded with annual grasses until stabilization was achieved and then planted with native vegetation. Efforts to control non-native vegetation on garden slopes above the headsprings should incorporate anti-erosion measures such as erosion control mats.

Lingering erosion issues may be contributing to decreases in water quality and increases in sedimentation in the adjacent spring run. In that respect, it is important to understand that DRP and the Office of Resilience and Coastal Protection maintain a strong working relationship that enables the pooling of resources to find solutions to these issues.

## **HYDROLOGY**

The Rainbow River is an ecologically viable, regionally significant aquatic resource within the Springs Coast region. In 1972, the U.S. Department of the Interior declared the Rainbow River a National Natural Landmark. The state of Florida subsequently designated the river an aquatic preserve and an Outstanding Florida Water. In addition, the Southwest Florida Water Management District (SWFWMD) classifies this spring-fed river as a Surface Water Improvement and Management (SWIM) priority water body (SWFWMD 2015; SWFWMD 2021d).

The park's most prominent hydrologic feature is the spring-fed Rainbow River, also known as Blue Run, which flows southward for nearly 6 miles before emptying into the Withlacoochee River. The entire Rainbow River is noted for its exceptional ecological significance and stunning scenic beauty and is listed as an aquatic preserve. Except for the Indian Creek and Sateke Village properties, the state of Florida owns and DRP manages most of the uplands and shoreline along the eastern side of the river from the headsprings downstream for about 4 miles. The park has management authority for the entire headsprings area. The park closely cooperates with the Office of Resilience and Coastal Protection (RCP) staff of the Rainbow Springs Aquatic Preserve in co-managing the upper 4 miles of river and in addressing many of the issues that arise along the entire river system (RCP 2016).

The surface watershed of the Rainbow River covers about 77 square miles and is a hydrologic unit of the larger (circa 2,100 square miles) Withlacoochee River basin (DEP, 2006; Trommer et al. 2009; Holland and Hicks 2013). The majority of the Rainbow River watershed is internally drained with little to no (circa 2%) surface water influencing the flow of the river (Holzwardt et al. 2017). Since 98% of the Rainbow River discharge comes from underground sources, it is important to focus on the specific area that contributes groundwater to its spring vents. The entire surface and subsurface land area that travels underground and contributes to the discharge of a spring vent is called a springshed (Scott et al. 2004; Holzwardt et al. 2017).

The Rainbow Springs springshed boundaries extend throughout western Marion, southern Alachua and eastern Levy counties. Improved groundwater well monitoring data and analysis has shown that the boundary area of the Rainbow springshed over the last 20 years has consistently averaged about 740



square miles (Holzwart et al. 2017). However, the Rainbow springshed primary protection area, which will be further discussed below under the “Water Quality” section, encompasses about 350 square miles (Jones et al. 1996; Farrell and Upchurch 2005), (See Rainbow Springs Springshed Map).

The Rainbow springshed receives nearly all its input (i.e. recharge) from rainfall, with annual average amounts for the region at about 54 inches per year (Holland and Hicks 2013; Holzwart et al. 2017). The boundaries of the Rainbow springshed are considered semi-permanent flow divides within the Upper Floridan aquifer (UFA) that are controlled by geology and aquifer water levels. It is important to understand that springshed boundaries may vary from year to year due to the availability of measured water level data from the Upper Floridan aquifer. Immediately east and adjacent to the Rainbow springshed is another major springshed known as Silver Springs Group. Precipitation that falls on the divide between Rainbow and Silver springsheds could recharge one or both spring groups (Phelps 2004; Holland and Hicks 2013; DEP 2015).

The Rainbow River system has experienced numerous anthropogenic changes over the past 100 years (SWFWMD 2004) and has been designated an impaired water body regarding nitrate-nitrogen levels (Holland and Hicks 2013; DEP 2015). Three landscape alterations that have had a significant impact on water quality and quantity in the river and its adjacent riparian areas are mining, damming and the use of fertilizers. Industrial phosphate mining that has taken place adjacent to the Rainbow River, the Inglis Dam that was constructed near the mouth of the Withlacoochee River, and the use of fertilizers by the agricultural community and by residential developments have all negatively influenced the ecological health of the Rainbow River (Downing et al., 1989).

One of the most significant landscape changes to impact the Rainbow’s surface water basin is Lake Rousseau, a manmade reservoir located downstream from the confluence of the Rainbow and Withlacoochee rivers. When the Inglis Dam was built in 1909 to generate hydroelectric power, it impounded the waters of the Withlacoochee River and created the lake (German 1978). Alterations to the river were considered when developing the minimum flows and levels (MFLs) for Rainbow River (Holzwart et al. 2017).

### **Rainbow Springs Group**

Rainbow Springs, once known as Blue Springs, is a first magnitude spring group consisting of at least 87 known spring vents of various discharge strengths (including documented sand boils) that are distributed throughout the first 5 miles of the spring run (Post, Buckley, Shuh & Jernigan and Debra Childs Woithe Incorporated (PBS & J and Woithe Inc.) 2007). The first 0.3 miles of the river are completely within park and aquatic preserve boundaries. Greater than 70% of the spring vents occur within the river’s first 0.5 miles but vents occur as far as 4.8 miles downstream. Surface runoff within the watershed contributes a very small percentage of the total discharge of the Rainbow River, thereby making groundwater the number one contributor to this system (German 1978; Holzwart et al. 2017).

The Rainbow Springs Group is Florida’s fourth-largest spring system by total river discharge (Spechler & Schiffer 1995). The group contains multiple named vents (Rosenau et al. 1977; Jones et al. 1996; Champion & Starks 2001; Scott et al. 2004; PBS & J and Woithe Inc. 2007; Holland and Hicks 2013; DEP 2021a). Several of these vents are significant first to third magnitude springs, including Rainbow Springs 1, 2, and 3 (first magnitude), Rainbow Spring 4 (first), Rainbow Springs 6 and 7 (first), Waterfall Spring (second magnitude), Bubbling Spring (second), Bridge Seeps North and South (third magnitude), Rainbow Seep 1 (third), East Seep 1 (third), and Indian Springs 1, 2, 3 and 4 (third). In addition to these

named sources, discharge occurs from numerous limestone crevices and sand boils in the bed of the river and along the banks of the upper 2 miles of the Rainbow River (Scott et al. 2004; Holland and Hicks 2013). Nearly 90 individual spring vents in the Rainbow River have been identified, with most in the upper 2 miles of the river (PBS & J and Woithe Inc. 2007; DEP 2021a).

One attribute that characterizes this springs group is the sheer density of spring vents throughout the system that contribute to the river's overall discharge. Many of the named springs are dense clusters of vents, which makes an accurate determination of the discharge for each individual spring vent challenging. For example, the Rainbow Springs 1-3 vents consist of three closely spaced, irregularly shaped, linear limestone fractures 30-50 feet in length and nearly 15 feet below the water surface. The combined discharge of these three vents qualifies them for classification as a first magnitude spring. Researchers at Rainbow Springs State Park have typically grouped vents that are near each other when discussing trends associated with overall discharge.

Approximately 1 mile south of the headsprings is Indian Creek, which is located on privately owned land. This spring-run stream is fed by Indian Springs. Even though the property is not managed by the park, the spring run and its riparian wetlands are significant features that are important contributors to the Rainbow River system. The Indian Creek Spring system consists of a series of four vents that coalesce into a single, 70-foot diameter circular spring pool located about 2,000 feet upstream from the confluence of the Indian Creek floodplain and the Rainbow River (Henigar and Ray 1987). Depending on groundwater levels, the spring system may discharge enough volume of water to provide flow through Indian Creek to the Rainbow River. However, in low rainfall years, the system mostly exists as an isolated karst window embedded within the central portion of a large elongated forested wetland that originates within the park to the north. An additional contributor to Indian Creek is up-gradient surface water that emanates from two depressional wetland systems, one of which extends north into the park as a chain of basin swamps in the mesic flatwoods.

### **Water Quantity**

The Rainbow River is one of 33 first magnitude spring systems in the state. Daily discharge data are available from 1965 to present, but periodic flow measurements go back as far as 1904 (i.e., Period of Record = POR). From February 1931 to September 2021, the average daily discharge of the Rainbow River, as measured by the United States Geological Survey (USGS) at State Road 484 near Dunnellon (Gage #02313100), was 688 cubic feet per second (cfs) (USGS 2021a). The minimum daily flow ever recorded for the entire river was 391 cfs on May 27, 2012, while the maximum was 1060 cfs on September 19, 1988 (USGS, 2021b).

The three primary sources of the river are the two main headspring vents, Rainbow Springs Group 1, 2 and 3 (118 cubic feet per second) and Rainbow Spring 4 (128 cubic feet per second), as well as the largest known discharge point on the entire river, Rainbow Springs Group 6 and 7 (163 cubic feet per second) (Jones et al. 1996). Analyses of these individual spring flows indicate discharge from the headspring area contributes up to 52% of the overall river flow.

The overall discharge of the Rainbow Springs Group has been recorded multiple monthly observations per year by the US. Geological Survey (USGS) beginning in 1931 from the Rainbow River (Dunnellon, Florida Gage No. 02313100) at its junction with the County Road 484 bridge (Holzwart et al., 2017). The USGS began continuous daily flow records at this station (Gage No. 02313100) in 1965. A second flow measuring station (Gage No. 02313098) was added by the USGS in 2015, located about 2 miles upstream

of the County Road 484 bridge (Holzwart et al., 2017). This station uses the index velocity method of flow measurement (Levesque and Oberg, 2021). The USGS recently switched to index velocity measurement at the County Road 484 station (Gage No. 02313100) in the fall of 2020. Previously, the USGS had relied on water level elevation data from a nearby UFA monitor well (i.e., Rainbow Springs near Dunnellon well, No. 290514082270701) to assist in flow determination at the County Road 484 station (Holzwart et al., 2017). (USGS 2021a).

The SWFWMD is responsible for prioritizing and establishing minimum flows and levels (MFLs) for water bodies within its boundaries. MFLs are set to protect against significant harm to the ecology and water resources of the area due to withdrawals. The SWFWMD developed Rainbow River's first MFL in 2017 and it was upheld in an administrative hearing in 2020 (Holzwart et al. 2017; Florida Department of Administrative Hearings 2020). The SWFWMD established a minimum flow that protects 95% of the natural flow – flow that would exist in the absence of groundwater withdrawals. The SWFWMD has determined that flow reduction due to current groundwater use is about 1-2% (Holzwart et al. 2017). SWFWMD staff forecasts water resource changes based on 20-year forecasted demand as part of its regional water supply planning process. The SWFWMD predicts there will be a flow reduction due to withdrawals of 2-3% percent (Holzwart et al. 2017) by 2040. MFLs are currently met and projected to be met for the next 20 years. A planned MFL re-evaluation is scheduled for 2027.

It will be important for DRP to work closely with the SWFWMD and other stakeholders during implementation of the Rainbow River MFL and other Withlacoochee basin MFLs, including the Silver Springs MFL, to ensure that the Rainbow system continues to receive the highest level of spring flow protection possible.

### **Water Quality**

The major water quality issue at the Rainbow River is nutrient contamination of groundwater within the Rainbow springshed from past land use activities (Farrell and Upchurch 2007; Holland and Hicks 2013; SWFWMD 2015). The primary nutrient of concern for the Rainbow River is nitrate nitrogen, though emerging evidence has shown the importance of benthic sediments, and specifically phosphorus and iron concentrations, in relation to altered submerged aquatic vegetation (SAV) coverages and increases of nuisance macroalgae in certain portions of the river (Cowell and Dawes 2007; Cowell and Dawes 2008; Hensley et al., 2017). Elevated levels of nitrate nitrogen in springs may overstimulate the growth of nuisance macroalgae and contribute to an imbalance to the flora and fauna of this sensitive ecosystem (Stevenson et al., 2007; Holland and Hicks 2013; Hensley et al., 2017).

Given the unique character of the Rainbow River as one of Florida's largest spring-fed ecosystems, with a 740 square mile springshed, it should not be surprising that the amount of research and monitoring that has been conducted to understand its ecological health has been extensive (e.g., Brown et al., 2008; Reddy et al., 2017; Mattson et al., 2019). Some of the most comprehensive ecological monitoring of a Florida spring has occurred on the Rainbow River. The overall health of the Rainbow River is based on good water quality, healthy benthic habitat and adequate spring discharge.

Various types of monitoring data are collected by federal, state and regional agencies, universities and non-governmental organizations. There are several documents available that have summarized historic water quality data and monitoring for the Rainbow River and its springshed, including the Rainbow River Aquatic Preserve Management Plan and the Rainbow River SWIM Plan (Jones et al. 1996; Stevenson et al., 2007; DEP 2008; Harrington et al., 2010; WSI 2010; SWFWMD 2015; RCP 2016; FSI 2016; SWFWMD 2021d). Additionally, there is an extensive well monitoring database for information collected

throughout the Rainbow springshed by numerous entities (Silvanima et al., 2008; DEP 2021a; DEP 2021b; SWFWMD 2021c). Well monitoring occurs for groundwater quality and background levels, waste management facilities, drinking water, contamination sites, and private, residential, and public areas (DEP 2021a). There are over 120 different wells scattered across the Rainbow surface watershed that are undergoing various levels of sampling. Much of the hydrological reporting, information and data collected and managed by various agencies can be accessed through a variety of web-based databases (DEP 2021a; DEP 2021b; USGS 2021a; USGS 2021b; SWFWMD 2021a; SWFWMD 2021c; FSI 2021).

Nitrate nitrogen concentrations in the Rainbow Springs main pool have measured from 0.16 milligrams per liter (May 1974) to just under 3.0 milligrams per liter in 2021 (Rosenau et al., 1977; WSI 2010; FSI 2016; SWFWMD 2015; SWFWMD 2021a; SWFWMD 2021c; USGS 2021a). In 1992, Brian Katz calculated an average nitrate nitrogen from 107 UFA wells in the SWFWMD region at 0.1 milligrams per liter (Katz 1992), however, in 1994, some groundwater wells within the Rainbow springshed had nitrate concentrations as high as 5.2 milligrams per liter (Jones et al., 1996. Appendix II). The earliest documented record of nuisance macroalgae benthic mats in the Rainbow River was in 1991, however, in the 1950s, Howard T. Odum noted that benthic algae increases did occur in the lower river (Water and Air Research Incorporated (WAR) 1991; SWFWMD 2015; Hensley et al., 2017). Despite increased nitrate nitrogen levels, some ecological health indicators (e.g., water clarity, SAV coverage) in the upper portion of the river are in good condition, especially within the first mile (Anastasiou 2006; SWFWMD 2015; RCP 2016).

A Total Maximum Daily Load (TMDL) was established in 2013 by DEP to address elevated nitrate nitrogen originating from the springs (Clark and DeBusk 2008; Holland and Hicks 2013). The two uppermost segments of the Rainbow River, namely waterbody identification (WBID) No. 1320A and 1320B, were declared impaired for nitrate nitrogen and benthic mats of macroalgae following Florida's surface water quality guidelines (Chapter 62-302 F.A.C.) and impaired rule standards (Chapter 62-303.430 FAC) (Harrington et al. 2010; Holland and Hicks 2013; DEP 2015). The DEP set a target monthly average TMDL in 2013 for nitrate nitrogen concentration at both WBID 1320A and 1320B segments at 0.35 milligrams per liter (Holland and Hicks 2013; SWFWMD 2015). This water quality target requires an 82% reduction of nitrate nitrogen within those two WBID segments in order to meet the TMDL standard.

A Basin Management Action Plan (BMAP) was finalized in 2015 and detailed nearly 100 activities within the Rainbow springshed that will target pollutant load reductions (i.e., nitrate nitrogen in the UFA) to help achieve the TMDL (Holland and Hicks 2015; Eller and Katz 2015). As part of the BMAP, DEP also developed a mapping tool called the Nitrogen Source Inventory and Loading Tool (NSILT) to identify and direct efforts toward the most significant sources of nitrogen needing reduction within the springshed (Eller and Katz 2015). DEP annually tracks the number of BMAP projects that are adopted (DEP 2018; DEP 2020).

Over 65% of all nitrogen input to the Upper Floridan aquifer within the Rainbow springshed comes from agricultural operations (livestock farms and fertilizers) (Jones et al. 1996; DEP 2015; Eller and Katz 2015). Similarly, within the Rainbow springshed, nearly 20% of the nitrogen input comes from septic tank systems (Henigar and Ray 1987; Holland and Hicks 2013; DEP 2015; Eller and Katz 2015). In Marion County, nearly 75% of the overall residential population uses on-site wastewater septic tank systems (Kuphal 2005). As this predominantly rural county continues to grow, many are concerned about increased nitrogen loading from agriculture operations, septic tanks and other forms of stormwater runoff within the springshed (Cohen 2007; Farrell and Upchurch 2005; Farrell and Upchurch 2007; Reddy et al., 2017). For this reason, the SWFWMD has identified, prioritized and funded multiple water quality

projects and studies over the years. This includes stormwater retrofits and other nutrient reducing-projects that are being implemented throughout the Rainbow springshed (SWFWMD 2015; DEP 2015; DEP 2018; DEP 2020).

In 2016, the Florida Legislature funded and DEP implemented additional protections to the Rainbow Springs Group through its inclusion as one of 30 Outstanding Florida Springs (Florida Springs and Aquifer Protection Act (Part VIII of Chapter 373, F.S.). The legislative mandate required additional protections specifically designed to assist efforts with the BMAP process, including water quality restoration (Borisova et al., 2021). Integral to this BMAP process is the designation of important springshed protection zones called Priority Focus Areas (PFA). The PFA is defined by DEP as a specific area within a springshed in which statutory prohibitions on certain activities will apply, and the area is essentially equivalent to the primary protection area of a springshed that Marion County defined in the early 2000s (Upchurch and Champion 2004; DEP 2018). DEP intends for the Rainbow Springs PFA to institute the highest protection level for this freshwater spring within its most vulnerable springshed area (DEP 2018). As land use changes within the springshed, DRP will continue to review and comment on environmental and water use permits that may contribute to declines in the health of the Rainbow River. Any undeveloped areas within the PFA of the Rainbow springshed should be considered a high priority for inclusion into a conservation land status.

In 1987, the Florida Legislature, through the Surface Water Improvement and Management (SWIM) Act, 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.) (SWFWMD 2021d). The Rainbow River was adopted as a priority SWIM water body in 1989 and the SWFWMD subsequently developed the first management plan for that spring-fed system. The Rainbow River SWIM plan is developed to implement long-term goals and strategies for restoration, protection and management of the surface waters of the Rainbow River (SWFWMD 2004; SWFWMD 2015; SWFWMD 2021d).

In 2015, the SWFWMD organized multiple stakeholder groups known as the Springs Coast Steering, Management and Technical Committees to develop the most recent update to the Rainbow River SWIM Plan (SWFWMD 2015; SWFWMD 2021e). The 2015 SWIM plan identifies several restoration targets, called "quantifiable objectives," which included water quality, quantity and natural system components (SWFWMD 2015). The primary goal of this SWIM plan is to identify and implement management actions and projects to address the major issues the system faces and that will restore, maintain and preserve the ecological balance of the Rainbow River.

### **Submerged Aquatic Vegetation**

One measure that has been conducted to track the ecological health of the Rainbow River is SAV assessments. Multiple SAV mapping efforts have been conducted in the Rainbow River (WAR 1991; Unpublished DEP data 1996; Post, Buckley, Schuh & Jernigan (PBS & J) 2000; PBS & J and Woithe Inc. 2007; Atkins North America, Incorporated and Debra Childs Woithe, Incorporated (ANAI / DCWI) 2012; WAR 2016). In 2018, the SWFWMD established 28 permanent Rainbow River transects to quantify trends in SAV abundance throughout the river. The first two of these transects are located within the Rainbow Springs State Park boundary. SAV mapping and water quality assessment at these transects has occurred annually since 2018 (SWFWMD 2018a; SWFWMD 2018b; SWFWMD 2019; SWFWMD 20120a; SWFWMD 2020b; SWFWMD 2021b). These mapping events have shown that hydrilla and nuisance macroalgae are present, but not abundant, in the upper portion of the river within the Rainbow Springs State Park boundary. As of 2023, the overall ecological health of aquatic vegetation in the river is in

good to poor condition considering that there are at least 17 native SAV species present, dependent on the location within the river.

To better quantify and understand temporal changes of the Rainbow River, the SWFWMD contracted University of Florida researchers in 2017 to conduct a multifaceted river assessment at 24 transects to understand SAV, nuisance filamentous algae and benthic sediments (Hensley et al., 2017). Several takeaways from this work include the following: 1) Nuisance filamentous algae occurs at its highest abundance in the lower river where nitrate nitrogen concentrations are at their lowest levels. 2) Nitrogen does not appear to be the driver of nuisance macroalgae proliferation. 3) There is a positive correlation between nuisance macroalgae and phosphorus concentration in the lower river. 4) Phosphates and benthic sediments, including iron enrichment, may play a more important role in SAV and macroalgae growth in the Rainbow River.

DRP has previously contracted two separate recreational impact and ecological health assessment studies in the Rainbow River (Holland and Cichra 1994; Cichra and Holland 2012). In these studies, SAV assessment was included. In both studies, motorboats on the river contributed the greatest impact on SAV plant beds of all user groups. The authors of this work stated that the tubing user group appeared to have little impact on the SAV, however they also mentioned the Ichetucknee River and the successful limitation of environmental damage on that river through the application of a carrying capacity. Early research on the Ichetucknee River documented the detrimental impacts of intense recreational tubing on the spring run SAV beds, which led to the establishment of a carrying capacity for the river (Dutoit 1979). Nonetheless, the Rainbow and Ichetucknee rivers differ in ways that may make the Rainbow more resilient to damage (Cichra and Holland 2012). The Rainbow is deeper, wider, and has a greater volume of flow and greater light availability, all of which may benefit the native aquatic vegetation and allow it to recover more quickly. However, trends noted by other research have indicated that SAV changes are occurring on the Rainbow River (ANAI/DCWI 2012). The extent of the relationship between recreational use and the ecological health of the river (i.e., SAV impacts) needs further investigation within the Rainbow River.

DRP staff consistently assess all stormwater runoff from impervious surfaces throughout the park. A chronic problem area has been identified within the main headspring. Stormwater runoff in this steep, sloping area has the potential to influence water quality within the headspring. Currently, runoff is captured by a variety of structures, ranging from trench-and-culvert to capture-and-pump systems. Many of these systems are holdovers from the previous property owner. While some of these systems are operational, they may not provide the necessary water quality treatment before discharge. Furthermore, the location and functionality of some of the systems may still be questionable. This will be addressed as information becomes available and should be considered during any redesign of the parking area north of the headspring. If necessary, a master stormwater plan for the park and all its facilities will be developed. This will incorporate existing structures where feasible.

When the state acquired Rainbow Springs, a wastewater treatment facility was in the park. It accepted wastewater from the Rainbow Springs Estates subdivision and from facilities within the park. That treatment plant provided only secondary treatment. Effluent was sprayed onto an open upland site known to be a high recharge area for the aquifer. Fortunately, both the subdivision and the park subsequently connected with a larger, more efficient municipal facility. A spray field adjacent to the park's main campground on the east side of the river is still functioning as a wastewater facility for the park. DRP is working to connect all park facilities to municipal sewer and will abandon this facility when that becomes possible.



The natural hydrology of most state parks has been impaired prior to acquisition to one degree or another. Florida's native habitats are precisely adapted to natural drainage patterns and seasonal water level fluctuations, and variations in these factors frequently determine the types of natural communities that occur on a particular site. Even minor changes to natural hydrology can result in the loss of plant and animal species from a landscape. Restoring state park lands to original natural conditions often depends on returning natural hydrological processes and conditions to the park. This is done primarily by filling or plugging ditches, removing obstructions to surface water sheetflow, installing culverts or low water crossings on roads, and installing water control structures to manage water levels.

### **Assessment of Needs**

**Objective: Conduct/obtain an assessment of the park's hydrological restoration needs.**

#### *Actions:*

- Continue to cooperate with other agencies and independent researchers regarding hydrological research and monitoring programs.
- Continue monitoring of surface and ground water quality at Rainbow Springs and tracking water quality changes within this natural spring system.
- Continue to monitor all on-site sewage treatment and disposal systems (OSTDS) in the park for any detrimental impacts to water quality and, if feasible, connect to the municipal water treatment system.
- Continue to monitor land-use or zoning changes around the park's resources.
- Continue to cooperate with the SWFWMD to ensure MFLs for Rainbow Spring are monitored for compliance to maintain historic river flows.

The Rainbow River system is the primary hydrologic feature of the park. The following are hydrological assessment actions recommended for the park. DRP will continue its tradition of closely cooperating with state and federal agencies and independent researchers engaged in hydrological research and monitoring programs within the park and the adjacent Rainbow River, and it will encourage and facilitate additional research in those areas. DRP will rely on agencies such as the SWFWMD, USGS and DEP to keep it apprised of any declines in surface water quality or any suspected contamination of groundwater in the region. Additional cooperative efforts may include facilitating the review and approval of research permits and providing researchers with assistance in the field, including orientation to park resources. Recommendations derived from these monitoring and research activities will be essential to the decision-making process during management planning.

DRP should encourage Rainbow springshed delineation, especially within its undefined eastern boundary (Holzwart et al. 2017). DRP should support all springshed research, including dye trace work that will help to understand groundwater sources of this important spring group. Previous dye trace studies in other managed springsheds have provided park management with invaluable information about the various sources of the springs and the timing of surface to groundwater interactions that potentially affect important surface water bodies. It is important for DRP to support, promote and lead in the implementation of ecosystem restoration projects throughout the Rainbow springshed, especially in the Primary Focus Area, in order to assist BMAP efforts and to offer the highest protection level possible within this Springs Coast priority waterbody per the 2016 Florida Springs and Aquifer Protection Act (DEP 2015).

DRP staff will continue to monitor land use or zoning changes within the landscape bordering the park's resources. Additionally, staff will continue to review comprehensive plan amendments and land development regulations that may govern proposed land-use changes on properties adjacent to the park.

Any major ground disturbances in the area, or any runoff into the main headspring of the park, could seriously degrade the quality of its resources. Whenever possible, staff will provide comments to other agencies regarding proposed changes in land use or zoning. In addition, staff will closely monitor all mining operations within the springshed for significant changes that may adversely affect the park's natural resources. Staff should also work with the appropriate entities to determine the flow of stormwater within the footprint of the former attraction at the park. Because this area was constructed years before acquisition by the state, there may be unknown drainage systems that contribute stormwater to the spring run.

DRP staff will continue to work closely with the SWFWMD to ensure that MFLs developed for the Rainbow Springs Group are implemented and that its historic spring flows are protected. Additionally, DRP will continue to cooperate with all work related to SWIM planning efforts for the priority waterbodies within the Springs Coast region, including Rainbow Springs.

### **Monitoring and Evaluation**

**Objective: Monitor and evaluate the natural hydrological conditions and functions within the headspring and improve approximately 0.1 discontinuous acres of spring-run stream natural community.**

#### *Actions:*

- Continue to support the SWFWMD monitoring plan to track changes to the SAV and health of the spring run and educate park visitors about these changes.
- Develop a plan for experimental plantings of key species of submerged aquatic vegetation in the spring and spring-run stream in areas that have experienced loss. Implement the plan if necessary.

DRP staff will work closely with aquatic preserve staff and the SWFWMD to assess any hydrological impacts and address any water quality or quantity issues that have caused degradation of the Rainbow spring-run community. DRP will also continue its cooperation with the aquatic preserve to control hydrilla proliferation in this system, especially within areas that are managed by DRP.

In addition, staff will continue to respond to all water quality impacts known to stem from the location or design of park facilities and mitigate those impacts using the best available options for remediation. When feasible, the park should connect the campground sewage treatment system to a municipal sewer system.

To protect the Rainbow spring-run habitat and SAV, the Division should support the efforts of SWFWMD 2015 SWIM Plan, especially ecological health assessments of the SAV. If data indicate that the natural resources of the park's headspring and spring run are becoming significantly degraded, recreational carrying capacities may need to be implemented to protect them from further damage.

Aquatic plant beds adjacent to and downstream of the designated swimming areas, headsprings canoe launch, tube launch and landing facility will be monitored for negative impacts and may require restoration plantings and continuous removal of hydrilla if re-infestation occurs. DRP will collaborate with the SWFWMD, Rainbow River Aquatic Preserve and the Florida Fish and Wildlife Conservation Commission (FWCO Wildlife and Invasive Plant Management bureau to control hydrilla in these areas. Within the next 10 years, staff will examine the feasibility of conducting experimental SAV plantings of key species at sites as needed.

### **Monitoring and Evaluation**

#### **Objective: Monitor and evaluate impacts associated with soil erosion at Rainbow Springs State Park.**

##### *Actions:*

- Perform dye trace or appropriate studies around the headspring to determine the stormwater flows within the developed uplands, particularly the former attraction.
- Develop and implement a plan to control erosion within the headspring and “The Bowl” day-use area.
- Remove excess headspring parking areas and associated impervious surfaces and revegetate to improve water infiltration.

Several areas within the park continue to experience significant erosion and sedimentation despite past corrective measures. In that respect, DRP will investigate best management options to continue to monitor public access at visitor access points such as the main headspring, canoe launch area and the overall tubing facility put-in and take-out locations. The following are hydrological restoration actions recommended for the park.

Areas of the park subject to significant erosion will be monitored, specifically within the headspring area. The area around the headspring referred to as “The Bowl” is heavily used, particularly during the summer months, and is subject to erosion as grass cover diminishes. The canoe/kayak concession area is subject to heavy foot traffic and erosion as well. Unauthorized foot traffic along the riverbanks can also greatly exacerbate soil disturbance.

Park staff will pursue corrective measures to prevent soil erosion or other impacts to water resources in these areas. DRP staff will monitor stormwater runoff from the walkways and other impervious surfaces on slopes above the headsprings to determine the function and extent of the existing underground drainage system. Many of these walkways channel runoff from slopes above the springs into a passive underground drainage system. If any portion of this system is discovered to allow leakage into the headsprings, DRP will develop corrective plans.

Impervious surfaces in excess parking areas will be removed to improve infiltration and the area will be revegetated. Additional vegetative terracing or plantings may also be designed and constructed to slow stormwater and minimize erosion during heavy rain events. Stormwater will be diverted as much as possible away from the headspring and into surrounding woodlands to encourage natural infiltration. If necessary, modifications will be made to the walkways or drainage system to meet current water quality standards.

Staff will evaluate other past alterations of the natural hydrological systems of the park and will initiate restoration measures when they are deemed necessary. Restoration may include backfilling of old fire plow scars that may be causing significant hydrological changes in wetland communities. Staff will also evaluate service roads that cut through wetlands and roads that traverse mesic flatwoods to determine possible effects on natural hydrological patterns and water quality. Management measures to preserve natural hydrology and water quality or to correct problem areas may include the installation of low water crossings or culverts in appropriate locations.

## **NATURAL COMMUNITIES**

### Upland Hardwood Forest

Much of the upland hardwood forest area has been impacted either by development or phosphate mining. The canopy currently consists primarily of live oak, southern magnolia, laurel oak and sweetgum with the understory species mentioned above. Management of this natural community in the park consists primarily of controlling invasive plant species.

### Mesic Flatwoods

The best example of mesic flatwoods occurs in the northeastern portion of the property in association with the basin swamps and depression marshes that drain toward the Indian Creek Bottoms. The mesic flatwoods are located along an elevation gradient between the downslope depression marshes and basin swamps and the upslope scrubby flatwoods and sandhills. A narrow band of mesic flatwoods also occurs as a transition zone on slopes parallel to the river between the sandhill and hydric hammock communities. This transition zone is broadest in the campground area. Isolated patches of mesic flatwoods also occur within the hydric hammock.

The longleaf and slash pine overstory of the mesic flatwoods was logged in the past, leaving an artificially low density of mature pines. The herbaceous component of the community seems to be relatively intact with a healthy population of wiregrass (*Aristida beyrichiana*) on site. Several old fire plow scars and abandoned roads dissect the mesic flatwoods, but they do not appear to have greatly altered the hydrology. The community appears to be in good condition despite past disturbances.

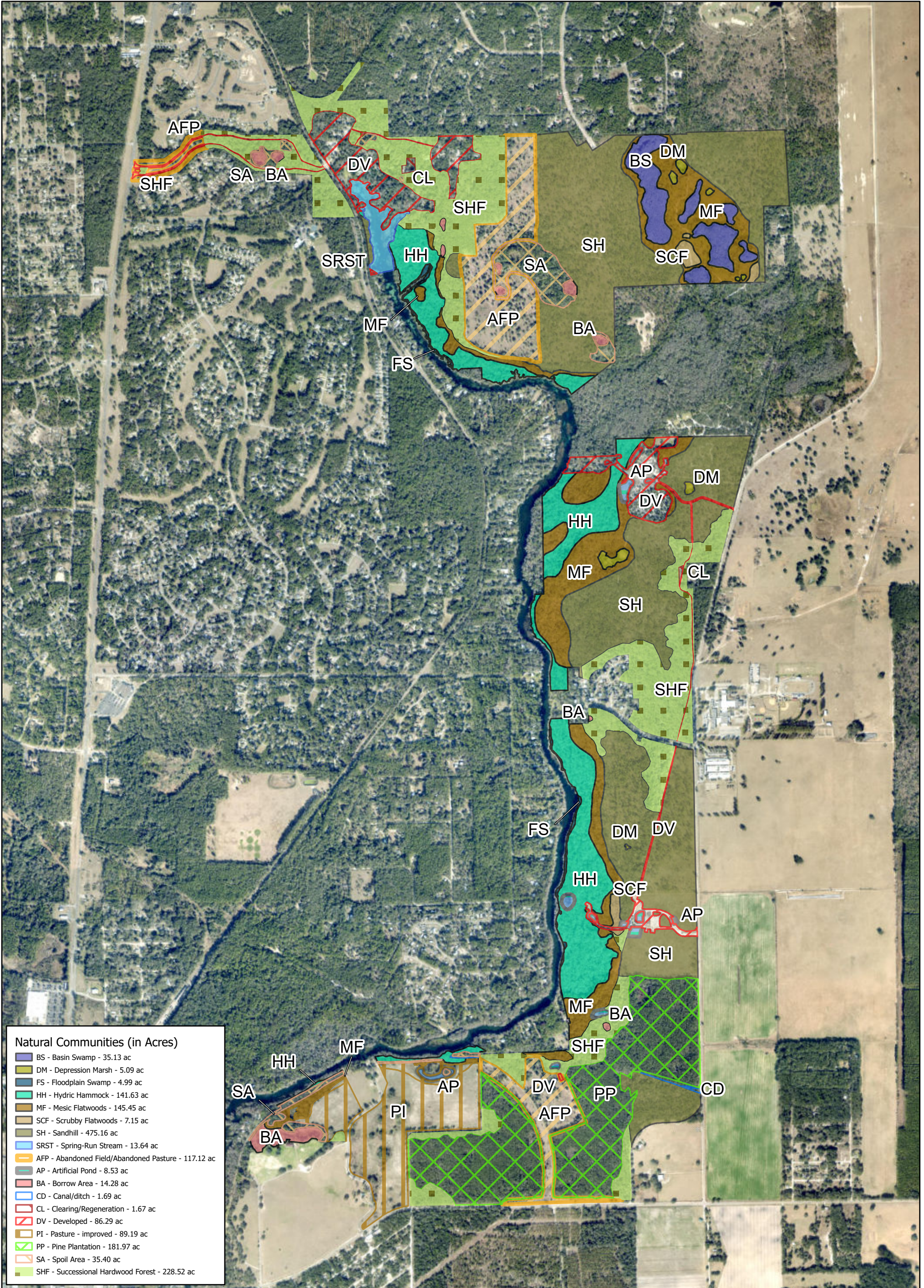
Additional prescribed fires and replanting with longleaf pines should suffice to restore much of this community. Some areas south of the campground may require some removal of off-site hardwoods to open the canopy and allow prescribed fires to penetrate.

### Sandhill

The sandhill natural community occurs throughout the xeric uplands of the park. Most of the sandhills are in good shape, but they have suffered from past fire exclusion. Before state acquisition, the last fires in the northern sandhills occurred in the late 1970s. It is likely that much, if not all, of the area was clearcut at some point. The herbaceous plant diversity has probably decreased through the years because of fire exclusion and low intensity cattle grazing. Despite these impacts, most of the sandhills remain in relatively good condition due to natural regeneration of longleaf pines and the presence of a relatively intact herbaceous layer.

The sandhills in the best condition are located on both sides of the mesic flatwoods in the northeastern part of the park, to the east of the large pasture. Another area in good condition lies to the east and south of the campground. These intact sandhill communities support a variety of wildlife species, including several rare and threatened species such as indigo snakes (*Drymarchon couperi*), gopher



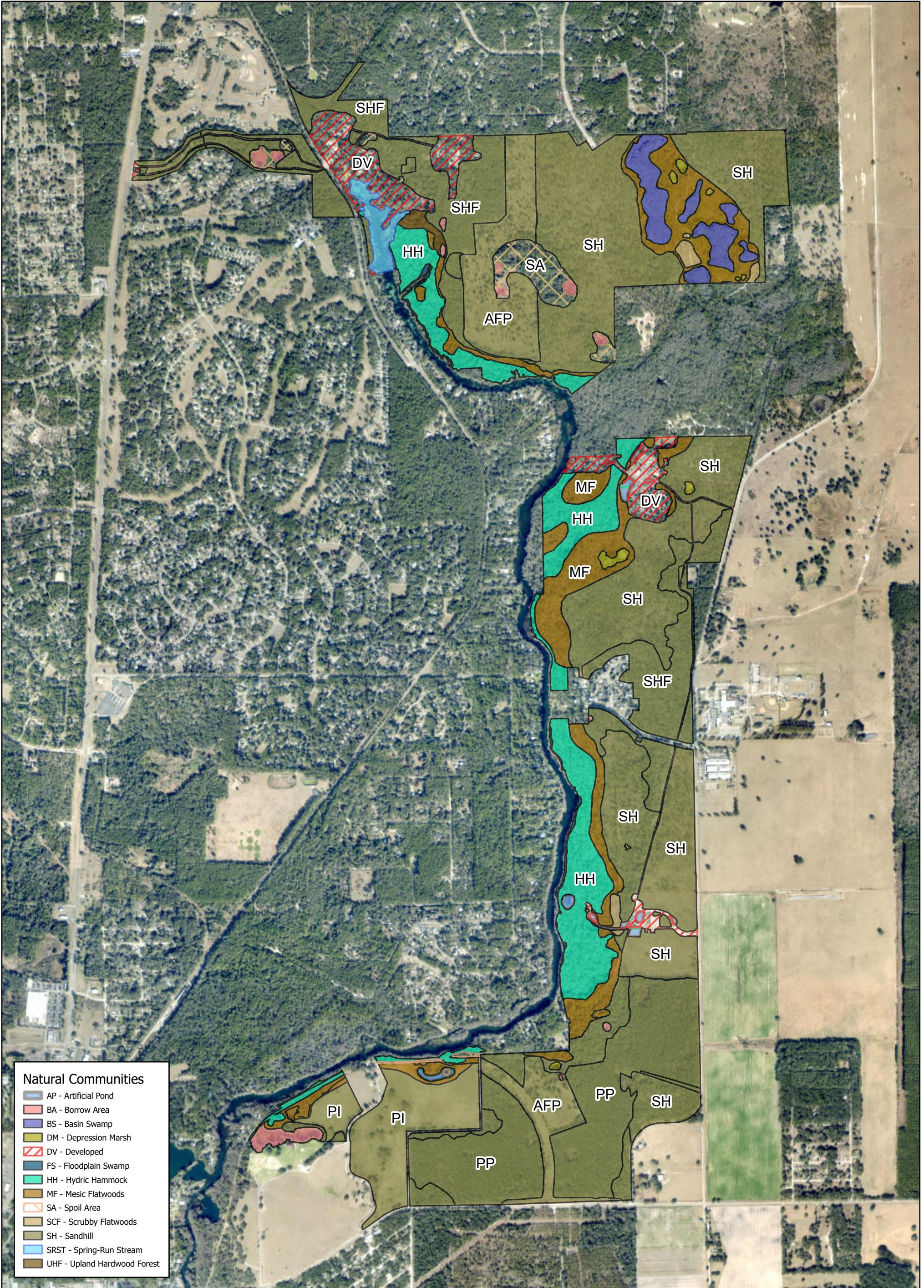


**RAINBOW SPRINGS STATE PARK**  
**Natural Communities - Existing Conditions**



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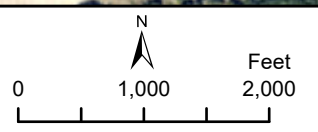




- Natural Communities**
- AP - Artificial Pond
  - BA - Borrow Area
  - BS - Basin Swamp
  - DM - Depression Marsh
  - DV - Developed
  - FS - Floodplain Swamp
  - HH - Hydric Hammock
  - MF - Mesic Flatwoods
  - SA - Spoil Area
  - SCF - Scrubby Flatwoods
  - SH - Sandhill
  - SRST - Spring-Run Stream
  - UHF - Upland Hardwood Forest



**RAINBOW SPRINGS STATE PARK**  
**Natural Communities - Desired Future Conditions**



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tortoises (*Gopherus polyphemus*), Florida mice (*Podomys floridanus*), southeastern fox squirrels (*Sciurus niger niger*), Florida pine snakes (*Pituophis melanoleucus mugitus*) and gopher frogs (*Lithobates capito*). Unfortunately, few natural sandhill areas remain outside the park to support these populations.

Several sandhill areas just west of the northern pastures have endured a relatively long period of fire exclusion. These areas have been extensively invaded by laurel oaks and other non-fire-adapted species and are only in fair condition. The small area of sandhill northeast of the parking lots is in poor condition. A small remnant area of sandhill in poor condition also occurs on the west bank of the Rainbow River south of the old Village Café building.

Remnants of the sandhill community also exist along the entrance drive. Much of this area has suffered from phosphate mining or has succeeded to successional hardwood forest, making restoration more problematic. Initial sandhill restoration efforts along the entrance drive have included hardwood removal and the reintroduction of fire.

Parts of the northern sandhill community were mined for phosphate within and to the east of the large pasture area. Several deep pits remain, surrounded by extensive spoil areas of the Candler clay overwash soil type. These areas lack wiregrass and other species characteristic of sandhills and are dominated by mesophytic oaks and weedy invader species. The areas covered by phosphate tailings will be more difficult to reclaim as sandhill because of the massive soil disturbance and the high density of off-site vegetation. These areas are classified as spoil areas.

At the southern end of the park, most of the Griffiths addition of the park was formerly sandhill. Unfortunately, past land-use practices have negatively affected much of the community, and they are now considered to be in poor condition. Native longleaf pine was logged in the late 1970s and off-site sand pines were planted over most of the sandhills in the early 1980s. The resulting plantation was harvested in the mid-1990s. Pinecones remained after logging facilitated sand pine regeneration over much of the area, and the sandhills are again dominated by off-site sand pines. The invasive cogongrass (*Imperata cylindrica*), which likely expanded onto the property from adjacent road shoulders, has invaded the sandhills. Logging of the sand pine plantation increased the extent of the cogongrass infestation. However, the sandhills still retain patches of wiregrass and other native groundcover species in areas not shaded by dense stands of sand pines or infested by cogongrass. These patches contain scattered gopher tortoise burrows. The eastern indigo snake has been found there also.

Restoration of disturbed sandhills within the park and acquisition of adjacent sandhill habitats remain a priority at Rainbow Springs State Park. Sandhill sites that retain native groundcover will receive a higher priority for restoration than degraded sites now devoid of characteristic species. Additional lightning season fires will no doubt continue to improve the sandhills that are in fair to good condition. Some sandhills will need additional off-site hardwood removal to improve conditions for prescribed fire and recovery of native groundcover. The areas converted to pastures will require more extensive restoration actions, including the removal of pasture grasses, planting of longleaf pines and restoration of groundcover species.

The Griffiths addition requires a phased removal of the sand pine plantation. Continued treatment of the remaining cogongrass patches will be an important part of the restoration of this area. As sand pines are removed, longleaf pines will be planted in their place and prescribed fires will be reintroduced. Care will be taken to protect the remaining patches of native groundcover and resident gopher tortoises and their

burrows. Plugging or direct seeding of native groundcovers may be required in some areas depending on what species respond to the sand pine removal and burning.

### Scrubby Flatwoods

The scrubby flatwoods at Rainbow Springs State Park are located in the northeastern part of the property and within the Griffiths addition, slightly upslope of the mesic flatwoods. Although limited in size, these areas contribute to the diversity of the park. As in the mesic flatwoods, it is apparent that the scrubby flatwoods have endured logging activities and fire exclusion in the past. Fire plow scars are also evident. In general, the scrubby flatwoods are in fair to good condition.

The application of prescribed fire at proper intervals should suffice to restore the scrubby flatwoods. In the southern end of the park, some hardwood removal may also be necessary.

### Basin Swamp

A number of basin swamps surrounded by mesic flatwoods are located in the northeastern part of the park. Pond cypress is the dominant tree. Superficially, the basin swamps of the park resemble domes, another natural community. However, their irregular, elongated shapes distinguish them from the more circular domes. It is likely that during periods of exceptionally high rainfall, these swamps are hydrologically connected by surface water flow with the Indian Creek bottomlands to the south.

Historically, these areas were probably logged, either selectively or by clearcut. However, the second growth cypress is well established and most of these swamps are in good condition. A boundary road or firebreak along the south fence line bisects one basin swamp. A second road with fire plow scars skirts the northern edge of the same basin swamp, but the disturbance is not as substantial. Soil disturbance from feral hog rooting has also impacted the basin swamps. The basin swamp in zone RS-2C has a recently discovered population of the Category I invasive plant, giant Salvinia (*Salvinia molesta*).

The basin swamps host a variety of amphibians and are critical breeding habitat for many of those species. The gopher frog (*Lithobates capito*), a species of special concern, has been recorded in at least one of the basin swamps.

Maintenance of a natural hydroperiod is essential for the preservation of these basin swamps and the species that depend on them. Prescribed fires should be allowed to burn into the edges of the basin swamps during wet periods to re-establish a more natural ecotone between the mesic flatwoods and the basin swamps. Continue to control giant Salvinia in cooperation with FWC.

### Depression Marsh

Several depression marshes of various sizes are located in the eastern and southern areas of the park. The grass-dominated marshes often contain open water, especially when rain has fallen recently. Hardwood encroachment into the marshes is not severe and should be easily controlled when the surrounding mesic flatwoods and sandhills are burned. The depression marshes are in good condition, although most show some adverse impacts from feral hogs.

Control of feral hogs and restoration of a natural fire regime are the primary management measures for the depression marshes. In some cases, removal of hardwoods or invading loblolly pines may be necessary to improve the condition of certain depression marshes in the park.

### Floodplain Swamp

A thin band of floodplain swamp lies between the Rainbow River and the hydric hammock that parallels the river. An additional finger of floodplain swamp extends from the river into the hydric hammock for approximately 700 feet, appearing as a narrow depressional system. The floodplain swamps of the park lack the cypress overstory characteristic of this natural community. Past logging practices and alterations of the natural hydroperiod of the river may explain this apparent aberration. The floodplain swamp is considered to be in good condition. Protection of the floodplain swamps from invasive plants and feral hogs will be necessary.

### Hydric Hammock

Hydric hammock occurs in the lowlands along the east bank of the Rainbow River. The hydric hammock community shares many characteristics and species with the bottomland forest and the floodplain swamp communities. One primary difference between these communities is the frequency and source of flooding. River flooding typically inundates bottomland and alluvial forests, while hydric hammocks receive hydrologic input from groundwater seepage and rainfall (Vince et al. 1989).

Historically, the lowland forests along the Rainbow River may have flooded at regular intervals. However, the construction of the dam across the Withlacoochee River, which formed Lake Rousseau, may have stabilized any natural fluctuations in the levels of the Rainbow River. The primary hydrologic inputs appear to be groundwater seepage from the adjacent spring-run stream, rainfall, and runoff from the uplands.

Alteration of the natural hydroperiod of the river has had an undetermined impact on the natural communities along the river. Much of the hydric hammock remains in fair to good condition, although feral hogs have severely impacted many areas. Phosphate mining within the hydric hammock has had severe localized impacts on the community. The presence of pits, spoil piles and mine tailings has permanently altered portions of this community. These areas, where identified, are classified as spoil areas.

Control of feral hogs and invasive plants are primary management measures for hydric hammocks. Care must also be taken to prevent stormwater runoff from developed areas or roads impacting adjacent hydric hammocks.

### Spring-Run Stream

Rainbow River is one of the largest spring-fed rivers in Florida. The headsprings are the fourth-largest first magnitude spring group in the state (Rosenau et al. 1977). The park extends about one-third of a mile south along the west bank of the river and about 1.1 miles south along the east bank of the river to the Gissy property. Then there is a quarter-mile gap in public ownership along the east bank to a point just north of the campground. From the campground, park property runs another 2 miles south along the eastern shoreline, with two private inholdings occupying about 0.4 miles of that shoreline. The sovereign lands below mean high water of the headsprings are included within the boundary of Rainbow Springs State Park. The remainder of the spring and river is also included in the Rainbow Springs Aquatic Preserve.

Two major side springs and their spring runs occur on the east side of the headsprings: Bubbling Springs to the south and an unnamed sand boil spring to the north. Bubbling Springs has a rocky limestone pavement around the main vents, while the unnamed spring has a predominantly sandy bottom. A large, deep basin occurs along the west bank just north of the property's south boundary. Although it

superficially resembles a large side spring, no vent is visible in the floor of the basin. While some natural process may have scoured it out, it is possible the basin was dredged or mined in the past.

Several docking structures associated with the old Rainbow Springs attraction remained in the headspring area after state acquisition. Both occurred on the west bank and consisted of large fiberglass-coated steel pilings that were sunk into the substrate. A concrete bulkhead was located by the northernmost set of pilings. A covered wooden structure near the Village Café was associated with the pilings to the south. These structures have been adapted for support of a swimming access platform to the north and a canoe launch facility at the Village Café site to the south.

The Rainbow River headspring has been adversely affected by factors such as increased nitrate levels and high public use. Fortunately, despite steadily increasing recreational use of the designated headspring swimming location over the years, its waters continue to exhibit a high degree of clarity (Anastasiou, 2006; SWFWMD 2015). Increasing nitrate concentration in the Rainbow springshed is concerning, and any development in these recharge areas will likely cause these trends to continue. The water quality of the Rainbow River's two uppermost segments (WBID 1320A and WBID 1320B) has been declared impaired for nitrate nitrogen levels and nuisance macroalgae benthic mats (Holland and Hicks 2013).

A swimming area defined with buoy system has long been designated within the headspring area managed by DRP. Canoes and kayaks can use the rest of the unbuoyed area of the headspring, but motorboats and any swimming are excluded. The SAV coverage of the upper 0.3 miles of the Rainbow headspring, except within the designated swimming area, is some of the most diverse in the entire river as of winter 2021 (SWFWMD 2021d). Within the designated swimming area boundary, a loss of sediments, resulting in exposure of the underlying bedrock in many areas and an almost complete loss of aquatic vegetation, has occurred.

Recreational use downstream of the headspring at the upper kayak launch, lower kayak/tuber launch and DRP takeout continues to have a detrimental impact on the aquatic plant beds and the spring run in those regions. In water depths of less than 5 feet, tubing, swimming and boating has extensively damaged the plant beds in the spring run and spring bottom. In shallower water increased numbers of tubers continue to damage SAV primarily when they drag their feet or exit tubing areas. Water clarity at the headspring is good but can be degraded downstream of the designated swimming area due at least in part to disturbance of sediments.

Stormwater runoff from adjacent uplands can also affect water quality. Restoration of shoreline vegetation and construction of vegetated berms by aquatic preserve and park staffs have mitigated these impacts to some extent. Additional areas would benefit from the construction of small, vegetated berms or other methods of stormwater mitigation. It needs to be determined if an existing underground drainage system also contributes stormwater to the system.

Management of complex aquatic systems is a difficult task. Since many impacts to the spring-run stream originate outside the park boundary in the groundwater sources, management must necessarily extend outside the park boundary. Protection of the Rainbow River springshed is a priority. DRP staff will continue to support the SWFWMD, Rainbow Springs Aquatic Preserve, Florida Springs Institute and the numerous researchers that are conducting hydrological projects associated with the river and the springshed. Continued monitoring of SAV transects by the SWFWMD will be supported in their tracking of trends in Rainbow Spring ecological health.

Water quality impacts to the Rainbow River are primarily due to elevated nutrients within the springshed which originate mainly outside the park. A potential contribution to the nutrients in the river is the wastewater treatment system and spray field associated with the campground. A long-term goal is to remove this system and connect to city sewer when it becomes available. As an interim measure, any septic tanks should be an advanced aerobic treatment system if they are not connected to the package plant. Foot traffic by tubers and other recreational users uproots vegetation and disturbs the stream bed. Proactive protection of the submerged aquatic vegetation from turbidity, physical disturbance and nutrient impacts is a high priority.

#### Aquatic Cave

Although none of the spring vents within Rainbow Springs State Park are large enough to allow human access and exploration, there are undoubtedly large underground conduits feeding the springs. These conduits within the Floridan aquifer are considered aquatic caves and are of unknown extent within the park. Since they are undisturbed, their condition is assumed excellent.

Protection of the springshed of Rainbow Springs from excessive groundwater withdrawals and contamination are important management measures for the aquatic caves as well as the spring-run stream. However, most of the springshed for Rainbow Springs lies outside the park boundary. As with the spring-run stream, park staff will continue to work with other agencies and researchers on issues that extend beyond the park boundary. The Rainbow Springshed Priority Focus Area (refer to Optimum Boundary Map) indicates land that has high aquifer recharge necessary for springs protection that should be placed in conservation status and can aid agencies' collaboration to achieve that aim. Current research projects include dye trace mapping to determine the extent of the springshed reach. Erosion of the slopes above the headspring must also be monitored and corrected to prevent siltation of the aquatic caves.

#### Abandoned Field/Abandoned Pasture

Most of the highly disturbed areas in the northern end of the park were originally sandhills, including all the pastures (management zones RS-1D and RS-1E) and the entrance drive (management zone RS-1A). These areas are in very poor condition, but they are restorable, with the possible exception of RS-1A. The pasture areas in 1D and 1E that are surrounded by good sandhills will be require removal of the non-native pasture grasses. Several areas within the pastures have been planted with longleaf pines. Some of the Griffiths addition sandhills were converted to improved pasture in 1972-73. The main pasture area, in management zone RS-5E, is located near the old horse stable, which is adjacent to the former canal authority property where pasture grasses also dominate. The desired future condition of these pastures is mostly sandhill with possibly some mesic flatwoods.

#### Borrow Area

At least nine significant borrow areas exist at the park. Most or all of these are the result of former phosphate mining prior to the establishment of the park. Many of the pits are associated with spoil piles excavated during mining. Invasive plants have colonized these sites. Japanese climbing fern (*Lygodium japonicum*) is found in the pits.

#### Canal/Ditch

At least two substantial ditches occur in the park in association with abandoned railroad rights-of-way. A deep ditch is located in zone 5H within a band of mesic flatwoods near the edge of the Rainbow River on the Griffiths addition. Another deep ditch that was presumably associated with a rail line or tram road is found along the eastern end of the boundary between zones 5C and 5D on the Griffiths addition. In

zones 6A and 6C, the rail bed is raised above the topography of the flood plain. Hydrological restoration needs for these areas will need to be determined and the appropriate natural community desired future condition of the ditches would be determined at that time.

### Clearing

Areas within the park were cleared in the past for various reasons. At the northern end of the gardens, a sewage package plant was in operation until after state acquisition. When municipal sewage became available to the park and surrounding private development, the package plant was dismantled and removed. Another clearing is located south of the campground along the tram road adjacent to a private parcel.

### Developed

Rainbow Springs State Park contains a large, developed area associated with the former tourist attraction. This area has numerous buildings and other structures, including abandoned animal cages and waterfalls. In addition to the buildings associated with the tourist attraction at the headsprings, there are parking lots, staff residences, a shop complex, and a greenhouse. Most of the developed area was probably once sandhill or upland hardwood forest.

Another remnant of the old Rainbow Springs tourist attraction is the large ornamental garden on the slopes above the headsprings. Some native species remain onsite, primarily tree species. Most of the ornamental plants used in the gardens are either native to Florida or are non-invasive species. A large number of Asian azaleas (*Rhododendron* sp.) are present. Some non-native ornamentals that aggressively invade natural areas, such as Japanese honeysuckle (*Lonicera japonica*), white flowered tradescantia (*Tradescantia fluminense*) and coral ardisia (*Ardisia crenata*) are also present. Another invasive, the air potato (*Dioscorea* spp.) spread throughout much of the gardens and surrounding areas during the two decades of neglect prior to state acquisition. The most insidious threat, skunk vine (*Paederia foetida*) is established in the gardens and surrounding areas and poses the greatest threat to adjacent natural areas.

The park also includes a campground that was originally developed in the early 1970s. The campground was expanded and redeveloped by DRP in 2008. In 2006, a tuber exit facility was constructed at the north end of the Griffiths addition. The development mainly impacted the sand pine plantation, although a number of gopher tortoises did have to be relocated onsite. A tram road was constructed at the same time to link the campground with the tuber exit facility. Although the tram road was located on an existing service road, the surrounding sandhill was peripherally impacted by the road construction and stormwater retention ponds. The Griffiths addition also includes an old horse stable that was constructed in 1972-73 according to aerial photography.

Many non-native plant control efforts in the park also have occurred in developed areas within and adjacent to the gardens and parking lots. These areas have had the highest concentrations of invasives, and their control may help prevent large-scale invasions of the adjacent hydric hammock and sandhill. Priority invasive plant species (Florida Invasive Species Council Category I and II species) will be removed from prioritized developed areas. Other management measures in developed areas include proper stormwater management and development guidelines that are compatible with prescribed fire management in adjacent natural areas.

### Impoundment/Artificial Pond

At least one depression marsh appears to have been modified into a permanent pond. This pond lies just north of the old horse stable on the Griffiths addition and appears to have been modified around early 1972 based on aerial photography. At least two phosphate pits contain permanent water bodies and are also classified as artificial ponds. Several stormwater retention ponds were installed during construction of the tuber exit facility, tram road and campground redevelopment.

### Pasture – Improved

Areas of former sandhill and mesic flatwoods in the Rainbow River Ranch parcel are improved pasture. The predominant pasture grass is Bermudagrass (*Cynodon dactylon*). Cogongrass (*Imperata cylindrica*) and sweet tangle head (*Heteropogon melanocarpus*) are invading the edges from infested road shoulders. Control of non-native pasture grasses like Bermuda grass (*Cynodon dactylon*) is ongoing at the Rainbow River Ranch in preparation for native groundcover restoration in conjunction with the Southwest Florida Water Management District.

### Pine Plantation

Most of the Griffiths addition at the southern end of the park, adjacent to and south of the tuber entrance, was formerly sandhill. Unfortunately, past land use practices have negatively affected much of the community, and it is now considered to be in poor condition. After logging of the native pines in the late 1970s, off-site sand pines were planted over most of the sandhills in the early 1980s. The resulting plantation was harvested in the mid-1990s. Pinecones that remained after logging facilitated sand pine regeneration over much of the area, and the sandhills are again dominated by off-site sand pines. The invasive cogongrass (*Imperata cylindrica*), which likely expanded onto the property from adjacent road shoulders, has invaded the sandhills. Removal of the sand pine plantation increased the extent of the cogongrass infestation. However, the sandhills still retain patches of wiregrass and other native groundcover species in areas not shaded by dense stands of sand pines or infested by cogongrass. These patches contain scattered gopher tortoise burrows.

Since acquisition by the state, the park has obtained grant funding through FWC to treat the cogongrass infestations. Cogongrass, skunkvine and centipede grass (*Eremochloa ophiuroides*) are the primary target species to control to assist with restoration activities there. Restoration of the sandhills requires removal of the sand pines and continued control of the cogongrass, while also minimizing damage to the remaining wiregrass, turkey oaks, sand post oak, blue-jack oak and longleaf pines and protecting the gopher tortoises.

### Road

Paved roads are associated with the developed areas in the northern part of the park, the campground area, the tuber exit and the tram road that connects the tuber exit to the campground. All efforts will be made to control priority invasive plant species (Florida Exotic Pest Plant Council Category I and II species) along road shoulders.

### Spoil Area

The majority of the spoil areas within the park are the result of past phosphate mining activities. The massive soil disturbances associated with the mine pits, spoil piles and mine tailings probably preclude restoration to a natural condition. Most of the mining took place in sandhills that have been irrevocably altered by the dumping of highly fertile mine tailings over naturally sterile sands. Some of these areas are now dominated by a thick growth of mesic-adapted oaks and other secondary succession plant species. Two large pits remain in the northern pasture. These have historically been used as dumping

sites for organic debris such as logs, limbs and leaf litter. Few species native to the sandhills remain on the phosphate-mined lands. The Rainbow River Ranch parcel has several large spoil piles and pits. A significant aspect of the phosphate sites is their impact on soil chemistry and thus on the vegetation currently growing in these areas. Because of the higher nutrient content of the soil and its disturbed nature, more hardwoods and invasive plants are present in these areas. In some cases this affects the fire return interval.

The mine tailings are identified as the Candler clay overwash soil type. Sites having overwash soils could potentially be developed as use areas since they are already degraded. However, it is very likely that the mine tailings contain uranium deposits that may release radon. No permanent enclosed structures are advisable for areas that have a high radon contamination.

The hydric hammock areas that were mined have a more natural species composition, but portions are still considered ruderal because of topographic alterations. Only the spoil piles and pits are labeled as spoil areas in these communities.

#### Successional Hardwood Forest

In most cases, successional hardwood forests occur on areas that were historically sandhills. Those successional hardwood forests that have encroached upon the edges of natural sandhills may be restored with hardwood reduction and replanting with longleaf pines and groundcover species if necessary. Those areas that have succeeded from abandoned pastures or phosphate mined areas may be very difficult to restore to a natural sandhill community due to a complete loss of groundcover species or alteration of soil profiles.

Successional hardwood forest occurs at the north end of the park between the developed areas and the sandhills. Some of this area may have historically been associated with the town of Juliette. Successional hardwood forest also occurs along the park entrance drive in areas impacted by phosphate mining and pasture conversion. A plant nursery area was developed during the 1970s as part of the tourist attraction to provide landscaping plants for the attraction. It is located in the northwest corner of management zone RS-1D. It remained an active nursery area until the late 1980s when it was abandoned and began to succeed to a hardwood forest. Restoration of the sandhills in RS-1D would require hardwood removal, groundcover replacement and planting of longleaf pines.

Some former sandhill that is now successional hardwood forest occurs in the southern portion of the park in zones RS-3B, RS-3C, RS-4A, RS-4B, RS-4C, 5C and 5F, among other areas. These areas need reduction or removal of off-site hardwood species and increased fire frequency.

### **Prescribed Fire**

**Objective A: Within 10 years, maintain 950 acres of the park within the optimum fire return interval.**

#### *Actions:*

- Develop/update annual prescribed fire plan.
- Manage fire dependent communities by burning 288-850 acres annually.

The table below contains a list of all fire-dependent natural communities found within the park, their associated acreage and optimal fire return interval, and the annual average target for acres to be burned.



<b>Prescribed Fire Management</b>		
<b>Natural Community</b>	<b>Acres</b>	<b>Optimal Fire Return Interval (Years)</b>
Sandhill	457	1-3
Pine Plantation	182	15-25
Mesic Flatwoods	145	1-3
Successional Hardwood Forest	240	2-10
Abandoned Pasture	117	2-4
Pasture – Improved	90	2-4
Scrubby Flatwoods	7	3-8
Depression Marsh	5	2-10
<b>Annual Target Acreage*</b>		<b>285- 840</b>
*Annual Target Acreage Range is based on the fire return interval assigned to each burn zone. Each burn zone may include multiple natural communities.		

Prescribed fire is planned for each fire zone at the appropriate interval. The park’s prescribed fire plan is updated annually because fire management is a dynamic process. To provide adaptive responses to changing conditions, fire management requires careful planning based on annual and very specific objectives. Each annual prescribed fire plan is developed to support and implement the broader objectives and actions outlined in this plan.

Rainbow Springs State Park contains a significant amount of burn habitat. Natural communities within the park that are naturally maintained by fire include sandhills, mesic flatwoods, scrubby flatwoods, basin swamps and depression marshes. Altered landcover types that may also be managed with fire include pine plantation, successional hardwood forest and abandoned pasture. The majority of the burn habitat consists of sandhills and mesic flatwoods of varying quality. A large area of sandhills on the Griffiths addition was converted to sand pine plantations in the past and is currently unavailable for prescribed fire due to the incendiary nature of sand pine plantations. Once the sand pines are removed through a timber harvest, those areas will be placed in rotation with the other sandhill management zones. Some sandhill and mesic flatwood areas have become dominated by off-site hardwoods, primarily laurel oaks, due to long-term fire suppression. These areas are currently classified as successional hardwood forest. Some of these areas may not be available for prescribed fire without substantial hardwood reduction. Abandoned pastures will also be managed with fire to suspend encroachment of off-site hardwoods and manage herbaceous vegetation.

Careful planning and execution of prescribed fires is essential due to the proximity of U.S. Highway 41, State Road 40, adjacent schools, and numerous residential communities. The highways and most of the residences are located to the north and west of the park boundaries, while two schools and a two-lane county road (Southwest 180<sup>th</sup> Avenue Road) are located east of the park.

Firebreaks around zones consist of pre-existing breaks such as service roads and park boundary lines, as well as natural firebreaks such as mesic woods or watercourses. Wherever appropriate, ecotones between natural communities will be maintained by fire. Prescribed fires should be allowed to burn through ecotones to the extent that natural fires would have. The basin swamps can be used as natural

firebreaks during wet years but may burn if the soils are not saturated. The construction of artificial firebreaks between natural communities is discouraged.

Where significant archaeological sites occur, soil disturbance in the preparation of firebreaks should be minimized. Neither the periphery of the large pasture (zone 1E) nor the road that runs along the south boundary of zone 2B should be disked. In most other areas, disking will not be required if proper equipment and staff are available to rake lines or if wet lines are used.

Fire was excluded from most of the burn habitat of the park for at least a decade before state acquisition. In many cases, fire had been absent much longer. With the exception of the Griffiths addition and the Rainbow River Ranch, all of the fire-type management zones in the park have been treated with fire multiple times. Some overgrown areas still require additional burns to reduce fuel levels and open the canopy. Even sandhills in relatively good condition that have been excluded from fire for too long require fuel reduction burns in the non-lightning season to protect longleaf pines that are surrounded by heavy fuel buildups and thick layers of duff. The ultimate goal, however, will be to burn predominantly during the lightning season to simulate natural fires. In practice, however, seasons and intervals are flexible and should vary over time to mimic natural random events and to take advantage of all opportunities to apply prescribed fire.

Management zones in the Griffiths addition (5C, 5D, 5E, 5F and 5G) are dominated by a sand pine plantation that was harvested in the mid-1990s and allowed to regenerate to another sand pine stand. Prescribed fires are not normally possible in sand pine stands due to the extreme volatility of the live fuels. Restoration of these stands to sandhill began with control of cogongrass infestations. As the sand pines are harvested, these management zones will be included in the annual prescribed fire plan for the park. Sand pines have been harvested in RS-5B and a portion of RS-5C.

Prescribed fire may also be useful in controlling the spread of invasive species. Rainbow Springs State Park has numerous scattered infestations of skunk vine, an FLEPPC Category I invasive plant. Fire is a valuable tool for controlling skunkvine. Some areas of successional hardwood forest may be given a higher priority for prescribed fires if they contain skunkvine that can be controlled with fire.

Many wildlife species within the park are adapted to and dependent on fire for maintenance of their natural habitats. Prescribed fire is a critical tool for the management of gopher tortoises, indigo snakes, Florida mice, southeastern fox squirrels, Bachman's sparrows, southeastern kestrels, Florida pine snakes, striped newts, gopher frogs and other imperiled species or species of greatest conservation need.

In order to track fire management activities, DRP maintains a statewide prescribed fire database. The database allows staff to track various aspects of each park's fire management program including individual fire zone histories and fire return intervals, staff training/experience, backlog, if objectives have been met and more. The database is also used for annual prescribed fire planning which allows DRP to document fire management goals and objectives on an annual basis. Each quarter, the database is updated, and reports are produced that track progress toward meeting annual prescribed fire objectives.

## Natural Communities Restoration

In some cases, the reintroduction and maintenance of natural processes is not enough to reach the natural community desired future conditions in the park, and active restoration programs are required. Restoration of altered natural communities to healthy, fully functioning natural landscapes often requires substantial efforts that may include mechanical treatment of vegetation or soils and reintroduction or augmentation of native plants and animals. For the purposes of this management plan, restoration is defined as the process of assisting the recovery and natural functioning of degraded natural communities to desired future condition, including the re-establishment of biodiversity, ecological processes, vegetation structure and physical characters.

Examples that would qualify as natural communities' restoration requiring annual restoration plans include large mitigation projects, large-scale hardwood removal and timbering activities, roller-chopping and other large-scale vegetative modifications. The key concept is that restoration projects go beyond management activities routinely done as standard operating procedures such as routine mowing, the reintroduction of fire as a natural process, spot treatments of invasive plants and small-scale vegetation management.

## Sandhill Restoration

**Objective: Conduct habitat/natural community restoration activities on 244 acres of sandhill community.**

### *Actions:*

- Develop a site-specific restoration plan.
- Implement restoration plan.

The southern end of Rainbow Springs State Park has approximately 244 acres of sandhill that were converted to sand pine plantation in the 1980s and additional acres that were converted into pasture. The area has gopher tortoises and indigo snakes. Scattered remnant native groundcover including wiregrass and giant orchid is still present, particularly in sunny gaps in the plantation. Some native sandhill oaks, turkey oak, blue jack oak and sand post oak are also present throughout the site. There are remnant longleaf pines and sand post oak. The area has received ongoing treatment of cogongrass since 2005.

Cogongrass treatment will need to continue as an integral part of the restoration process. Scattered areas of centipede grass also occur throughout. It can outcompete native groundcover and must be treated to prevent spread by equipment. Sand pine will need to be harvested from the site. Prior to logging, the older sand post oaks and any turkey oak, blue jack oak, southern red oak, mockernut hickory, dogwood and *Crataegus* species should be identified and marked as "leave" trees. Because this area has gopher tortoises, logging during the winter is preferable. It may be necessary to treat off-site hardwoods mechanically or chemically. Fire will be a critical part of the restoration process and will be needed to kill the young sand pine recruitment that occurs after the harvest. It also will be a very important tool to control off-site hardwood sprouting.

After sand pine harvest and prescribed fire, it will be necessary to evaluate the site for groundcover enhancement or restoration. Other sandhill zones in Rainbow Springs State Park may serve as a seed

source for groundcover restoration. Planting wiregrass plugs or direct seeding of some areas may also be necessary. Longleaf pine will be planted throughout the area.

This is a long-term project and restoration will not be complete during the life of this plan. Cogongrass maintenance treatment is extremely important during the project and cogongrass and centipede grass should be monitored and treated annually. Natal grass has recently been discovered in the tuber entrance area. This will need aggressive monthly treatment. Treatment of off-site hardwood re-sprouts and monitoring of groundcover species including wiregrass is very important. Monitoring the survival of planting longleaf pines will be important so that it can be determined if any replanting is needed.

Maintenance activities will include prescribed fire, follow-up treatment of cogongrass, centipede grass, natal grass and other invasive species, and retreatment of invading off-site hardwoods and their sprouts. This is the highest priority restoration project the park has at this time.

### **Sandhill/Flatwoods Restoration**

**Objective: Conduct habitat/natural community restoration activities on 75 acres of sandhill and flatwoods natural communities on the Rainbow River Ranch parcel.**

#### *Actions:*

- SWFWMD develops a site-specific restoration plan.
- SWFWMD implements the restoration plan with initial steps consisting of:
  - 1) Multiple applications of a chemical treatment and possible mechanical treatment of non-native pasture grasses and invasive species for up to two years.
  - 2) After removal of pasture grasses, SWFWMD will site, prepare, and direct seed native groundcover species appropriate to the sandhill at the Rainbow River.
  - 3) SWFWMD will follow native groundcover seeding by monitoring establishment success of native groundcover and treating any remaining non-native pasture grasses and other invasive species.
- After year three, DRP will continue monitoring and control of non-native pasture and other species and using fire to manage the site.
- Plant longleaf pine seedlings.

The Rainbow River Ranch parcel was acquired by the SWFWMD in 2017. It contains approximately 82 acres of improved pasture and 0.44 miles of riverfront. The SWFWMD has developed a restoration plan for the former sandhill which involves chemical and mechanical removal of non-native pasture grass followed by seeding of native groundcover species. Initial non-native pasture grass treatment began in September 2019. Native groundcover seeding is planned for winter 2021. The contract will continue through 2024. Once the native groundcover is established and the non-native pasture is under control, the site will be managed by fire and planted with longleaf pine trees.

## Natural Communities Improvement

Improvements are similar to restoration but on a smaller, less intense scale. This typically includes small-scale vegetative management activities or minor habitat manipulation. Following are the natural community/habitat improvement actions recommended at the park.

**Objective: Conduct natural community/habitat improvement activities on at least 10 acres of sandhill community and successional hardwood forest.**

*Action:*

- Develop and implement a plan to treat off-site hardwoods.

Scattered areas of sandhill are overgrown with off-site hardwoods and are becoming successional hardwood forest due to lack of fire. Invading hardwoods, such as laurel oak and sweetgum, will need mechanical and/or chemical treatment. Fire will be an important part of the process to control hardwood resprouting, stimulate remnant groundcover species and control invasive plants like skunkvine. Limited planting of longleaf pines may also be included in this improvement project. Maintenance activities would include prescribed fire, retreatment of off-site hardwood sprouts and supplemental planting of longleaf and/or groundcover species if needed.

### **IMPERILED SPECIES**

Imperiled species are those that are (1) tracked by the Florida Natural Areas Inventory (FNAI) as critically imperiled (G1, S1) or imperiled (G2, S2) or (2) listed by the U.S. Fish and Wildlife Service (USFWS), FWC or Florida Department of Agriculture and Consumer Services (FDACS) as endangered, threatened or of special concern.

The number of imperiled plant species within the park is probably underestimated. More extensive surveys for rare and endangered plants must be conducted before a list that truly reflects the natural diversity of the park will be available. The imperiled species list for vertebrates, however, is much more complete, because of a comprehensive survey that was conducted by the FWC Nongame Wildlife Program near the time of state acquisition.

Many of the imperiled vertebrate species are associated with the sandhill natural community. Years of fire suppression and conversion to other uses by humans have altered most of this habitat statewide, resulting in the endangerment of a number of species that depend on sandhills. At Rainbow Springs State Park, there still appears to be a relatively healthy population of gopher tortoises, although some poaching probably occurred on the property before state acquisition. Other imperiled or rare species that occur as gopher tortoise commensals, such as eastern indigo snakes (*Drymarchon couperi*), gopher frogs and Florida mice (*Podomys floridanus*) have also been recorded on the property. Southeastern fox squirrels (*Sciurus niger niger*) are often sighted in or near the sandhills, but the population is probably very small given the limited amount of habitat. Other imperiled sandhill species identified within the park include the southeastern kestrel (*Falco sparverius paulus*), striped news (*Notophthalmus perstriatus*) and Florida pine snake (*Pituophis melanoleucus mugitus*). Bachman's sparrow (*Aimophila aestivalis*) is a species of conservation need that is also found within the sandhills at Rainbow Springs State Park. Habitat destruction jeopardizes the continued existence of these species in Florida. Large tracts of natural sandhills are necessary to maintain viable populations. In the future, if the park becomes isolated by development, the small number of sandhill acres currently found within the park

will not support most of these species indefinitely. Relatively few undeveloped sandhills remain in western Marion County, with Rainbow Springs State Park representing one of the only major publicly owned sandhill tracts.

Several depression marshes and basin swamps have been surveyed in recent years for striped newts in cooperation with an FWC initiative to document additional breeding ponds. Unfortunately, no striped newts have been recently documented in the park. DRP staff will continue to work with FWC to try to determine the status of striped newts in the park.

In 2011, transects were set up in the Rainbow Springs State Park sandhills to monitor Bachman's sparrows as well as other bird species listed as Species of Greatest Conservation Need (FWC 2005). Birds monitored include the redheaded woodpecker (*Melanerpes erythrocephalus*), common ground dove (*Columbina passerina*), northern bobwhite (*Colinus virginianus*) and swallow-tailed kite (*Elanoides forficatus*).

Other imperiled bird species recorded within the park include several species of herons, egrets and raptors. These populations are probably not seriously threatened at present, although continued habitat loss and human-related disturbance may ultimately change that. Monitoring of avian species is supplemented with data from the Audubon Society Christmas Bird Count.

Several gopher tortoise surveys have been conducted in the past, usually in response to a development proposal. The only tortoises relocated due to development occurred in 2006 prior to construction of the tuber exit on the Griffiths addition. The tortoises were relocated onsite a short distance from their impacted burrows. In the spring of 2018, FWC conducted a formal gopher tortoise census using the Line Transect Distance Sampling (LTDS) methodology (Smith et al 2009). The model estimated the population within the sampled areas of the park to be 479 tortoises with an average density of about 2 tortoises per hectare. The population is considered viable since there are greater than 250 acres of available habitat and more than 250 tortoises. The habitat suitability was rated a 2 due to an overabundance of oaks in some areas (FWC 2018).

Gopher tortoises still exist within the sand pine plantations that were not censused during the FWC LTDS census. These areas are scheduled for restoration to sandhill. Impacts from logging activities will be minimized by careful placement of loading zones and skidder trails. Burrows near high impacts areas will be staked and marked to avoid inadvertent damage to burrows. Staff will continue to refer to the FWC Gopher Tortoise Management Plan (FWC 2012) to guide management of this imperiled species.

Another rare turtle species is the Suwannee cooter (*Pseudemys suwanniensis*). Dr. Peter Meylan of Eckerd College has been conducting a mark-recapture study of the aquatic turtle community at the Rainbow River since 1990 (Meylan et al 1992; Huestis and Meylan 2004). Comparisons to data collected in the early 1940s by Marchand (1942) have shown that there has been a marked decrease in the numbers, particularly of the larger size classes, of the Suwannee cooter, peninsula cooter (*Pseudemys peninsularis*), and Florida red-bellied cooter (*Pseudemys nelsoni*) in the Rainbow run. Meylan et al (1992) and Giovanetto (1992) attribute this to potential impacts from harvesting for human consumption. Long-term data from Meylan's work have shown that there is a distinct decrease in survivorship of larger individuals in the Rainbow River (Mattheus and Meylan 2010) which is likely attributable to harvesting or some other anthropogenic impact. Past actions by FWC make it illegal to harvest cooters (*Pseudemys* spp.) from the wild in Florida. It is hoped that this will decrease additional impacts to the aquatic turtle community at the Rainbow River.

Construction of the Inglis Dam may have led to the disruption of wildlife movement routes such as those used by certain anadromous fishes in their annual migration from the Gulf of Mexico to the Rainbow River. According to current monitoring, some of the migratory fish once common in the river, such as the hogchoker (*Trinectes maculatus*) and the striped mullet (*Mugil cephalus*), have not been observed in the Rainbow system for over 20 years. Another example of the dam's potentially negative effect on wildlife migration is that there is only one historic record of a Florida manatee (*Trichechus manatus latirostris*) using the Rainbow system as a warm-water refuge during the winter (Powell and Rathbun 1984; Beeler and O'Shea 1988; Valade et al. 2020). There undoubtedly could be other factors contributing to the absence of manatees in the Rainbow River (Laist and Reynolds 2005), however, state and federal fish and wildlife agencies have recently made it a high priority to restore all available winter refugia for this federally endangered species in Florida, including those at Homosassa Springs, Crystal River and Fanning Springs.

The harvest of all wildlife, except for fish, is prohibited along the length of the Rainbow River where the river passes through, or along the boundary of, Rainbow Springs State Park. The area under jurisdiction of the park includes a 400-foot zone from the edge of mean high water along sovereign submerged lands of the Rainbow River. Where emergent wetland vegetation exists, the zone extends waterward 400 feet beyond the vegetation.

Eastern indigo snakes have been documented within the park on numerous occasions. They are typically associated with gopher tortoise burrows. Given the limited amount of habitat within the park, it is likely that the resident indigo snakes range outside the park boundary. This puts them at risk of being harmed or killed by uninformed residents of the surrounding developments and at risk of being killed by vehicles on adjacent roadways. Improvement and restoration of sandhill habitats within the park might reduce these threats or might provide support for a larger population of indigo snakes. There are similar concerns over the Florida pine snake (*Pituophis melanoleucus mugitus*) population, which also frequents sandhills and tortoise burrows, as well as pocket gopher tunnels. The park should consider developing an interpretive program about indigo snakes and pine snakes to help ensure their protection.

Most of the imperiled plant species found within the park do not appear to have any imminent threats. Careful management of the natural communities of the park and prudent park development planning should suffice to protect and preserve their populations. However, feral hogs have the potential to cause severe impacts to certain plant species, particularly those that occur within wetland edges or ecotones. Feral hogs damaged many of the wetland ecotones in the park in the past. These areas may have harbored populations of imperiled plant species. If feral hogs become an issue again in the future, the park will activate the feral hog removal program.

Several imperiled plant species occur under slightly unusual circumstances in the park. Giant orchid (*Orthochilus ecristata*) is found on the Griffitts tract in areas invaded by cogongrass. Because of the grass-like appearance of its leaves, staff and contractors treating cogongrass will need to take special care not to spray the orchid. The star anise (*Illicium parviflorum*), a threatened species endemic to central Florida, is found planted as an ornamental throughout the developed area of the park. While it is questionable whether any naturally occurring star anise grows along the banks of the Rainbow River, the proper habitat for it does exist there. Planted specimens of Ashe's magnolia (*Magnolia ashei*), an endangered species endemic to the Florida Panhandle, are found along the entrance drive.

The table below contains a list of all known imperiled species within the park and identifies their status as defined by various entities. It also identifies the types of management actions that are currently being taken by DRP staff or others and identifies the current level of monitoring effort. The codes used under the column headings for management actions and monitoring level are defined following the table. Explanations for federal and state status as well as FNAI global and state rank are provided in the appendix.

Imperiled Species Inventory						
Common and Scientific Name	Imperiled Species Status				Management Actions	Monitoring Level
	FWC	USFWS	FDACS	FNAI		
<b>PLANTS</b>						
Golden leather fern <i>Acrostichum aureum</i>			LT	G5,S3		Tier 1
Star anise <i>Illicium parviflorum*</i>			LE	G2,S2		Tier 1
Ashe's magnolia <i>Magnolia ashei*</i>			LE	G3,S3		Tier 1
Florida Milkvine <i>Matelea floridana</i>			LE	G2,S2		Tier 1
Yellow butterwort <i>Pinguicula lutea</i>			LT		1, 4, 10	Tier 1
Southern tubercled orchid <i>Platanthera flava</i>			LT			Tier 1
Giant orchid <i>Orthochilus ecristata</i>			LT	G2,S4	1, 2	Tier 1
<b>INVERTEBRATES</b>						
Florida cebrionid beetle <i>Selonodon floridensis</i>				G2, G4, S2, S4		
Large-jawed cebrionid beetle <i>Selonodon mandibularis</i>				G2, G3, G4, S2, S4		
<b>AMPHIBIANS</b>						
Striped newt <i>Notophthalmus perstriatus</i>	ST			G2, G3, S2	1,6	Tier 2
<b>REPTILES</b>						
American alligator <i>Alligator mississippiensis</i>	FT (S/A)	T(S/A)		G5,S4		Tier 1
Eastern indigo snake <i>Drymarchon couperi</i>	FT	LT		G3, S2?	1,6	Tier 1



Imperiled Species Inventory						
Common and Scientific Name	Imperiled Species Status				Management Actions	Monitoring Level
	FWC	USFWS	FDACS	FNAI		
Gopher tortoise <i>Gopherus polyphemus</i>	ST			G3,S3	1,6,13	Tier 3
Florida pine snake <i>Pituophis melanoleucus mugitus</i>	ST			G4,S3	1,6,13	Tier 1
<b>BIRDS</b>						
Little Blue Heron <i>Egretta caerulea</i>	ST			G5,S4	4	Tier 2
Tricolored Heron <i>Egretta tricolor</i>	ST			G5, S4	4	Tier 2
Swallow-tailed Kite <i>Elanoides forficatus</i>				G5, S2		Tier 2
Southeastern American Kestrel <i>Falco sparverius paulus</i>	ST			G5, T4, S3	1, 5, 6	Tier 2
Wood Stork <i>Mycteria americana</i>	FT	LT		G4, S2	4	Tier 2

**Management Actions:**

- |   |                                     |
|---|-------------------------------------|
| 1. Prescribed Fire                                  | 8. Predator Control                 |
| 2. Exotic Plant Removal                             | 9. Erosion Control                  |
| 3. Population Translocation/Augmentation/Restocking | 10. Protection from visitor Impacts |
| 4. Hydrological Maintenance/Restoration             | 11. Decoys (shorebirds)             |
| 5. Nest Boxes/Artificial Cavities                   | 12. Vegetation planting             |
| 6. Hardwood Removal                                 | 13. Outreach and Education          |
| 7. Mechanical Treatment                             | 14. Other                           |

**Monitoring Level:**

Tier 1.

Non-Targeted Observation/Documentation: includes documentation of species presence through casual/passive observation during routine park activities (i.e. not conducting species-specific searches). Documentation may be in the form of *Wildlife Observation Forms*, or other district specific methods used to communicate observations.

Tier 2.

Targeted Presence/Absence: includes monitoring methods/activities that are specifically intended to document presence/absence of a particular species or suite of species.

Tier 3.

Population Estimate/Index: an approximation of the true population size or population index based on a widely accepted method of sampling.

Tier 4.

Population Census: A complete count of an entire population with demographic analysis, including mortality, reproduction, emigration, and immigration.

Tier 5.

Other: may include habitat assessments for a particular species or suite of species or any other specific methods used as indicators to gather information about a particular species.

DRP strives to maintain and restore viable populations of imperiled plant and animal species primarily by implementing effective management of natural systems. Single species management is appropriate in state parks when the maintenance, recovery or restoration of a species or population is complicated due to constraints associated with long-term restoration efforts, unnaturally high mortality or insufficient habitat. Single species management should be compatible with the maintenance and restoration of natural processes and should not imperil native species or compromise park values.

In the preparation of this management plan, DRP staff consulted with staff of FWC's Imperiled Species Management or FWC's regional biologist and other appropriate federal, state and local agencies for assistance in developing imperiled animal species management objectives and actions. Likewise, for imperiled plant species, DRP staff consulted with FDACS. Data collected by the USFWS, FWC, FDACS and FNAI as part of their ongoing research and monitoring programs will be reviewed by staff periodically to inform management of decisions that may have an impact on imperiled species at the park.

Ongoing inventory and monitoring of imperiled species in the Florida State Parks system is necessary to meet the DRP mission. Long-term monitoring is also essential to ensure the effectiveness of resource management programs. Monitoring efforts must be prioritized so that the data collected provides information that can be used to improve or confirm the effectiveness of management actions on conservation priorities. Monitoring intensity must at least be at a level that provides the minimum data needed to make informed decisions to meet conservation goals. Not all imperiled species require intensive monitoring efforts on a regular interval. Priority must be given to those species that can provide valuable data to guide adaptive management practices. Those species selected for specific management actions and those that will provide management guidance through regular monitoring are addressed in the objectives below.

### **Inventory**

**Objective: Update baseline imperiled species occurrence inventory lists for plants and animals.**

Although parts of Rainbow Springs State Park have been surveyed for imperiled vertebrate species in the past, additional surveys for plants and invertebrates are needed. Staff will document species occurrences whenever possible and will work with outside researchers and institutions to document additional species occurrences.

### **Fauna**

**Objective: Monitor and document seven selected imperiled animal species in the park.**

*Action:*

- Implement monitoring protocols for the seven animal species mentioned below.

Southeastern kestrel, indigo snake, striped newt, gopher frog, gopher tortoise, Suwannee cooter and Bachman's sparrow will be monitored.

Rainbow Springs State Park has documented populations of a number of imperiled animal species that would benefit from additional monitoring. Staff will continue to report incidental sightings of indigo snakes and will record dates and locations. Dip net surveys for striped newts and gopher frogs will be

continued in cooperation with DRP and FWC biologists. Reconfirming the presence of these species at breeding ponds in the park is a priority.

Specific surveys for gopher tortoises have been conducted in the past. These surveys will be expanded within the Griffiths addition as part of the sandhill restoration project to estimate baseline tortoise populations within the restoration zone. An LTDS survey for gopher tortoises was conducted in the spring of 2018 by FWC staff.

Nest boxes for southeastern kestrels were installed in the past within the park. These boxes will continue to be monitored for activity. In 2011, a series of transects were established to monitor Bachman's sparrow populations during the spring breeding season. Surveys of singing males will provide an index for monitoring the number of breeding pairs within the park.

DRP staff will continue to support and assist with the ongoing population studies of Suwannee cooters and other aquatic turtle species in the Rainbow River. This long-term study by Dr. Peter Meylan and his associates from Eckerd College provides valuable data on the Suwannee cooter population and will continue to provide guidance for management and protection of turtle populations within the park.

## Flora

**Objective: Monitor and document one selected imperiled plant species in the park.**

### *Actions:*

- Develop a monitoring protocol for Giant orchid.
- Implement the monitoring protocol for the imperiled plant species listed in Action 1.

The giant orchid occurs in fire-adapted uplands within the park. A population has been documented on the Griffiths addition. This population will be monitored during and after the sandhill restoration on the Griffiths addition. A monitoring protocol for this species will be developed.

## **INVASIVE SPECIES**

Rainbow Springs State Park is faced with the management of a diversity of Category I and Category II invasive plant species as classified by the Florida Invasive Species Council (FISC 2019). Many of these invasives are concentrated near the headsprings within and adjacent to the footprint of the gardens of the former attraction, within the remnant phosphate pits or at the southern end of the park where logging occurred prior to state acquisition.

Skunkvine (*Paederia foetida*), which was probably introduced by birds, is becoming widespread throughout the park particularly in the gardens and disturbed areas. Japanese climbing fern (*Lygodium japonicum*) and skunkvine are also found in the phosphate pits and the clay settling pond associated with the former phosphate mining. Air potato (*Dioscorea bulbifera*) is present in the garden and some of the phosphate pits, although its prevalence has been dramatically reduced by the introduction of the biocontrol beetle *Lilioceris cheni*. The Griffiths addition at the southern end of the park has about 200 acres of sandhill which is infested with cogongrass (*Imperata cylindrica*). Natal grass (*Melinis repens*) was recently found along the tuber entrance drive and threatens the sandhill restoration projects there. Hydrilla (*Hydrilla verticillata*) is found in the river.

The gardens of the former attraction provided an initial source for many of the invasive plants at the north end of the park. Air potato (*Dioscorea bulbifera*), ardisia (*Ardisia crenata*), camphor (*Cinnamomum camphora*), privet species (*Ligustrum lucidum*, *Ligustrum sinensis*), tuberous sword fern (*Nephrolepis cordifolia*) and silver thorn (*Elaeagnus pungens*) are all species that have expanded beyond the boundaries of the former attraction's garden. The Friends of Rainbow Springs State Park citizen support organization has previously supported the renovation of the former garden. This includes the removal of many invasive plants and supplementing the plantings with native species.

The park is regularly surveyed for invasive plants. Surveys and treatments are tracked in the statewide database. Additional surveys are conducted as treatment continues to proactively find new infestations before they increase in size.

In 2019, giant salvinia (*Salvinia molesta*) was found in a basin marsh in RS-2C. FWC has been instrumental in treating this aggressive species.

The recently acquired Rainbow River Ranch and the Mann parcel need an initial survey and a treatment plan. The SWFWMD, the acquisition and initial restoration partner for the ranch property, is treating cogongrass and invasive pasture grasses in preparation for groundcover restoration. Additional treatment of woody species is needed in the historic cemetery and river corridor.

Invasive plant management consists of in-house treatment by park staff, AmeriCorps members, the District 2 invasive plant rover and DRP biologists, as well as contractor assistance provided by the Friends of Rainbow Springs, FWC, the former BIPM and District projects as funding allows. The SWFWMD will provide initial control in the pasture areas of the Rainbow River Ranch to initiate the restoration process. Within the river, the Rainbow Springs Aquatic Preserve provides critical assistance in the control of hydrilla. Park staff conducts invasive removal days in the garden area. District staff provides support with invasive removal throughout the park and particularly in the natural areas. This includes project development and contractor management.

Because the park manages swimming, tubing, camping and the garden attraction, staff is limited in its ability to fully treat the invasives found in the park. For this reason, it will be very important to consistently apply for invasive plant removal funding from FWC on an annual basis and partner with the CSO to remove invasives and with the aquatic preserve to remove hydrilla.

Table 4 contains a list of the FISC Category I and II invasive plant species found within the park. The table also identifies relative distribution for each species and the management zones in which they are known to occur. An explanation of the codes is provided following the table.

Invasive animal species include non-native wildlife species, free-ranging domesticated pets or livestock, and feral animals. Because of the negative impacts to natural systems attributed to invasive animals, DRP actively removes invasive animals from state parks, with priority being given to those species causing the greatest ecological damage.

In some cases, native wildlife may also pose management problems or nuisances within state parks. A nuisance animal is an individual native animal whose presence or activities create special management problems. Examples of animal species from which nuisance cases may arise include raccoons, venomous snakes and alligators that are in public areas. Nuisance animals are dealt with on a case-by-case basis in accordance with DRP's Nuisance and Exotic Animal Removal Standard.

Fortunately, Rainbow Springs State Park has few invasive animals. Terrestrial species are feral hogs (*Sus scrofa*), nine-banded armadillo (*Dasypus novemcinctus*) and occasional feral cats or dogs. Feral hog sign is most often seen in in the southern end of the park known as the Griffiths addition.

Feral hogs, cats and dogs are removed as needed. Armadillos may cause extensive ground disturbance and are a threat to ground nesting birds and small reptiles and amphibians. Armadillos are sometimes removed by park staff. Coyotes are common in north central Florida and are well established in the park. There are currently no control measures in place for coyotes. With the extirpation of the native red wolf in the southeast, the coyote may be filling a portion of that species’ niche. The aquatic invasive fish, vermiculated sailfin catfish (*Pterygoplichthys disjunctivus*), is found in the Rainbow River.

The invasive fire ant (*Solenopsis invicta*) also occurs within the park. This noxious species may compete with native ant species and is undesirable in visitor use areas. In recent years, a phorid fly, a biological control for the fire ant, has been released in Florida by the USDA-APHIS (Collins and Scheffrahn, 2008). If fire ants become a problem, the park should first contact the Division of Plant Industry and USDA-APHIS in Gainesville to see about establishing a biocontrol release at the park. Because most of the public recreation areas are adjacent to the headspring and Rainbow River, biological control should be the first resort to control fire ants. Fire ants can also be controlled using fire ant bait approved by DRP. Bait should be applied directly to the mounds, rather than broadcast, to avoid impacting non-target ant species. Fire ant bait should only be used if the biological control agent has not significantly reduced the incidence of fire ants.

In 2002, the red bay ambrosia beetle (*Xyloborus glabratus*) was first detected in the United States in southeast Georgia. The beetle carries the fungal pathogen (*Raffaelea lauricola*) which it transmits to red bay trees (*Persea borbonia*) and other species in the Lauraceae family, causing laurel wilt disease and death. The beetle and its associated pathogen spread rapidly, and by 2005 it had appeared in Duval County. Today, the disease is found in every county in Florida. The disease has killed most of the adult red bays in the park and the beetle (and laurel wilt) has now spread throughout most of Florida and into many neighboring states. The disease top-kills adult red bays which then continue to re-sprout from their roots. It may be that members of the Lauraceae family will continue to survive in shrub form as the remnant tree root systems continue to re-sprout. At this point, much remains unknown about the long-term impacts of this disease on red bays and other Lauraceae. The park should continue to restrict the movement of firewood in the park and educate visitors about the issue.

DRP actively removes invasive species from state parks, with priority being given to those causing ecological damage. Removal techniques may include mechanical treatment, herbicides, or biological control agents.

Invasive Plant Species			
Species Name Scientific Name - Common Name	FISC Category	Distribution	Zone ID
<i>Albizia julibrissin</i> - Mimosa	I	Single Plant or Clump Scattered Plants or Clumps	RS-1A, RS-3B, RS-1G
<i>Ardisia crenata</i> - Coral ardisia	I	Scattered Plants or Clumps	RS-1A, RS-1B, RS-1D, RS-1G, RS-1J

Invasive Plant Species			
Species Name Scientific Name - Common Name	FISC Category	Distribution	Zone ID
<i>Cinnamomum camphora</i> - Camphor-tree	I	Single Plant or Clump Scattered Plants or Clumps	RS-1E, RS-3B, RS-1A, RS-1D, RS-1G, RS-1J, RS-4A, RS-5E
<i>Colocasia esculenta</i> - Wild taro	I	Scattered Plants or Clumps	RS-1G
<i>Dioscorea bulbifera</i> - Air-potato	I	Scattered Plants or Clumps	RS-1E, RS-1G, RS-3B
<i>Elaeagnus pungens</i> - Silverthorn	II	Scattered Plants or Clumps	RS-1G
<i>Imperata cylindrica</i> - Cogon grass	I	Single Plant or Clump Scattered Plants or Clumps Scattered Dense Patches Dominant Cover	RS-1D, RS-1G, RS-2E, RS-3B, RS-5C, RS-5D, RS-5E, RS-5F, RS-5G, RS-3A
<i>Ligustrum lucidum</i> - Glossy privet	I	Scattered Plants or Clumps	RS-1G
<i>Ligustrum sinense</i> – Chinese privet	I	Single Plant or Clump Scattered Plants or Clumps	RS-1D, RS-1G
<i>Lygodium japonicum</i> – Japanese climbing fern	I	Scattered Plants or Clumps Scattered Dense Patches	RS-1A, RS-1E, RS-5H, RS-2B
<i>Melinis repens</i> - Natal grass	I	Scattered Dense Patches	RS-3A
<i>Nephrolepis cordifolia</i> – Tuberous sword fern	I	Scattered Dense Patches	RS-1D, RS-1G
<i>Paederia foetida</i> - Skunk vine	I	Scattered Plants or Clumps Scattered Dense Patches	RS-1A, RS-1B, RS-1C, RS-1E, RS-1F, RS-1G, RS-5D, RS-5F, RS-5G, RS-5H, RS-1D, RS-1J, RS-5E
<i>Sapium sebiferum</i> – Chinese tallow tree	I	Single Plant or Clump Scattered Plants or Clumps	RS-1E, RS-3B, RS-3C, RS-5E
<i>Sphagneticola trilobata</i> - Wedelia	II	Scattered Plants or Clumps	RS-1G
<i>Tradescantia fluminensis</i> – Small leaf spiderwort	I	Scattered Dense Patches	RS-1G
<i>Urena lobata</i> - Caesar's weed	I	Single Plant or Clump Scattered Plants or Clumps Scattered Dense Patches	RS-3B, RS-3A, RS-2B
<i>Wisteria sinensis</i> – Chinese wisteria	II	Scattered Dense Patches	RS-1G
<i>Xanthosoma sagittifolium</i> - Elephant ear	II	Scattered Plants or Clumps	RS-1G
<i>Xanthosoma sagittifolium</i> - Elephant ear	II	Scattered Dense Patches	RS-1E

## **Invasive Plant Treatment**

### **Objective A: Annually treat 200 acres of invasive plant species in the park.**

#### *Actions:*

- Annually develop/update invasive plant management work plan.
- Implement annual work plan by treating 200 gross acres in the park annually and continuing maintenance and follow-up treatments.
- Continue annual treatment of cogongrass in all zones but particularly the zones adjacent to and south of the tuber entrance.
- Develop and implement a control tactic for natal grass at the tuber entrance area to prevent invasion into the adjacent restoration areas.
- Survey and treat the Rainbow River Ranch and Mann acquisitions.

The primary focus of the invasive control efforts should be to keep the natural areas as free of invasives as possible. The park should continue to implement its annual treatment plan for the natural upland areas and gardens. The plan should clearly differentiate and address the treatment needs of the upland natural acres of the park and the garden. Annual treatment goals should be set for each area. In addition, the park should refine the plan to address the need to retreat areas with sufficient frequency to keep the most aggressive invasives from reproducing. Natal grass in particular needs a plan to treat it at least every 30 days. Two recent acquisitions to the park, the Rainbow River Ranch and the Mann parcel, need to be surveyed for invasives and have an annual treatment plan.

Zones that have cogongrass under pine plantations that are undergoing restoration need ongoing annual treatment each fall and spring to prevent rapid regrowth of cogongrass. This is critical to the success of the restoration. In addition, natal grass now occurs in the retention ponds by the tuber entrance, where it was likely brought in by contract mowing. It has begun to move into restoration zones 5B and the initial clearcut in 5C. To stop the spread of natal grass, these areas should be observed and any emerging natal grass should be removed at least every 30 days.

The park currently does not have the resources to achieve this level of treatment in-house. However certain actions can help make this goal more attainable. More frequent prescribed fire should be used to enhance invasive plant treatment whenever possible. This might mean treating a zone prior to or the year following treatment. This is particularly important with regard to skunkvine, which is moving from the disturbed areas into the natural areas. Applying prescribed fire to areas such as the main park drive, around the shop and the clay settling pond will help control skunkvine, which is reproducing aggressively there. Project funding sources such as the FWC weed management project should be applied for on an annual basis. Continued collaboration with the Friends of Rainbow Springs to control invasives in the garden and the SWFWMD to control invasives on the Rainbow River Ranch will be very important.

The park should also continue to collaborate with the aquatic preserve in the removal of hydrilla from the headspring and other areas. Research on the biological control of skunkvine, ardisia, cogongrass and Japanese climbing fern would benefit the park and many other natural areas.

## **Invasive Plant Preventative Measures**

### **Objective: Develop and implement measures to prevent the accidental introduction or further spread of invasive plants in the park.**

*Action:*

- Prepare and implement written guidelines to prevent the introduction and spread of invasive plants. Provide staff with the tools to implement the guidelines.

Rainbow Springs State Park has a garden that remains from the former attraction. To prevent the accidental introduction of potentially invasive species, it is very important to carefully select species that will be planted. If new plants are introduced to the garden area, native plants should be the first choice. Any new plant introductions should be reviewed by DRP biologists prior to planting. This will help prevent introductions of species that have the potential to become invasive. Any FISC Category I or II species occurring in the gardens should be removed.

To prevent new invasive plant populations from expanding, the park should survey for and map new invasives in every zone within the park at least twice within the next 10 years. It is important to know what species are present within the park, where they are located and how severe their infestations are. It is also very important to know what zones or communities are currently free of invasives so that the park can keep those areas invasive-free. This is particularly true for high quality or ecologically important habitats. By regularly surveying these invasive-free zones, staff can discover new infestations at an early stage and eliminate them before they increase significantly in size. Areas that serve as sources of particularly aggressive species, or of species that can dramatically change ecosystem function, may need to be scouted more frequently. Finding new populations of invasive plants before they become established will help prevent larger infestations from developing. The focus should be on FISC Category I and II species while at the same time keeping a watch out for new species that exhibit aggressive tendencies.

Invasive plants often invade an area accidentally through preventable methods of entry. An example of this is the recently observed natal grass at the tuber entrance that is being spread by mowing. To limit accidental introduction and movement of invasive species, park staff will need to develop and practice preventative measures, including a protocol for equipment inspection and decontamination. Activities such as mowing, landscaping debris disposal, logging, fire line preparation and road building can introduce or redistribute invasives through contaminated equipment. Fill dirt, lime rock, potted horticultural plants and mulch are all potentially contaminated by invasives even if they are not readily visible at the time of entry into the park. Some new infestations of invasives may be preventable by ensuring that contractors clean their equipment before entering the park. The further spread of invasives already established in the park may be avoided by making sure that staff and contractors do not move equipment, landscaping debris or soil from a contaminated area to an invasive-free area within the park. Any equipment that is moved from a contaminated area to an invasive-free area should be cleaned prior to moving it.

### **Invasive and Nuisance Animal Control**

**Objective: Implement control measures on three nuisance and invasive animal species in the park.**

*Action:*

- Remove and document nuisance animals as they occur in the park.

Feral cats and dogs will be removed from the park as they are encountered. The park periodically has feral hogs. Areas where damage occurs will continue to be monitored. A feral hog control program will be implemented on an as-needed basis.



## **CULTURAL RESOURCES**

Cultural resources are individually unique and collectively very challenging for the public land manager whose goal is to preserve and protect them in perpetuity. DRP is implementing the following goals, objectives, and actions, as funding becomes available, to preserve the cultural resources found in Rainbow Springs State Park.

The management of cultural resources is often complicated because these resources are irreplaceable and extremely vulnerable to disturbances. The advice of historical and archaeological experts is required in this effort. All activities related to land clearing, ground disturbing activities, major repairs or additions to historic structures listed or eligible for listing in the National Register of Historic Places must be submitted to the Division of Historical Resources (DHR) for review and comment prior to undertaking the proposed project. Recommendations may include concurrence with the project as submitted, monitoring of the project by a certified archaeological monitor, cultural resource assessment survey by a qualified professional archaeologist, modifications to the proposed project to avoid or mitigation of potential adverse effects. In addition, any demolition or substantial alteration to any historic structure or resource must be submitted to DHR for consultation, and DRP must demonstrate that there is no feasible alternative to removal and must provide a strategy for documentation or salvage of the resource. Florida law further requires that DRP consider the reuse of historic buildings in the park in lieu of new construction and must undertake a cost comparison of new development versus rehabilitation of a building before electing to construct a new or replacement building. This comparison must be accomplished with the assistance of DHR.

### **Prehistoric and Historic Archaeological Sites**

The 25 known archaeological sites and two historic cemeteries in the park are recorded with the Florida Master Site File (FMSF).

Rainbow Springs State Park contains evidence of over 10,000 years of human history, from prehistory through the discovery of phosphate rock and the development of tourism during the mid-20<sup>th</sup> century. Archaeologically, several cultures meet where Rainbow Springs is located (Vojnovski, 1999). Because the park contains archaeological evidence for many periods of the aboriginal cultural sequence from Paleoindian times through European contact, it has the potential to yield significant information concerning changing settlement patterns in north central Florida.

During the Archaic period from 7000-1000 B.C., settlement and subsistence patterns changed from the nomadic lifestyle of the Paleoindians to a lifestyle marked by seasonal settlements of large populations. Social groups would come together at certain times of the year to share food resources and then break into smaller family groups as the seasons changed and the need to share food was not so urgent (Milanich and Fairbanks 1987).

Several archaeological surveys and studies have been undertaken at Rainbow Springs State Park over the past 35 years. These include Carty (2004), Quinn et al. (2004), Chance (1980, 1988), Vojnovski et al. (1999), Memory, (1999), Memory and Newman (2000) and Newman (1991).

At least two large prehistoric sites occur within the park. Research indicates at least one site shows evidence of being used during the Paleoindian, Archaic, and Weeden Island culture formative periods (Chance, 1988; Weisman, 1991). The area was much drier during the Paleoindian period than it is

present day. Spring was probably a significant gathering place for animals and the Paleoindian hunters (Chance, 1988).

The first European economic and political center of western Marion County was a settlement sequentially called Canton, Blue Springs and, finally, Juliette. This settlement, situated around the headwaters of the Rainbow River, was homesteaded as early as 1839. By 1883, about 75 people lived in this farming community. Juliette's railroad station, sawmill, hotel, several stores, and post office were located at Rainbow Springs (Vojnovski et al. 1999). The exact locations of the community structures are unknown.

The park contains two historical cemeteries. One of the cemeteries (MR2057) may be associated with the community of Juliette. The other is known as the Blue Run Cemetery (MR2752). Cemetery MR02057 may have been associated with the community of Juliette. Cemetery MR2057 contains three tombstones and a wooden stake. It is not known if other unmarked graves are present. The Blue Run Cemetery (MR2752) encompasses the period from 1888 to 1960.

The economy of the area changed when phosphate was discovered. The phosphate industry in Florida began with the discovery of phosphate in 1879 in Hawthorne. Hard rock phosphate was discovered near Dunnellon in 1889 by Albertus Vogt (Blakely, 1973). This initiated an economic boom in the area. The first company to mine hard rock phosphate was the Marion Phosphate Company around Dunnellon.

Phosphate mining required the removal of the overburden of sand and clay. The overburden then would be impounded in a vacant area. Initially, phosphate was mined by hand with picks, shovels and horse-drawn scrapers. Later, steam shovels and hydraulics were used if possible. The maximum overburden depth that could be removed by hand was 15 feet. Use of the pick-and-shovel method continued until about 1904. In some areas around Dunnellon, the water table was too high for the pick-and-shovel method. In that case, steam dredges on wooden hulls were used to mine below the surface of the water (Blakely 1973).

Phosphate was transported from the Dunnellon area by rail to several ports, including Fernandina. From there, it was shipped to Europe. Mining continued in the area until 1966 when the last mine, the section 12 mine near Dunnellon, closed in the very spot where mining had first begun in 1889 (Blakely, 1973).

Rainbow Springs State Park has at least nine sites where mining took place. Phosphate mine pits, spoil piles and clay settling areas are found in several areas.

Ten of the archaeological sites at the park are prehistoric in nature: Rainbow Springs 2 (MR00207), Rainbow Springs 3 (MR00208), Rainbow Springs State Park (MR02397), Jungle Café (MR02667), Tipi (MR02701), Rainbow Ridge (MR03268), Campground East (MR03269), AmeriCorps site (MR03343), Rainbow River Ranch 1 (MR3312) and Rainbow River Ranch (MR3313).

The sandhill cistern (MR03657) is historic in nature and may also have been associated with the community of Juliette. The depth and actual age of this brick lined cistern is unknown at this time. It is located on the edge of some of the phosphate mining disturbance and may have been associated with some of the early mining activities.

The following sites are all relics of the phosphate mining industry that occurred within the park: Rainbow Springs Phosphate Pit 1 (MR03648), Rainbow Springs Phosphate Pit 2 (MR03649), Rainbow

Springs Phosphate Pit 3 (MR03650), Rainbow Springs Phosphate Pit 4 (MR03651), Rainbow Springs Phosphate Pit 5 (MR03652), Rainbow Springs Phosphate Pit 6 (MR03653), Rainbow Springs Phosphate Spoil Pile (MR03654), Phosphate Clay Settling Pond (MR03655) and Phosphate Pit and Mining Spoil (MR03656).

Most or all of these areas appear in 1940 aerial photographs, indicating that they were mined prior to 1940. At least one of the pits on the park entrance drive (MR03648) appears to have a ramp entering the pit. This may indicate that it was mined with picks, shovels and horses prior to 1905, but further research would be needed to confirm the date of mining. Several areas contain mine spoil: Rainbow Springs Phosphate Spoil Pile (MR03654), Phosphate Clay Settling Pond (MR03655) and the Phosphate Pit and Mining Spoil (MR03656) sites. After 1927, the mining technology changed to allow more recovery of phosphate from the washer debris. It might be possible to determine the age of these sites based on the nature of the spoil. No research has been conducted on the phosphate sites and no artifacts have been recovered.

A predictive model for the park was completed in 2012 (Collins et al., 2012).

Of the 25 archaeological sites, 21 are in good condition and two are in fair condition.

The Campground East (MR03269) is in fair condition. It has been disturbed in the past by development. Regular foot traffic has the potential to cause low level continued disturbance.

The Tipi (MR02701) site has been severely looted in the past. Although this site has been restored and is in good condition, it is close to houses and could be looted again. Rainbow Ridge (MR03268) is a high-density site that is close to houses. This could be an attractive site to looters.

The cemetery (MR2057) is becoming overgrown by off-site hardwoods, particularly laurel oaks. Since these are not long-lived, strong trees, the headstones could be damaged by falling branches. The Blue Run Cemetery (MR2752) needs vegetation maintenance, particularly the control of invasive plants and removal of any tree limbs threatening the structures of the cemetery.

The sandhill cistern (MR03657) is in good condition. However, in the past, air potato was disposed of by dumping it into the cistern. This could serve as a source of air potato infestation in that area, and it should be checked for invasives.

Sites with looting potential should be observed regularly.

One archaeological site in the park, the Rainbow Ridge (MR03268) site, has been determined eligible for the National Register of Historic Places by the State Historic Preservation Officer (SHPO), who agreed with the surveyor that the site's intact deposits of Paleoindian and Late Archaic artifacts had the potential to yield significant information about Florida's aboriginal peoples and the greater southeast (National Register Criterion D). One other site within the park was considered potentially eligible for the National Register by its surveyor, but the site was not formally evaluated by the SHPO. The Tipi (MR02701) site was believed to be potentially National Register eligible by the surveyor, although the site had been extensively looted in the past. More testing was recommended as a high concentration of artifacts was still observed at the site, as well as topographic features which seem to indicate a much larger site.

Four of the recorded archaeological sites in the park have been determined ineligible for the National Register. Campground East (MR03269) was determined ineligible by the SHPO, who agreed with the surveyor that the lack of density and tools at the site indicated that it held no further research potential. The Abandoned Railroad Grade (MR03270), the Dunnellon Short Railroad Grade (MR03271), and a portion of the Atlantic Coast Line/CSX Railroad (MR03402) which lies within the park were all determined ineligible by the SHPO, who concurred with the surveyors' opinions that the leveling of a portion of the railroad grades and alteration or removal of the tracks had affected the integrity of the sites and limited their research potential.

The remaining recorded archaeological sites in the park have not been evaluated for National Register eligibility. However, two of these sites were noted for potential local significance. Rainbow Springs 3 (MR00208) was believed to be locally significant as one of the only aboriginal sites near the Rainbow Springs area when the site file was updated in 1988. However, the recorder did not venture an opinion as to its potential National Register eligibility nor was the site formally evaluated by the SHPO. The cemetery (MR02057), which is believed to be associated with the former town of Juliette, was not evaluated for National Register eligibility due to insufficient information regarding the cemetery and its relationship to the former town site and the limited testing of the site when surveyed.

All archaeological sites in the park are protected. The park needs to develop an annual monitoring program which ensures that all sites are visited regularly. Photo documentation of the more vulnerable sites is recommended. It will be especially important to institute more frequent monitoring of sites that are subject to looting. Staff will document any new looting that occurs at previously looted sites or at currently intact sites. The park will request that law enforcement assist in protecting these sites if necessary.

### **Historic Structures**

Rainbow Springs State Park has 24 historic structures and five resource groups. All the historic structures and two of the resource groups are associated with the tourist attraction. The remaining resource groups are railroad lines. All known historic structures are registered with the FMSF.

In 1886, the Dunnellon Short (the Silver Springs, Ocala, and Gulf railroad) reached the community of Juliette located at the Rainbow River headspring. In 1887, construction of the rail line continued on the west bank of the river toward Homosassa (Riley, 2005). This section is still active today.

Hard rock phosphate was discovered near Dunnellon in 1889 and the phosphate economic boom began. The first phosphate shipment to Europe was in 1902 and continued in the area until after World War I when the industry collapsed (Riley, 2005).

The community of Juliette no longer exists. While its exact location is unknown, it was described by Albertus Vogt, the discoverer of hard rock phosphate in the area. He stated, "Immediately at the head of the springs are beautiful residences, lit by gas, with dancing pavilions, pleasure boats, and post office stores. Stone terraces encompass the springs" (Vogt in Dinkins, 1969:50-1). The community continued until at least 1926, the last date it had a postmaster. The Rainbow Springs tourist attraction was not developed until the 1930s.



Commercial development of the spring was begun by the Blue Springs Company in the 1930s (Dinkins, 1969). Later, F.R. Greene and F.E. Hemphill joined forces. They renamed the spring Rainbow Springs and by the mid-1930s the gift shop and many other structures were built. One of the waterfalls was constructed by 1937 in time for the grand opening that summer (Riley, 2005). Cages for reptiles, tropical birds and animals were built in 1939. The attraction operated under several owners through the years until it finally closed to the public in 1974. It was purchased by the state of Florida in 1990.

Three linear resources in the park predate the development of the Rainbow Springs tourist attraction. These are the rail lines: Dunnellon Short Railroad Grade (MR03271), Abandoned Railroad Grade (MR03270) and the Atlantic Coastline/CSX Railroad (MR03402). Today, the latter is still an active rail line, the Dunnellon Short is abandoned and portions of MR03270 are used by the park as a tuber tram road.

Structures from the original Rainbow Springs attraction include two of the waterfalls: Rainbow Falls (MR3636) and Seminole Falls (MR3635). Soil to construct Seminole Falls was dredge soil from a nearby phosphate pit. Various animal cages are original to the first attraction: the otter pool (MR3634), the alligator pool (MR3633), the tropical bird cage (MR3639) and the animal cages (MR3638). They are constructed of concrete and stone. Several buildings still in use today were built as vacation cottages in 1947 for the attraction: Building A (MR3622), Building B (MR3623), and Building C (MR3624). These are stone structures that currently house the aquatic preserve office, the park's administration and a conference room.

During the later development phase of the attraction, additional structures were built. The entrance fountain (MR3640), the gift shop (MR3628), the restroom at springs (MR3629) and Building D (MR3625) were built in 1968. These are still used for their original function except Building D, which formerly housed the offices of the attraction, and the fountain, which now functions as an entrance planter. In 1968, submarine boats (MR3641) were used in the park so that visitors could view the beauty of the spring and the river from below the water surface. These boats are present at the park today but are not functional. Their deteriorated condition and distance from the water make them ineligible for the National Register of Historic Places.

Between 1970 and 1972, other structures were built as part of the attraction. These include Aviary Falls (MR3637), the Forest Flight (MR3642), Building E (MR3626), the greenhouse (MR3627), canoe shed (MR3630), veterinarian's office (MR3631), residence pumphouse (MR3632), campground recreation building (MR3644), river bathhouse (MR3645), campground shop pole barn (MR3646) and the campground water tank shed (MR3647). The most interesting of these structures is the Forest Flight, which was a monorail ride. Visitors traveled through the attraction in leaf-shaped gondolas. They even passed through a very large aviary which no longer exists. Most of these structures continue to serve their original use. The exceptions are the veterinarian's office, which was demolished because of its condition, and the Forest Flight, of which only the foundations remain.

The Division of Historical Resources has determined that Rainbow Springs State Park is eligible as a district for listing on the National Register of Historic Places at the local level under Criterion A for Settlement/Exploration and Entertainment/Recreation and Criterion C for Architecture. The period of significance is from 1884 to 1898 and circa 1930s to 1971. The archaeological sites are still undergoing review, but there is an opportunity to add them while the nomination is being prepared or added via amendment at later date. The nomination should focus now on the cemetery (MR2057) as remnants of the town of Juliette and the historic roadside attraction. All the resort structures together could be

submitted in the future to the FMSF as a historic district. A suggested name is Rainbow Springs Resort and Attraction.

In general, the park's historic structures are in good condition. The exceptions to this are the tropical bird cage (MR3639), campground shop pole barn (MR3646), and campground water tank shed (MR3647) which are in fair condition and the submarine boats (MR3641) and the Forest Flight (MR3642) which are in poor condition. The Forest Flight is considered to be in poor condition because all that remains of the monorail are the footers. The condition of the Forest Flight will not be improved but rather preserved as it is. The submarine boats are in poor condition due to age and exposure to weather. The veterinarian's office was in poor condition and was demolished.

The condition of the submarine boats will continue to deteriorate as long as they are exposed to the weather. A decision needs to be made about their future management. The veterinarian's office deteriorated past the point of rehabilitation for park use. This structure was removed.

The SHPO has evaluated the attraction area, and several buildings, structures, sites, and objects are considered to be potentially eligible for the National Register under Criteria A (Event) and C (Design/Construction) in relationship to the former Rainbow Springs Resort and Attraction (MR03643) and the town of Juliette. These historic structures are representative elements of a once popular, pre-Disney resort and attraction, and contain excellent examples of rustic designed buildings and landscape elements, as well as tourist-specific elements such as animal enclosures and submarine boats. Contributing historic structures to a potential National Register district include Building A (MR03622), Building B (MR03623), Building D (MR03625), Building E (MR03626), the gift shop (MR03628), the alligator pool (MR03633), the otter pool (MR03634), Seminole Falls (MR03635), Rainbow Falls (MR03636), Aviary Falls (MR03637), animal cages (MR03638), the tropical bird cage (MR03639), the entrance fountain (MR03640), cemetery (MR02057), canoe shed (MR03630), residence pumphouse (MR03632), restroom at springs (MR03629), the brick walkways, and the stone walls in the attraction area.

Other historic structures recorded within the boundary of the potential district are considered as ineligible for the National Register and therefore non-contributing to a potential district due to either insensitive alterations or additions or an overall lack of material integrity. They include Building C (MR03624), the greenhouse (MR03627), the veterinarian's office (MR03631), the quarter-horse barn (MR04275), the quarter-horse rodeo grounds (MR04274), submarine boats (MR03641), and the remaining foundation pads for Forest Flight (MR03642).

The campground recreation building (MR03644), river bathhouse (MR03645), campground shop pole barn (MR03646) and campground water tank shed (MR03647) are located on the property of a former private campground and are not associated with the former Rainbow Springs attraction. All buildings were constructed in the early 1970s and will become 50 years of age during the scope of this management plan. All of these buildings are of standard campground and shop design and are unlikely to be considered as eligible for the National Register. The surveyor's opinion is that these structures are potentially ineligible for the register due to their lack of either notable architectural features or similarity of design which could result in a potential district.

The park needs a formalized historic structure management plan that includes preventative, routine and corrective maintenance.

Some of the historic structures which are in good condition have developing issues that need attention before they affect the overall building condition.

Building A (MR3622) and Building B (MR3623) have recently had their roofs replaced. Building C (MR3624), Building D (MR3625) and Building E (MR3626) will all need new roofs. All the buildings except Building E have T111 siding which needs to be replaced. Building B has settlement cracks in the walls and floor which need repair.

The gift shop (MR3628) was damaged in a fire and has been renovated. The non-historic portion of the building was removed, the roof was repaired and the poles supporting the veranda were replaced. The building also has T111 siding which needs replacement.

The alligator pool (MR3633) is structurally sound but continuously holds water. The drain system needs repair.

Rainbow Falls (MR3636) has a masonry trough at the top of the falls which needs repair. A tree fall during Hurricane Irma broke the corner of the masonry trough. If this deteriorates further, it could impact the functioning of the falls.

The animal cages (MR3638) need some rockwork repair.

The cemetery (MR02057) was originally located in sandhill. The site is overgrown with vegetation, including smilax vines encircling the gravestones, and is being invaded by fire-intolerant oaks. To date, boundaries of the cemetery have not been determined and additional unmarked burials within the cemetery are possible. Furthermore, a pile of brick rubble has been noted near the cemetery that may be related to the cemetery. To bring it into good condition, off-site hardwoods should be removed, and the boundaries should be determined.

The veterinarian's office (MR3631) has been demolished due to safety concerns. This structure is part of the later development of the attraction. It sat idle for 20 years before the state purchased the park. During that time, it deteriorated structurally. It was not suitable for rehabilitation for reuse and was not considered a significant historic structure.

The park needs a plan to manage the submarine boats (MR3641). Exposure to the elements threatens all of them. The park does not have a structure to house all the boats. It is not known if they are all the same age. They should be evaluated to decide which, if any, to restore, interpret or document and deaccession.

## **Collections**

Rainbow Springs State Park has very few items in its collection and all of its collection is informal. The most important items are five boats that were part of the former attraction. These are described as submarine boats because the viewing portholes are below the surface of the water. The boats are a steel construction with concrete decks to help them submerge to a proper underwater viewing level. They may be unique in Florida due to their partially submersible nature.

Other than the boats, the park has a few items that relate to the former attraction. A diorama from the 1964 World's Fair depicts the headspring when it was owned by the attraction. This is on loan to the

park. There are several plastic decals that were sold by the attraction's gift shop, a pre-1959 souvenir coin depicting the paddle wheeler, "the Rainbow Queen," a lifesaving mermaid ring and maps from the attraction era, photographs, glass bottles from the headsprings and several pieces of china marked "Rainbow Springs." There are a few natural history items, including fossil bones that were recovered from the river as well as a stuffed bobcat, alligator skulls, turtle shells, a deer hide and antlers and other bones and skulls. The fossils were found in the Rainbow River and represent the park's natural history.

At one time, the park had a dugout canoe as part of its collection. This was transferred to Collier-Seminole State Park. The five submarine boats are each at least 40 feet by 15 feet and the diorama is 3 feet by 3 feet. The rest of the collection probably occupies no more than 5 cubic feet.

The boats are in poor condition. They are stored outside at the shop area. One is covered with a tarp. This boat has been partially restored. The remaining four are not protected from the weather. Rainwater accumulation is a serious problem because the boats are not under cover, and they hold water. The park does keep vegetation trimmed away from the boats. A better method of storage for the boats is needed.

The diorama is in good condition. It is stored at the environmental education building in climate-controlled conditions. The other collection items are in good condition. They are stored in the manager's office or the visitor center. All buildings are climate controlled, receive pest control and are locked when not attended. Relative humidity is not monitored, and temperatures are set manually. The visitor center has an alarm system.

All collection items originated in the park and therefore are significant to the interpretation of the park's history and natural resources. The boats and mermaid lifesaving ring were used in the park during the era of the original tourist attraction and represent that historic period. The decals and coin were souvenirs from the original attraction and the diorama represented the attraction at the 1964 World's Fair. The park's collection focuses on the interpretation of the former attraction and the natural resources of the headspring and the Rainbow River.

All objects are valuable for their research, interpretive, and educational potential in relation to the cultural and natural history of the park.

The park needs to develop a Scope of Collections Statement to guide the deaccession and acquisition of collection items. All items in the collection should be inventoried. No collections management assessment has been done for the park. The boats should be evaluated to determine how many, if any, the park should retain in its collection. The remaining boats should be documented and deaccessioned. An important part of the park's history is the phosphate mining industry and its remaining impacts on the land. There are no items from this era in the collection. The park should decide in the Scope of Collections Statement if such things as photos and other items from this era would be a potential part of the collection.

The table below contains the name, reference number, culture, or period and brief description of all the cultural sites within the park that are listed in the Florida Master Site File. The table also summarizes each site's level of significance, existing condition, and recommended management treatment.



Cultural Sites Listed in the Florida Master Site File					
Site Name & FMSF #	Culture/Period	Description	Significance	Condition	Treatment
Rainbow Springs 2 MR00207	Pre-Colombian	Archaeological Site	NE	G	P
Rainbow Springs 3 MR00208	St. Johns, Weeden Is.	Archaeological Site	NR	G	P
Cemetery MR02057	Early 19 <sup>th</sup> Century	Historical Cemetery	NR	F	P
Rainbow River Ranch Mine MR2228	Late 19 <sup>th</sup> & Early 20 <sup>th</sup> Century	Archaeological Site	NE	G	P
Rainbow Springs State Park MR02397	Pre-historic, Historic	Archaeological Site	NE	G	P
Jungle Café MR02667	Pre-historic, 20 <sup>th</sup> Century	Archaeological Site	NE	G	P
Tipi MR02701	Pre-historic through the present	Archaeological Site	NR	G	P
Blue Run Cemetery MR2752	1888 - 1960	Historical Cemetery	NE	F	P
Rainbow Ridge MR03268	Archaic, Historic	Archaeological Site	NR	G	P
Campground East MR03269	Pre-historic	Archaeological Site	NS	F	P
Abandoned Railroad Grade MR03270	19 <sup>th</sup> and 20 <sup>th</sup> Century	Linear Resource Group	NE	G	RH
Dunnellon Short Railroad Grade MR03271	Late 19 <sup>th</sup> Century	Linear Resource Group	NE	G	P
Rainbow River Ranch 1 MR3312	Archaic	Archaeological Site	NE	G	P
Rainbow River Ranch 2 MR3313	Archaic	Archaeological Site	NE	G	P
AmeriCorps Site MR03343	Pre-historic, Unknown	Archaeological Site	NE	G	P
Atlantic Coastline/ CSX Railroad MR03402	Early 20 <sup>th</sup> Century	Linear Resource Group	NE	G	NA
Building A MR3622	Mid-20 <sup>th</sup> Century - 1947	Historic Structure	NR	G	RH
Building B MR3623	Mid-20 <sup>th</sup> Century - 1947	Historic Structure	NR	G	RH
Building C MR3624	Mid-20 <sup>th</sup> Century - 1947	Historic Structure	NS	G	RH

Cultural Sites Listed in the Florida Master Site File					
Site Name & FMSF #	Culture/Period	Description	Significance	Condition	Treatment
Building D MR3625	Mid-20 <sup>th</sup> Century - 1968	Historic Structure	NR	G	RH
Building E MR3626	20 <sup>th</sup> Century - 1970	Historic Structure	NR	G	RH
Greenhouse MR3627	20 <sup>th</sup> Century - 1972	Historic Structure	NS	G	RH
Gift Shop MR3628	20 <sup>th</sup> Century -1968	Historic Structure	NR	G	RH
Canoe Shed MR3630	20 <sup>th</sup> Century - 1970	Historic Structure	NR	G	RH
Veterinarian's Office MR3631	20 <sup>th</sup> Century - 1971	Historic Structure/ Removed	NS	P	R
Residence Pumphouse MR3632	20 <sup>th</sup> Century - 1971	Historic Structure	NR	G	RH
Alligator Pool MR3633	Early 20 <sup>th</sup> Century - 1939	Historic Structure	NR	G	P
Otter Pool MR3634	Early 20 <sup>th</sup> Century - 1939	Historic Structure	NR	G	P
Seminole Falls MR3635	Early 20 <sup>th</sup> Century - 1937	Historic Structure	NR	G	P
Rainbow Falls MR3636	Early 20 <sup>th</sup> Century - 1937	Historic Structure	NR	G	P
Aviary Falls MR3637	20 <sup>th</sup> Century - 1970	Historic Structure	NR	G	P
Animal Cages MR3638	Early 20 <sup>th</sup> Century - 1939	Historic Structure	NR	G	P
Tropical Bird Cage MR3639	Early 20 <sup>th</sup> Century - 1939	Historic Structure	NR	F	P
Entrance Fountain MR3640	20 <sup>th</sup> Century -1968	Historic Structure	NR	G	P
Submarine Boats MR3641	20 <sup>th</sup> Century -1968	Historic Structure	NS	P	RS/RH/ R
Forest Flight MR3642	20 <sup>th</sup> Century	Resource Group	NS	P	P
Campground Recreation Building MR3644	20 <sup>th</sup> Century - 1972	Historic Structure	NS	G	RH

Cultural Sites Listed in the Florida Master Site File					
Site Name & FMSF #	Culture/Period	Description	Significance	Condition	Treatment
River Bathhouse MR3645	20 <sup>th</sup> Century - 1972	Historic Structure	NS	G	RH
Campground Shop Pole Barn MR3646	20 <sup>th</sup> Century - 1972	Historic Structure	NS	F	RH
Campground Water Tank Shed MR3647	20 <sup>th</sup> Century - 1972	Historic Structure	NS	F	RH
Rainbow Springs Phosphate Pit 1 MR03648	Late 19 <sup>th</sup> Century- Early 20 <sup>th</sup> Century	Archaeological Site	NE	G	ST
Rainbow Springs Phosphate Pit 2 MR03649	Late 19 <sup>th</sup> Century- Early 20 <sup>th</sup> Century	Archaeological Site	NE	G	ST
Rainbow Springs Phosphate Pit 3 MR03650	Late 19 <sup>th</sup> Century- Early 20 <sup>th</sup> Century	Archaeological Site	NE	G	ST
Rainbow Springs Phosphate Pit 4 MR03651	Late 19 <sup>th</sup> Century- Early 20 <sup>th</sup> Century	Archaeological Site	NE	G	ST
Rainbow Springs Phosphate Pit 5 MR03652	Late 19 <sup>th</sup> Century- Early 20 <sup>th</sup> Century	Archaeological Site	NE	G	ST
Rainbow Springs Phosphate Pit 6 MR03653	Late 19 <sup>th</sup> Century- Early 20 <sup>th</sup> Century	Archaeological Site	NE	G	ST
Rainbow Springs Phosphate Spoil Pile MR03654	Late 19 <sup>th</sup> Century- Early 20 <sup>th</sup> Century	Archaeological Site	NE	G	ST
Phosphate Clay Settling Pond MR03655	Late 19 <sup>th</sup> Century- Early 20 <sup>th</sup> Century	Archaeological Site	NE	G	ST
Phosphate Pit and Mining Spoil MR03656	Late 19 <sup>th</sup> Century- Early 20 <sup>th</sup> Century	Archaeological Site	NE	G	ST
Sandhill Cistern MR03657	Late 19 <sup>th</sup> Century- Early 20 <sup>th</sup> Century	Archaeological Site	NE	G	ST
Quarter-Horse Rodeo Grounds MR04274	1968	Historic Structure/ Archaeological Site	NS	F	P

Cultural Sites Listed in the Florida Master Site File					
Site Name & FMSF #	Culture/Period	Description	Significance	Condition	Treatment
Quarter-Horse Barn MR04275	1968	Historic Structure/ Archaeological Site	NS	G	P

### Condition Assessment

**Objective: Assess and evaluate 56 of 56 recorded cultural resources in the**

**park. Action:**

- Complete 56 assessments/evaluations of cultural sites.
- Complete one Historic Structures Report for the gift shop (MR03628).

The park needs to develop a protocol to assess its cultural resources on a regular basis. Most of the sites are in good condition. The exceptions are sites MR02057, MR2752, MR03269, MR03639, MR03646 and MR03647, which are considered to be in fair condition, and sites MR03641 and MR03642, which are ranked as poor. The site MR02701 was looted in the past. It needs to be assessed more frequently as a preventative measure even though it is in good condition. Although many of the historic structures are currently in good condition, they need regular assessment to retain that status.

The two historic cemeteries, MR2057 and MR2752, should have their boundaries delineated with ground penetrating radar or other method to ensure protection of all the gravesites.

Of the two sites in poor condition, the submarine boats (MR03641) should be assessed to prevent further deterioration until a decision is made about restoration or deaccession.

Rainbow Springs State Park has many historic structures currently in adaptive reuse by the park. At this time, the only structure recommended to receive a Historic Structures Report (HSR) is the gift shop (MR03628). Additional structures may require an HSR, but that has yet to be determined. During the next 10 years, the park should try to remedy that situation by deciding which of the structures, if any, will need an HSR. For this process, the park could consider the Rainbow Springs Resort and Attraction structures as one group. If an HSR identifies any necessary rehabilitation or maintenance projects, park staff will prioritize them.

**Objective: Compile reliable documentation for all recorded historic and archaeological resources.**

**Actions:**

- Delineate the bounds of the historic cemetery (MR02057) and Blue Run Cemetery (MR2752) using ground penetrating radar or other appropriate method.
- Ensure all known sites are recorded or updated in the Florida Master Site File.
- Develop and utilize a Scope of Collections Statement.



- Consult with DHR regarding the need for archaeological reconnaissance surveys for areas identified by the predictive model.
- Prepare and submit the nomination of Rainbow Springs State Park to the National Register of Historic Places at the local level under Criterion A for Settlement/Exploration and Entertainment/Recreation and Criterion C for Architecture.

As new historic or archaeological resources are identified, the park will submit this information to the FMSF. All currently known sites have been submitted to the FMSF. The Veterinarian's Office MR3631 has been demolished and the FMSF form needs to be updated to reflect that.

The park needs to develop a Scope of Collections Statement around specific themes. This statement will also help guide any deaccession and acquisition of collection items. The focus of the Scope of Collections Statement will provide guidance on the type of historic and archaeological resources to document and interpret. At this time, the park has very little documentation of the community of Juliette, the historic cemetery and the history of the phosphate mining that occurred within the park. Additional documentation of the Forest Flight monorail location would be of interest. More information is needed on the fossils found in the area and the pre-European native peoples who utilized the spring resource.

The boundaries of the historic cemeteries are currently unknown. This could be documented using ground penetrating radar. This would assist in protecting the site as well.

A predictive model for locating archaeological sites within the park was completed in 2012. Rainbow Springs State Park has a rich history of human habitation, including pre-European settlements, 19<sup>th</sup>-century pioneer communities, 19<sup>th</sup>- and 20<sup>th</sup>-century phosphate mining and an early-20<sup>th</sup> century tourist attraction. The predictive model indicates areas of high, medium, and low probability for the occurrence of archaeological sites. The model also provides guidance for future development and will aid in selecting the best locations for future Phase 1 archaeological surveys. The park should identify the areas that are highest priority for a Phase 1 survey based on the results of the predictive model report.

**Objective: Bring 11 of 56 recorded cultural resources into good condition.**

*Actions:*

- Develop/implement a protocol to assess known cultural resources.
- Develop/implement a plan to bring the gift shop (MR3628) into good condition.
- Develop/implement a plan to repair Rainbow Falls (MR03636).
- Develop and implement a plan to manage, restore or deaccession the submarine boats (MR3641).

The park needs to develop a cyclical maintenance program for its cultural resources, particularly its historic structures and cemetery. Any problems identified should be described in a work plan. The maintenance plan should include actions and schedules that are preventative, routine and corrective in nature.

The park should develop a monitoring program for all of its cultural resources. Staff should formalize that program by writing and adopting a clear protocol. This should include a visual evaluation of buildings on a weekly basis.

Because the park has so many historic structures, it is necessary to prioritize their repair to bring or maintain them in good condition. The ability of the park to improve these structures to a good condition will also depend on the availability of funding. The following is a prioritized list of cultural resources in the park that need repairs or removal: Building A (MR3622), Building B (MR3623), Building C (MR3624), Building D (MR3625), Building E (MR3626), Rainbow Falls (MR03636), cemetery (MR02057), and the submarine boats (MR03641).

The gift shop (MR3628) has T111 siding which needs replacement.

Building C (MR3624), Building D (MR3625) and Building E (MR3626) will all need new roofs within a few years. All the buildings except Building E have T111 siding which needs to be replaced. Building B has settlement cracks in the floor which need repair.

Rainbow Falls (MR3636) has a masonry trough at the top of the falls which needs repair. If this deteriorates, it could impact the functioning of the falls.

The cemetery (MR02057) was originally located in sandhill. The site is overgrown with vegetation, including smilax vines encircling the gravestones, and is being invaded by fire-intolerant oaks. To date, boundaries of the cemetery have not been determined and additional unmarked burials within the cemetery are possible. To bring it into good condition, off-site hardwoods should be removed, and the boundaries should be determined and delineated for protective purposes.

A plan needs to be developed and implemented that addresses the restoration and/or deaccession and interpretation of the submarine boats (MR3641). Exposure to the elements currently threatens all the boats and they may currently be beyond repair. Consult with DHR and restoration experts as to possible steps.

While the sandhill cistern (MR03657) appears to be in good condition, it is a potential safety issue, particularly during prescribed fires. Since the site is flush with the ground, DHR should be consulted to determine if it could be filled in for safety reasons.

## **SPECIAL MANAGEMENT CONSIDERATIONS**

### **Arthropod Control Plan**

All DRP lands are designated as “environmentally sensitive and biologically highly productive” in accordance with Ch. 388 and Ch. 388.4111 Florida Statutes. If a local mosquito control district proposes a treatment plan, the DRP works with the local mosquito control district to achieve consensus. By policy of DEP since 1987, aerial adulticiding is not allowed, but larviciding and ground adulticiding (truck spraying in public use areas) is typically allowed. The DRP does not authorize new physical alterations of marshes through ditching or water control structures.

Rainbow Springs State Park does not have an Arthropod Control Plan. Mosquito control plans temporarily may be set aside under declared threats to public or animal health, or during a Governor’s Emergency Declaration.

## Minerals

The Dunnellon phosphate boom of the 1890s ushered in an era of phosphate ore mining within the Rainbow River watershed (Dinkins 1969). Hard rock phosphate deposits like those mined around Dunnellon occur in Florida from southern Columbia and Suwannee Counties to eastern Hernando County (Blakey 1973). Prior to the 1940s, hard rock phosphate was mined by hand or steam shovel (Southwest Florida Water Management District (SWFWMD) 2004). Only those deposits with an overburden that had a maximum depth of 15 ft could be mined by hand (Blakey 1973). Only the hard rock and larger grain-sized phosphate nodules were removed. Since the technology to remove the smaller-sized particles was not yet available, ore processing consisted simply of screening and washing. Leftover materials, primarily sands, clays, and phosphate, were deposited as waste next to the mine pit. Phosphate mining radically changed the topography in several areas of what is now Rainbow Springs State Park. Mining activities occurred in the uplands, in lowlands along the river, and even within the Rainbow River itself. Relicts of these activities persist in the park in the form of excavated pits and mounds of overburden, spoil, tailings, and debris. One of the pits is a large, deep water-filled basin within the hydric hammock along the east bank of the Rainbow River near the park's tuber take-out facility (zone 5A). Superficially, the circular basin resembles a large spring feature that may have once discharged into the Rainbow. A more likely explanation, however, is that the basin was mined in the past and subsequent erosion has softened the edges of the basin. One highly significant historic mining operation along the Rainbow River, named the Blue Cove Mine, was located about five miles downstream from the main headspring (Henigar and Ray 1987; Ellis et al. 2007). Tugboats once transported ore up and down the river from the Blue Cove, and extensive dredging helped to maintain the depth of the river for uninterrupted passage (Ellis et al. 2007).



## LAND USE COMPONENT

### VISITATION

Home to Florida's fourth-largest first magnitude spring and the first three miles of the Rainbow River, the park is a popular destination. Visitors can experience the water by swimming, snorkeling, paddling, and tubing, or enjoy the tranquility of the park's natural woodlands along 3 miles of trail. The park also offers both RV and tent camping.

#### **Trends**

Between 2009 and 2019, Rainbow Springs State Park received an estimated 3,649,929 visitors, with an annual average of 364,994. Visitation at the park follows a clear seasonal pattern, with a noticeable uptick in the summer with June, July and August experiencing the highest visitation.

### EXISTING FACILITIES AND INFRASTRUCTURE

The park consists of two separate units referred to, for planning purposes, as the Northern and Southern Tracts. Facilities are grouped into eight areas – the Entrance Area, Parking Area, Headsprings Day Use Area, Campground, Tube Concession Area, Northern Support Area, Southern Support Area, and the Griffiths Addition.

#### **Northern Tract**

##### Entrance Area

The entrance area is accessed from U.S. Highway 41. Construction of an entrance station will be completed early in this planning cycle.

##### Parking Area

The Headspring Day Use parking area currently provides 400 spaces.

##### Headsprings Day Use Area

The Headsprings are the primary destination for visitors. A dock and descending stairs provide access to the water for swimming and snorkeling. The kayak/canoe launch and boat storage are located on the western bank of the river just a short walk from the swimming area. Restrooms, picnic pavilions, a gift shop, and a food concessionaire are in vicinity of the spring bowl. Approximately 3 miles of hiking trails are available on the east side of the river where visitors encounter natural areas as well as elements of the former roadside attraction such as artificial waterfalls.

Stonework associated with the ornamental gardens of the former roadside attraction are retained as cultural features.

##### Northern Tract Support Area

Most of the support facilities are located within the park's northern tract, east of the Headspring Day Use Area. Facilities include three conference rooms, pumphouses, a shop building, equipment shelters and two residences.

## Southern Tract

### Campground

The campground is accessed from 94<sup>th</sup> Street via 180<sup>th</sup> Avenue and offers both RV and tent camping, including pull through sites and paved sites for enhanced mobility. The tent sites are provided with electricity and seclusion is provided by hiking in from a nearby parking area. Within the greater use area are several bathhouses, a gift shop, a concessions building, a playground, and two picnic pavilions, as well as access to trails and the Rainbow River.

Just west of the campground is a shelter where tubers are trammed and dropped off to begin their float. A short walkway to the riverfront leads to a swimming area, bathhouse and the tubing launch.

### Tube Concessions Area

The tube concession/exit area is dedicated to tubers. The use area is accessed from 180<sup>th</sup> Avenue via a small entrance station. Parking consists of 106 spaces. The tubing concession building is located here along with a restroom and two picnic pavilions. Tubers are trammed north to the launching point near the campground referenced above. After about a two-hour float downstream, tubers reach the landing site where they exit the river, drop off their tubes, and walk back to their vehicles.

### Southern Support Area

Support facilities on the park's Southern Tract are in vicinity of the campground. These include two residences, an office which also functions as a gift shop, a concessions building, multiple storage sheds, and a shop building.

### Griffitts Addition

The Griffitts Addition includes the quarter horse grounds and barn associated with the later years of the former roadside attraction.

## Facilities Inventory

<i>Entrance Area (Northern Tract)</i>	
Entrance Station	1
<i>Parking Area (Northern Tract)</i>	
Parking Spaces	400
<i>Headsprings Day Use Area (Northern Tract)</i>	
Gift Shop	1
Canoe/Kayak Rental	1
Boathouse	1
Pavilions	4
Restrooms	2
Swimming area and dock	1
Hiking trails (mileage)	approx. 3
Canoe/Kayak Rental	1
Canoe/kayak launch	1
Scenic Overlooks	2
Ornamental Gardens	1
<i>Support Area (Northern Tract)</i>	

Shop	1
Residence	2
10X16 Storage Building	1
16X20 Storage Building	1
Admin Building B	1
Aquatic Preserve Office Building A	1
Building D	1
Canoe/Kayak Rental	1
Carport	1
Conference Building C	1
Education Building	1
Equipment Shelter	1
Fuel Storage	1
Glass Bottom Boat Storage	1
Greenhouse	1
Paint Shed	1
Plastic Storage Building	1
Portable Storage Unit	2
Pumphouse	3
Carport/Shed	1
Storage	1
Supply And Storage Shed	1
<i>Campground (Southern Tract)</i>	
Gift Shop and Concessions	1
Picnic Pavilion	2
Standard Campsites	53
Tent Campsites	7
Playground	1
Swimming area	1
Tuber/Canoe/Kayak Launch	1
Tubing Launch Drop Off Shelter	1
Bathhouse	3
River Bathhouse	1
<i>Tube Concessions (Southern Tract)</i>	
Tubing Entrance Station	1
Concessions Building & Restroom	1
Tuber Loading Building	1
Picnic Pavilion	2
Parking (Spaces)	106
Tuber take-out ramp	1
Tram road (mileage)	2
<i>Griffitts Addition</i>	
Horse Stables (Barn)	1
<i>Support Area (Southern Tract)</i>	
Shop	1
Residence	2



ATV Storage Shed	1
Carport	1
Carport/Storage Shed	1
Electrical Shed	1
Park Office/Recreation Hall	1
Kayak Storage	1
Mower Shed	1
Pumphouse	1
Shed	1
Storage Building	1

## **CONCEPTUAL LAND USE PLAN**

### **Park Entrance**

#### **Objective: Formalize park entrance.**

##### *Action:*

- Complete new entrance station

A new entrance station will be completed during this planning cycle, just west of the railroad tracks. This new ranger station will provide a sense of arrival and improve both fee compliance and orderly ingress/egress.

### **Parking Area**

#### **Objective: Improve efficiency, springs protection, and ease of parking.**

##### *Actions:*

- Redesign parking area
- Develop wayfinding elements

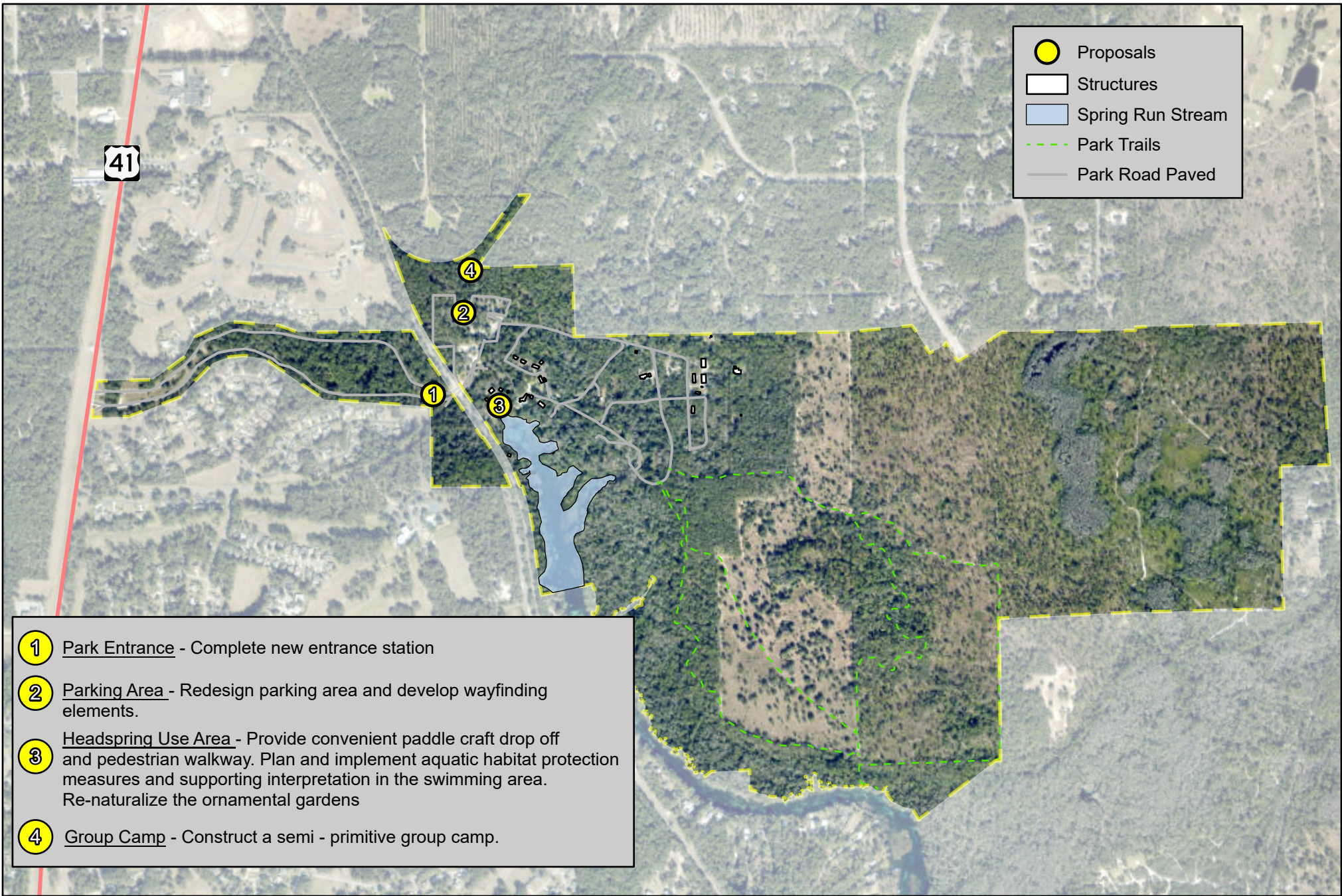
The Headsprings Day Use parking area was originally constructed to accommodate the extensive operations of the former private attraction such as boat tours, a theme park style ride, and other springs uses that exceeded sustainable carrying capacity. With the establishment of more balanced visitor use, the parking area should be reduced by up to 200 spaces in the northeast corner to improve efficiency and allow restoration intended to increase pervious natural area within the immediate springshed. Appropriate parking space should be retained for the proposed primitive group camp. Other measures include reconfiguration along with improved directional signage.

### **Springs Day Use Area**

#### **Objective: Improve visitor experience while enhancing safety.**

##### *Actions:*

- Provide convenient paddlecraft drop off and pedestrian walkway



- ① Park Entrance - Complete new entrance station
- ② Parking Area - Redesign parking area and develop wayfinding elements.
- ③ Headspring Use Area - Provide convenient paddle craft drop off and pedestrian walkway. Plan and implement aquatic habitat protection measures and supporting interpretation in the swimming area. Re-naturalize the ornamental gardens
- ④ Group Camp - Construct a semi - primitive group camp.



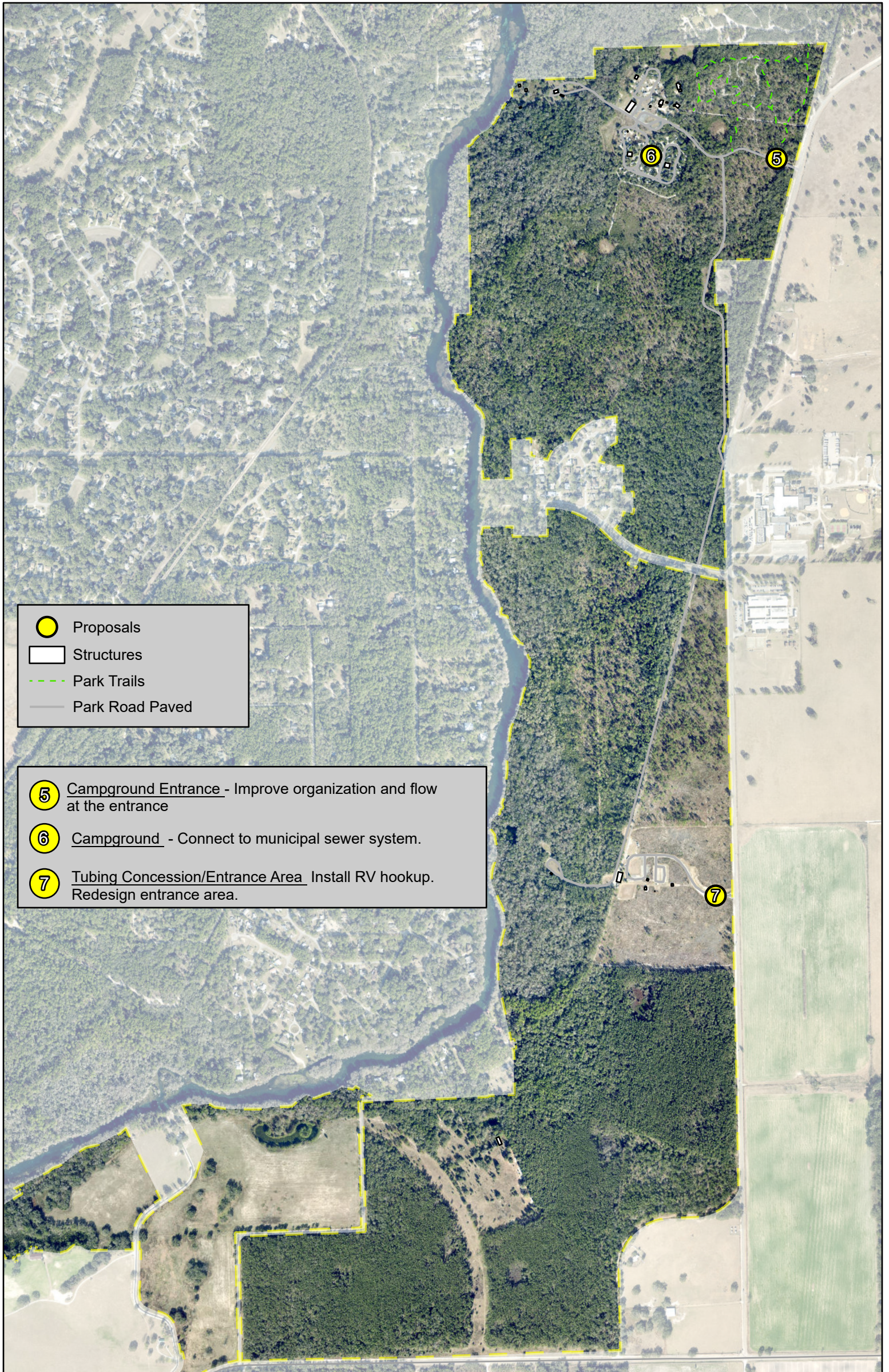
# Rainbow Springs State Park - North Tract





## Conceptual Land Use Plan 1 of 2






0 500 1,000 Feet





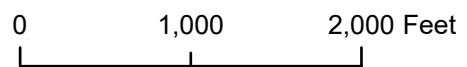
-  Proposals
-  Structures
-  Park Trails
-  Park Road Paved

-  Campground Entrance - Improve organization and flow at the entrance
-  Campground - Connect to municipal sewer system.
-  Tubing Concession/Entrance Area Install RV hookup. Redesign entrance area.



# Rainbow Springs State Park - South Tract

Conceptual Land Use Plan 2 of 2





- Plan and implement aquatic habitat protection measures and supporting interpretation in the swimming area
- Re-naturalize the ornamental gardens

While the park's concessionaire offers convenient river access for rented canoes and kayaks, those who bring their own paddlecraft must carry or wheel a long distance to reach this designated launch site. A new paddlecraft drop off point located past the entrance station, coupled with a more direct walkway to the launch site, would better serve this user group.

Due to the natural bathymetry of the springs bowl, water depth requires swimmers to tread water. Construction of a submerged or floating platform was considered during this planning period, however, it was determined that such structures would impact the benthic environment and natural aesthetics. Swimmers who find the deeper water challenging are encouraged to utilize floating devices which can be brought into the park or provided at the gift shop. There is evidence that a small number of swimmers have attempted to build standing platforms with limestone rocks removed and relocated from the bottom. Deterrence of this damaging activity will continue via visitor interface and interpretation.

Expansion of natural areas in the immediate springshed should consider re-naturalization of the ornamental gardens with site appropriate native species. The constructed waterfalls and other historic stonework should be preserved.

Interpretive planning is recommended for the Springs Day Use Area to determine the most effective way to connect visitors to the site's natural and cultural themes. The type, design, quantity, and placement of interpretive elements to deepen understanding will be specified during this additional planning process.

### **Primitive Group Camp**

**Objective: Increase capacity for low-infrastructure group camping.**

*Action:*

- *Construct a small semi-primitive group camp.*

A new primitive group camp accommodating up to 30 individuals is proposed north of the Springs Day Use parking area. The new group camp should include a restroom, potable water, and two fire rings, and should connect to the Springs Day Use Area via a scenic walkway that includes interpretation of springshed protection.

### **Campground**

**Objective: Improve campground facilities.**

*Actions:*

- *Connect to municipal sewer system.*
- *Improve organization and flow at the entrance.*

Two major improvements include connecting the campground to the city of Dunnellon sewer system and a redesign of the entrance area.

Connection to the central sewer will provide a major enhancement to the area, allowing the park to remove the in-house waste processing facility and additional spray field. This will reduce localized nutrient impacts to the springs and the Rainbow River and help protect water quality.

Finally, there should be coordination with the Florida Department of Transportation (FDOT) or Marion County to consider the possibility of alternative configurations for entrance off 180 Avenue to improve ingress and egress from the park and to prevent back up of traffic.

### **Tube Concession/Entrance Area**

#### **Objective: Enhance the entrance area.**

##### *Actions:*

- *Install RV hookup.*
- *Redesign entrance area.*

Stacking of cars lined up at the tubing area entrance station can occur during peak season. DRP should coordinate with Marion County to plan for a turn lane into the park from the county road.

A new RV site should be developed with electric and water connections. The RV site is intended to be occupied by the tubing concessionaire, whose operations are centered in this southern area of the park.

### **Griffitts Addition**

#### **Objective: Remove infrastructure that is underutilized and in poor condition.**

The Griffitts addition is located in the far southern portion of the park's south tract. The area is not frequented by visitors. The Griffitts addition contains an area of improved pasture that is now naturalizing and slowly reverting to woodland. There is also a relict horse stable, likely from livestock operations that occurred in the 1970s. The horse stable is in poor condition and should be removed within the next planning cycle.

### **Staff Residence**

#### **Objective: Remove aging state-owned structure and replace it with an employee-owned Trailer/RV site.**

The current state-owned staff residence located near the shop is aged-out and in need of removal. Once removed, this structure should be replaced with an employee-owned trailer/RV site.

## **OPTIMUM BOUNDARY**

### **Rainbow Springs Priority Focus Area**

The Rainbow Springs Priority Focus Area has several properties which would create connectivity between conservation lands by filling in gaps between conservation areas. Further additions would provide a corridor from the Goethe State Forest to the Marjorie Harris Carr Cross Florida Greenway State Recreation and Conservation Area along the Withlacoochee River and form a linkage to the Etoniah Cross Florida Greenway Florida Forever Project. These infills would provide further safeguards for the already altered Rainbow River.

### **Identified Optimum Boundary Parcels**

A total of 40 total parcels, comprising 1,274 acres, make up the optimum boundary for the park. Some properties comprise significant acreage while others are relatively small. They are divided into four sections based on their location: northwest, northeast, central and south.

#### **Northwest Group**

The northwest group is comprised of 11 parcels. Together they amount to 394 acres. An extensive portion of this land is within the Rainbow River Florida Forever Project and would help in the protection of recharge areas. The area may be suited for future park activities.

#### **Northeast Group**

The northeast group is the largest of all optimum boundary areas, separated across 18 parcels and comprised of 674 acres. Of these parcels, 178 acres are within the Rainbow River Corridor Florida Forever Project. Preserving these parcels would improve the likelihood of further habitat protection including sandhill communities. It would also connect the northern and southern areas of the park and could expand the recreational opportunity of trails. Furthermore, this addition would protect waters that flow into the spring/spring-run. These parcels comprise a small private property which contains the second magnitude Gissy Springs. The Gissy Spring and its spring run flow into the Rainbow River.

#### **Central Group**

The smallest of these groups is the central group, with four parcels composed of 17 acres. Fourteen acres in total are in the Rainbow River Florida Forever Project. Fragile spring shoreline would be brought under state ownership and control after acquiring underdeveloped parcels.

#### **South Group**

The south group is comprised of seven parcels which total roughly 190 acres. These parcels are within the Rainbow River Corridor Florida Forever Project and would provide greater protection of the springshed, allow more habitat protection for imperiled species, and facilitate additional resource management.

### **Crucial Lands for Spring Protection**

The main purpose of these efforts is to obtain privately held land with minimal development or human impacts in areas that are vital for the protection of the Rainbow River springhead. Southern parcels may bring a significant zone of underdeveloped shoreline under control of the public and commence

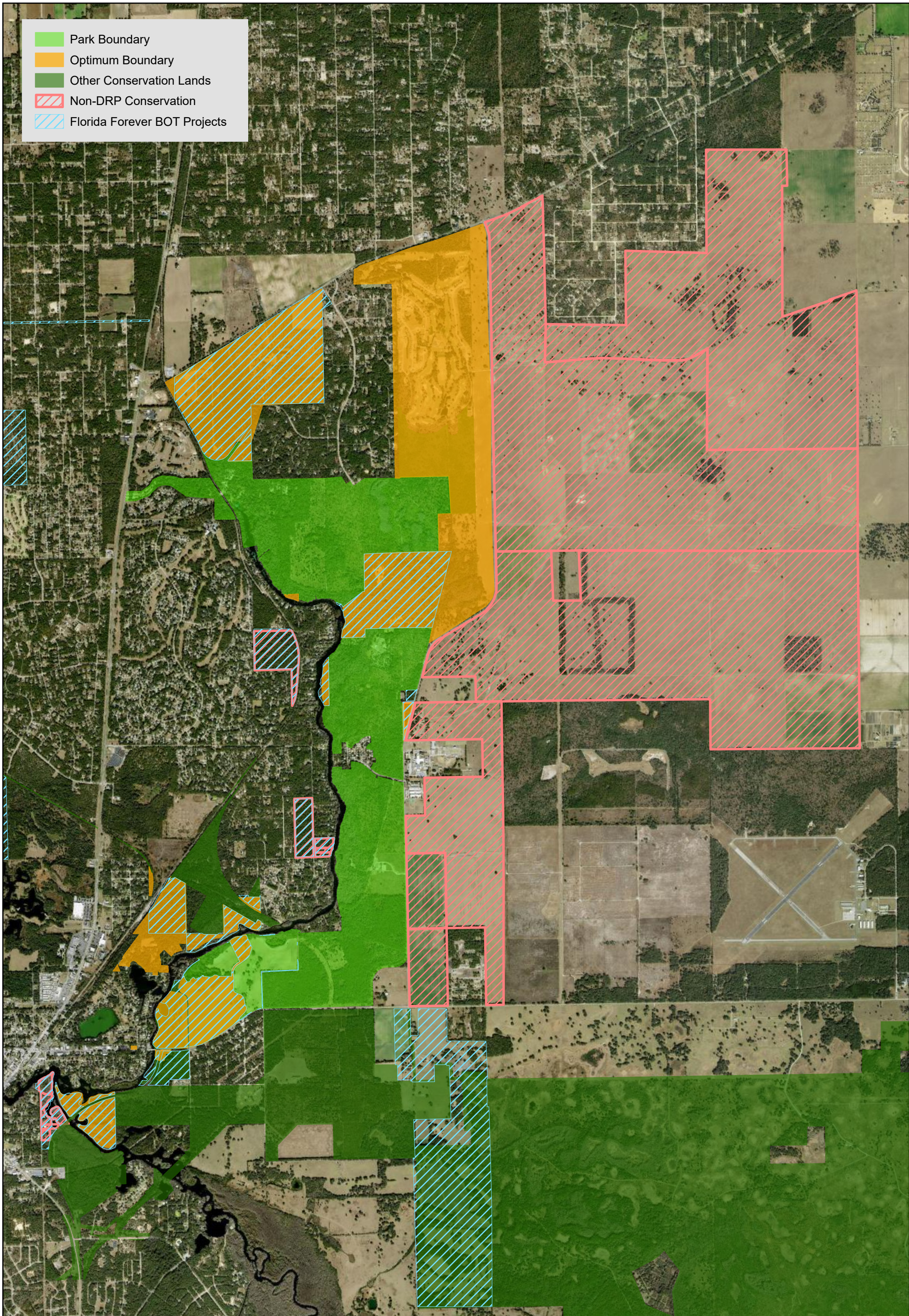


conservation efforts. This will ensure future expansion will be minimal and the spring's ecological health will remain preserved in the future. Similarly, habitat restoration and improvements in enhanced water quality will be achieved for one of Florida's largest spring-run streams. Other conservation agencies have expressed interest in adjacent and neighboring parcels which would further protect the health of the springshed with areas such as sandhill communities and recharge areas of the Rainbow Spring system chosen for acquisition.

The protection of these minimally developed private lands would be of high importance to both protecting the Rainbow River and Rainbow Springs State Park.

Several Florida Forever projects overlap with the optimum boundary. These are located at various locations surrounding the park. These parcels are in the northwest, central and southern areas of the park. The northern and southern areas within the park would be connected by the grouping identified as the northeast discussed above. In the northeast grouping, 178 acres are within the Rainbow River Corridor Florida Forever Project. There are also small parcels surrounding the park boundary which are in proximity to or near the park border.

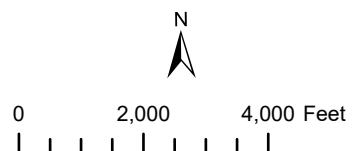




- Park Boundary
- Optimum Boundary
- Other Conservation Lands
- Non-DRP Conservation
- Florida Forever BOT Projects



**RAINBOW SPRINGS STATE PARK**  
Optimum Boundary



Sources: ESRI, Florida Department of Environmental Protection, Florida Natural Areas Inventory.  
This graphical representation is provided for informational purposes only and should not be considered authoritative for navigational, engineering, legal, or other uses.