



# FLORIDA DEPARTMENT OF Environmental Protection

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October 19, 2018

Mr. Steven Cutshaw  
Division of Recreation and Parks  
Department of Environmental Protection  
3900 Commonwealth Boulevard, MS 525  
Tallahassee, Florida 32399-3000

**RE: Crystal River Preserve State Park - Lease No. 4084**

Dear Mr. Cutshaw:

On **October 19, 2018**, the Acquisition and Restoration Council (ARC) recommended approval of the **Crystal River Preserve State Park** management plan. Therefore, Division of State Lands, Office of Environmental Services, acting as agent for the Board of Trustees of the Internal Improvement Trust Fund, hereby approves the **Crystal River Preserve State Park** management plan. The next management plan update is due October 19, 2028.

Pursuant to s. 253.034(5)(a), F.S., each management plan is required to “describe both short-term and long-term management goals, and include measurable objectives to achieve those goals. Short-term goals shall be achievable within a 2-year planning period, and long-term goals shall be achievable within a 10-year planning period.” Upon completion of short-term goals, please submit a signed letter identifying categories, goals, and results with attached methodology to the Division of State Lands, Office of Environmental Services.

Pursuant to s. 259.032(8)(g), F.S., by July 1 of each year, each governmental agency and each private entity designated to manage lands shall report to the Secretary of Environmental Protection, via the Division of State Lands, on the progress of funding, staffing, and resource management of every project for which the agency or entity is responsible.

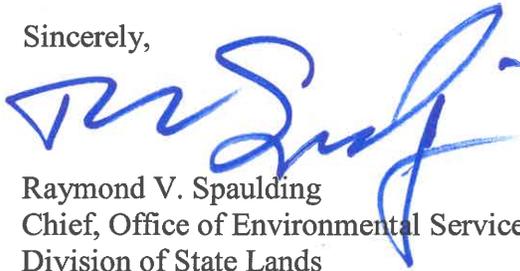
Pursuant to s. 259.036(2), F.S., management areas that exceed 1,000 acres in size, shall be scheduled for a land management review at least every 5 years.

Pursuant to s. 259.032, F.S., and Chapter 18-2.021, F.A.C., management plans for areas less than 160 acres may be handled in accordance with the negative response process. This process requires small management plans and management plan amendments be submitted to the Division of State Lands for review, and the Acquisition and Restoration

Council (ARC) for public notification. The Division of State Lands will approve these plans or plan amendments submitted for review through delegated authority unless three or more ARC members request the division place the item on a future council meeting agenda for review. To create better efficiency, improve customer service, and assist members of the ARC, the Division of State Lands will notice negative response items on Thursdays except for weeks that have State or Federal holidays that fall on Thursday or Friday. The Division of State Lands will contact you on the appropriate Friday to inform you if the item is approved via delegated authority or if it will be placed on a future ARC agenda by request of the ARC members.

Approval of this land management plan does not waive the authority or jurisdiction of any governmental entity that may have an interest in this project. Implementation of any upland activities proposed by this management plan may require a permit or other authorization from federal and state agencies having regulatory jurisdiction over those particular activities. Pursuant to the conditions of your lease, please forward copies of all permits to this office upon issuance.

Sincerely,



Raymond V. Spaulding  
Chief, Office of Environmental Services  
Division of State Lands  
Department of Environmental Protection

# Crystal River Preserve State Park

## Approved Unit Management Plan

STATE OF FLORIDA  
DEPARTMENT OF ENVIRONMENTAL PROTECTION  
Division of Recreation and Parks  
October 2018





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## **INTRODUCTION**

Crystal River Preserve State Park is located adjacent to the Gulf of Mexico in western Citrus County (see Vicinity Map). Access to the park is from US Highway 19, west to State Park Street (see Reference Map). The Vicinity Map also reflects significant land and water resources existing near the park.

Crystal River Preserve State Park was initially acquired on August 20, 1974 as a donation from the Crystal River Development Corporation. Currently, the park comprises 27,417.30 acres. The Board of Trustees of the Internal Improvement Trust Fund (Trustees) hold fee simple title to the park and on March 7, 1996, the Trustees leased (Lease Number 4084) the property to DRP under a 50-year lease. The current lease will expire on March 6, 2046.

Crystal River Preserve State Park is designated single-use to provide public outdoor recreation and other park-related uses. There are no legislative or executive directives that constrain the use of this property (see Addendum 1).

### **Purpose and Significance of the Park**

The purpose of Crystal River Preserve State Park is to protect the mosaic of diverse natural communities that sustain the biologically rich ecosystems comprising one of the state's largest springs complex and an exemplary estuary, all while providing a uniquely scenic experience for resource-based outdoor recreation.

### **Park Significance**

- As a part of the Springs Coast region, the karst features of the region produce the Crystal River Springs complex, which includes over 70 springs and one of the state's largest grouping of springs. The park preserves diverse natural communities such as salt marsh, hydric hammock, and mangrove swamp surrounding the springs complex. These natural communities serve as filters protecting the water quality of the estuary and buffers for potential hurricanes.
- The park protects the water quality of first magnitude, spring-fed rivers such as the Crystal River and Homosassa River. These rivers and their springsheds are crucial to the supply of freshwater to the Gulf of Mexico, where it mixes with the saltwater to create one of Florida's most productive and biologically diverse estuaries.
- The park conserves the habitat essential to numerous imperiled species. The park is an important southern terminus for migratory waterfowl such as the brown pelican, little blue heron, snowy egret, tricolored heron, and yellow-crown night heron. In addition, imperiled reptiles include the ornate diamond-backed terrapin, gopher tortoise, and four species of sea turtle.

- Given its natural community diversity, the park is an ideal location for birding and wildlife viewing. The park also offers several miles of hiking and biking trails, a boat tour of the preserve, fishing, and paddling opportunities. With over 100 recorded archaeological sites, the park provides a glimpse into the history of the region and its early peoples.

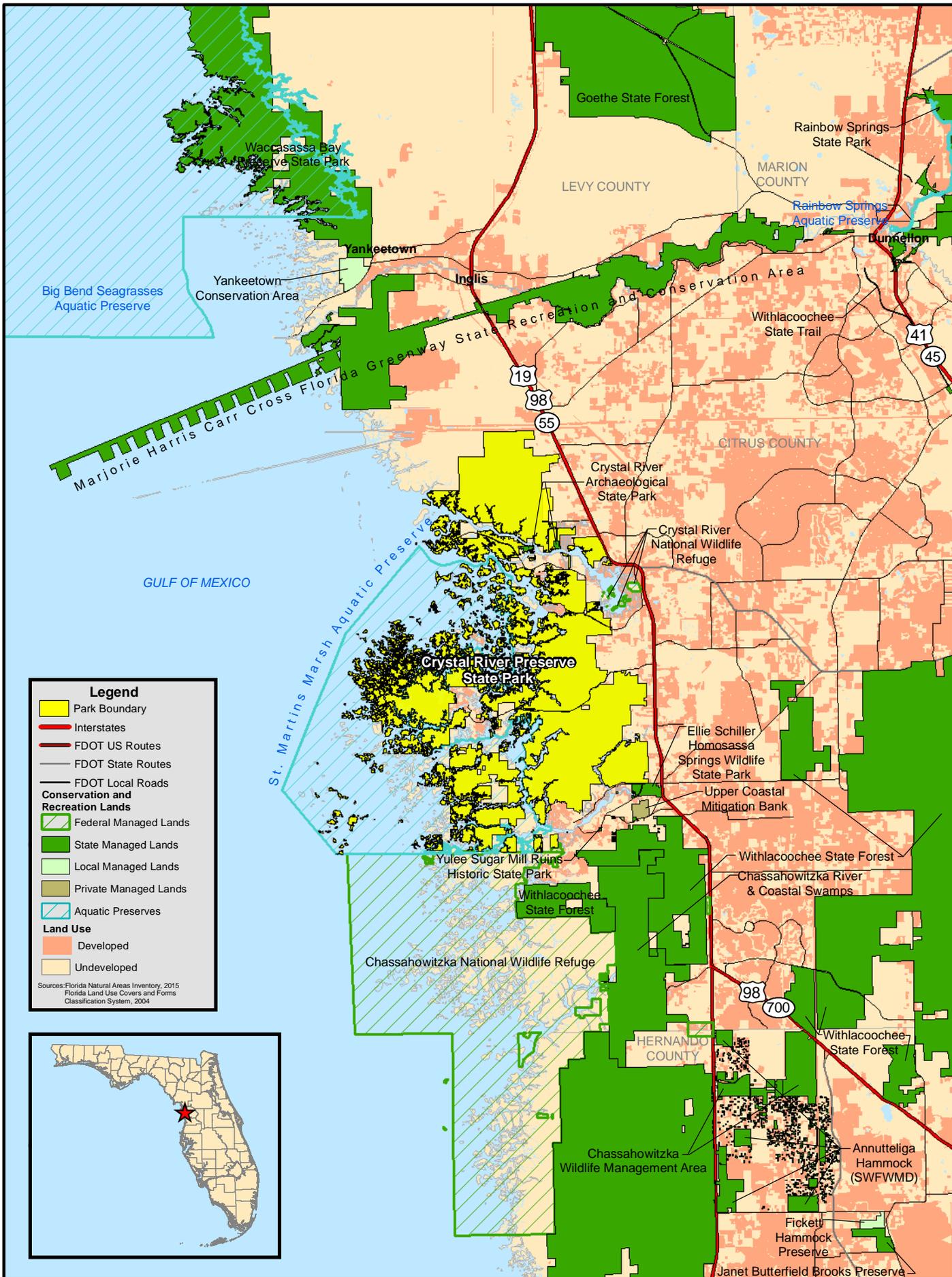
Crystal River Preserve State Park is classified as a state preserve in the DRP's unit classification system. In the management of a state preserve, preservation and enhancement of natural conditions is all important. Resource considerations are given priority over user considerations and development is restricted to the minimum necessary for ensuring its protection and maintenance, limited access, user safety and convenience, and appropriate interpretation. Permitted uses are primarily of a passive nature, related to the aesthetic, educational and recreational enjoyment of the preserve, although other compatible uses are permitted in limited amounts. Program emphasis is placed on interpretation of the natural and cultural attributes of the preserve.

### **Purpose and Scope of the Plan**

This plan serves as the basic statement of policy and direction for the management of Crystal River Preserve State Park as a unit of Florida's state park system. It identifies the goals, objectives, actions and criteria or standards that guide each aspect of park administration, and sets forth the specific measures that will be implemented to meet management objectives and provide balanced public utilization. The plan is intended to meet the requirements of Sections 253.034 and 259.032, Florida Statutes, Chapter 18-2, Florida Administrative Code, and is intended to be consistent with the State Lands Management Plan. With approval, this management plan will replace the 2004 approved plan.

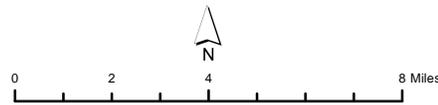
The plan consists of three interrelated components: the Resource Management Component, the Land Use Component and the Implementation Component. The Resource Management Component provides a detailed inventory and assessment of the natural and cultural resources of the park. Resource management needs and issues are identified, and measurable management objectives are established for each of the park's management goals and resource types. This component provides guidance on the application of such measures as prescribed burning, exotic species removal, imperiled species management, cultural resource management and restoration of natural conditions.

The Land Use Component is the recreational resource allocation plan for the park. Based on considerations such as access, population, adjacent land uses, the natural and cultural resources of the park, and current public uses and existing development, measurable objectives are set to achieve the desired allocation of the physical space of the park. These objectives identify use areas and propose the types of facilities and programs as well as the volume of public use to be provided.



# CRYSTAL RIVER PRESERVE STATE PARK

# VICINITY MAP

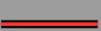


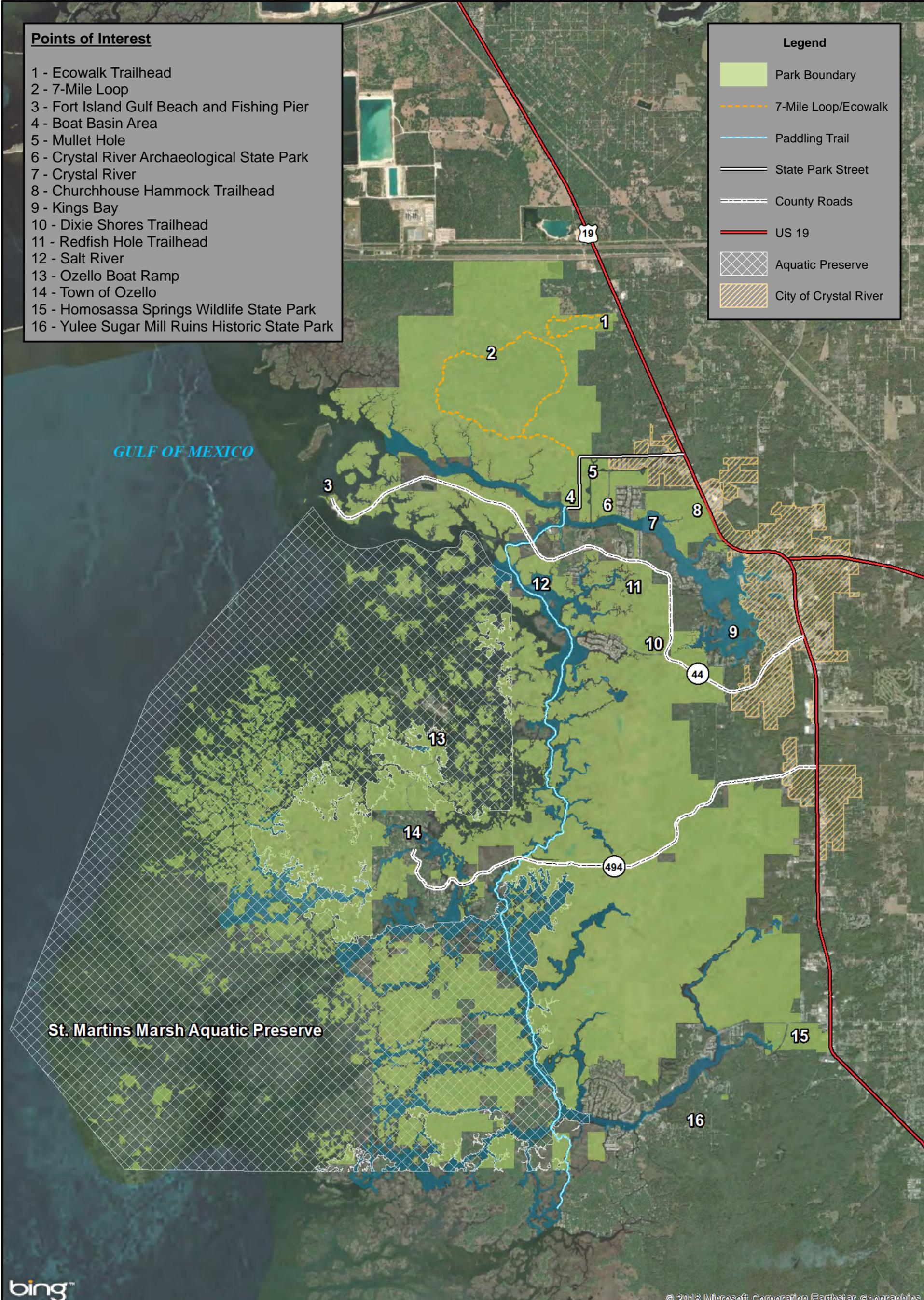


**Points of Interest**

- 1 - Ecowalk Trailhead
- 2 - 7-Mile Loop
- 3 - Fort Island Gulf Beach and Fishing Pier
- 4 - Boat Basin Area
- 5 - Mullet Hole
- 6 - Crystal River Archaeological State Park
- 7 - Crystal River
- 8 - Churchhouse Hammock Trailhead
- 9 - Kings Bay
- 10 - Dixie Shores Trailhead
- 11 - Redfish Hole Trailhead
- 12 - Salt River
- 13 - Ozello Boat Ramp
- 14 - Town of Ozello
- 15 - Homosassa Springs Wildlife State Park
- 16 - Yulee Sugar Mill Ruins Historic State Park

**Legend**

-  Park Boundary
-  7-Mile Loop/Ecowalk
-  Paddling Trail
-  State Park Street
-  County Roads
-  US 19
-  Aquatic Preserve
-  City of Crystal River



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CRYSTAL RIVER PRESERVE  
STATE PARK



REFERENCE MAP



The Implementation Component consolidates the measurable objectives and actions for each of the park's management goals. An implementation schedule and cost estimates are included for each objective and action. Included in this table are (1) measures that will be used to evaluate the DRP's implementation progress, (2) timeframes for completing actions and objectives and (3) estimated costs to complete each action and objective.

All development and resource alteration proposed in this plan is subject to the granting of appropriate permits, easements, licenses, and other required legal instruments. Approval of the management plan does not constitute an exemption from complying with the appropriate local, state or federal agencies. This plan is also intended to meet the requirements for beach and shore preservation, as defined in Chapter 161, Florida Statutes, and Chapters 62B-33, 62B-36 and 62R-49, Florida Administrative Code.

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 the resource needs and values of the park. This analysis considered the park's natural and cultural resources, management needs, aesthetic values, visitation and visitor experiences. For this park, it was determined that timber management as part of the park's natural community management and restoration activities could be accommodated in a manner that would be compatible and not interfere with the primary purpose of resource-based outdoor recreation and conservation. This compatible secondary management purpose is addressed in the Resource Management Component of the plan.

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 forest management activities specifically identified in this plan) would not be consistent with this plan or 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 timber management as part of the park's natural community management and restoration activities could be appropriate at this park as an additional source of revenue for land management since it is compatible with the park's primary purpose of resource-based outdoor recreation and conservation. Generating revenue from consumptive uses that are not a byproduct of resource management activities is not contemplated in this management plan.

DRP may provide the services and facilities outlined in this plan either with its own funds and staff or through an outsourcing contract. Private contractors may provide assistance with natural resource management and restoration activities or a concessionaire may provide services to park visitors in order to enhance the visitor experience. For example, a concessionaire could be authorized to sell merchandise

and food and to rent recreational equipment for use in the park. A concessionaire may also be authorized to provide specialized services, such as interpretive tours, or overnight accommodations when the required capital investment exceeds that which DRP can elect to incur. Decisions regarding outsourcing, contracting with the private sector, the use of concessionaires, etc. are made on a case-by-case basis in accordance with the policies set forth in DRP's Operations Manual (OM).

## **Management Program Overview**

### **Management Authority and Responsibility**

In accordance with Chapter 258, Florida Statutes and Chapter 62D-2, Florida Administrative Code, the Division of Recreation and Parks (DRP) is charged with the responsibility of developing and operating Florida's recreation and parks system. These are administered in accordance with the following policy:

*It shall be the policy of the Division of Recreation and Parks to promote the state park system for the use, enjoyment, and benefit of the people of Florida and visitors; to acquire typical portions of the original domain of the state which will be accessible to all of the people, and of such character as to emblemize the state's natural values; conserve these natural values for all time; administer the development, use and maintenance of these lands and render such public service in so doing, in such a manner as to enable the people of Florida and visitors to enjoy these values without depleting them; to contribute materially to the development of a strong mental, moral, and physical fiber in the people; to provide for perpetual preservation of historic sites and memorials of statewide significance and interpretation of their history to the people; to contribute to the tourist appeal of Florida.*

The Board of Trustees of the Internal Improvement Trust Fund (Trustees) has granted management authority of certain sovereign submerged lands to the DRP under Management Agreement MA 68-086 (as amended January 19, 1988). The management area includes a 400-foot zone from the edge of mean high water where a park boundary borders sovereign submerged lands fronting beaches, bays, estuarine areas, rivers or streams. Where emergent wetland vegetation exists, the zone extends waterward 400 feet beyond the vegetation. The agreement is intended to provide additional protection to resources of the park and nearshore areas and to provide authority to manage activities that could adversely affect public recreational uses.

Many operating procedures are standardized system-wide and are set by internal direction. These procedures are outlined in the OM that covers such areas as personnel management, uniforms and personal appearance, training, signs, communications, fiscal procedures, interpretation, concessions, public use regulations, resource management, law enforcement, protection, safety and maintenance.

## **Park Management Goals**

The following park goals express DRP's long-term intent in managing the state park:

- Provide administrative support for all park functions.
- Protect water quality and quantity in the park, restore hydrology to the extent feasible and maintain the restored condition.
- Restore and maintain the natural communities/habitats of the park.
- Maintain, improve or restore imperiled species populations and habitats in the park.
- Remove exotic and invasive plants and animals from the park and conduct needed maintenance-control.
- Protect, preserve and maintain the cultural resources of the park.
- Provide public access and recreational opportunities in the park.
- Develop and maintain the capital facilities and infrastructure necessary to meet the goals and objectives of this management plan.

## **Management Coordination**

The park is managed in accordance with all applicable laws and administrative rules. Agencies having a major or direct role in the management of the park are discussed in this plan.

The Florida Department of Agriculture and Consumer Services (FDACS), Florida Forest Service (FFS), assists DRP staff in the development of wildfire emergency plans and provides the authorization required for prescribed burning. The Florida Fish and Wildlife Conservation Commission (FWC) assists staff in the enforcement of state laws pertaining to wildlife, freshwater fish and other aquatic life existing within the park. In addition, the FWC aids DRP with wildlife management programs, including imperiled species management. The Florida Department of State (FDOS), Division of Historical Resources (DHR) assists staff to ensure protection of archaeological and historical sites. The Florida Department of Environmental Protection (DEP), Florida Coastal Office (FCO) aids staff in aquatic preserves management programs.

## **Public Participation**

DRP provided an opportunity for public input by conducting a public workshop and an advisory group meeting to present the draft management plan to the public. These meetings were held on April 26, 2018 and April 27, 2018, respectively. Meeting notices were published in the Florida Administrative Register (April 16, 2018 – Vol. 44/74), included on the Department Internet Calendar, posted in clear view at the park, and promoted locally. The purpose of the advisory group meeting is to provide the advisory group members an opportunity to discuss the draft management plan (Addendum 11).

### **Other Designations**

Crystal River Preserve State Park is not within an Area of Critical State Concern as defined in Section 380.05, Florida Statutes, and it is not presently under study for such designation. The park is a component of the Florida Greenways and Trails System, administered by the Department's 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 the Department. This park is adjacent to the St. Martins Marsh Aquatic Preserve as designated under the Florida Aquatic Preserve Act of 1975 (Section 258.35, Florida Statutes).

## **RESOURCE MANAGEMENT COMPONENT**

### **Introduction**

The Florida Department of Environmental Protection (DEP), Division of Recreation and Parks (DRP) in accordance with Chapter 258, Florida Statutes, has implemented resource management programs for preserving for all time the representative examples of natural and cultural resources of statewide significance under its administration. This component of the unit plan describes the natural and cultural resources of the park and identifies the methods that will be used to manage them. Management measures expressed in this plan are consistent with the DRP's overall mission in natural systems management. Cited references are contained in Addendum 3.

The DRP's philosophy of resource management is natural systems management. Primary emphasis is placed on restoring and maintaining, to the degree possible, the natural processes that shaped the structure, function and species composition of Florida's diverse natural communities as they occurred in the original domain. Single species management for imperiled species 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 other native species or seriously compromise the park values.

The DRP's management goal for cultural resources is to preserve sites and objects that represent Florida's cultural periods, significant historic events or persons. This goal often entails active measures to stabilize, reconstruct or restore resources, or to rehabilitate them for appropriate public use.

Because park units are often components of larger ecosystems, their proper management can be affected by conditions and events that occur beyond park boundaries. Ecosystem management is implemented through a resource management evaluation program that assesses resource conditions, evaluates management activities and refines management actions, and reviews local comprehensive plans and development permit applications for park/ecosystem impacts.

Measurable objectives and actions have been identified for each of the DRP's management goals for Crystal River Preserve State Park. Please refer to the Implementation Schedule and Cost Estimates in the Implementation Component of this plan for a consolidated spreadsheet of the recommended actions, measures of progress, target year for completion and estimated costs to fulfill the management goals and objectives of this park.

While the DRP utilizes the ten-year management plan to serve as the basic statement of policy and future direction for each park, a number of annual work plans provide more specific guidance for DRP staff to accomplish many of the

resource management goals and objectives of the park. Where such detailed planning is appropriate to the character and scale of the park's natural resources, annual work plans are developed for prescribed fire management, exotic plant management, and imperiled species management. Annual or longer-term work plans are developed for natural community restoration and hydrological restoration. The work plans provide the DRP with crucial flexibility in its efforts to generate and implement adaptive resource management practices in the state park system.

The work plans are reviewed and updated annually. Through this process, the DRP's resource management strategies are systematically evaluated to determine their effectiveness. The process and the information collected is used to refine techniques, methodologies and strategies, and ensures that each park's prescribed management actions are monitored and reported as required by Sections 253.034 and 259.037, Florida Statutes.

The goals, objectives, and actions identified in this management plan will serve as the basis for developing annual work plans for the park. The ten-year management plan is based on conditions that exist at the time the plan is developed. The annual work plans provide the flexibility needed to adapt to future conditions as they change during the ten-year management planning cycle. As the park's annual work plans are implemented through the ten-year cycle, it may become necessary to adjust the management plan's priority schedules and cost estimates to reflect these changing conditions.

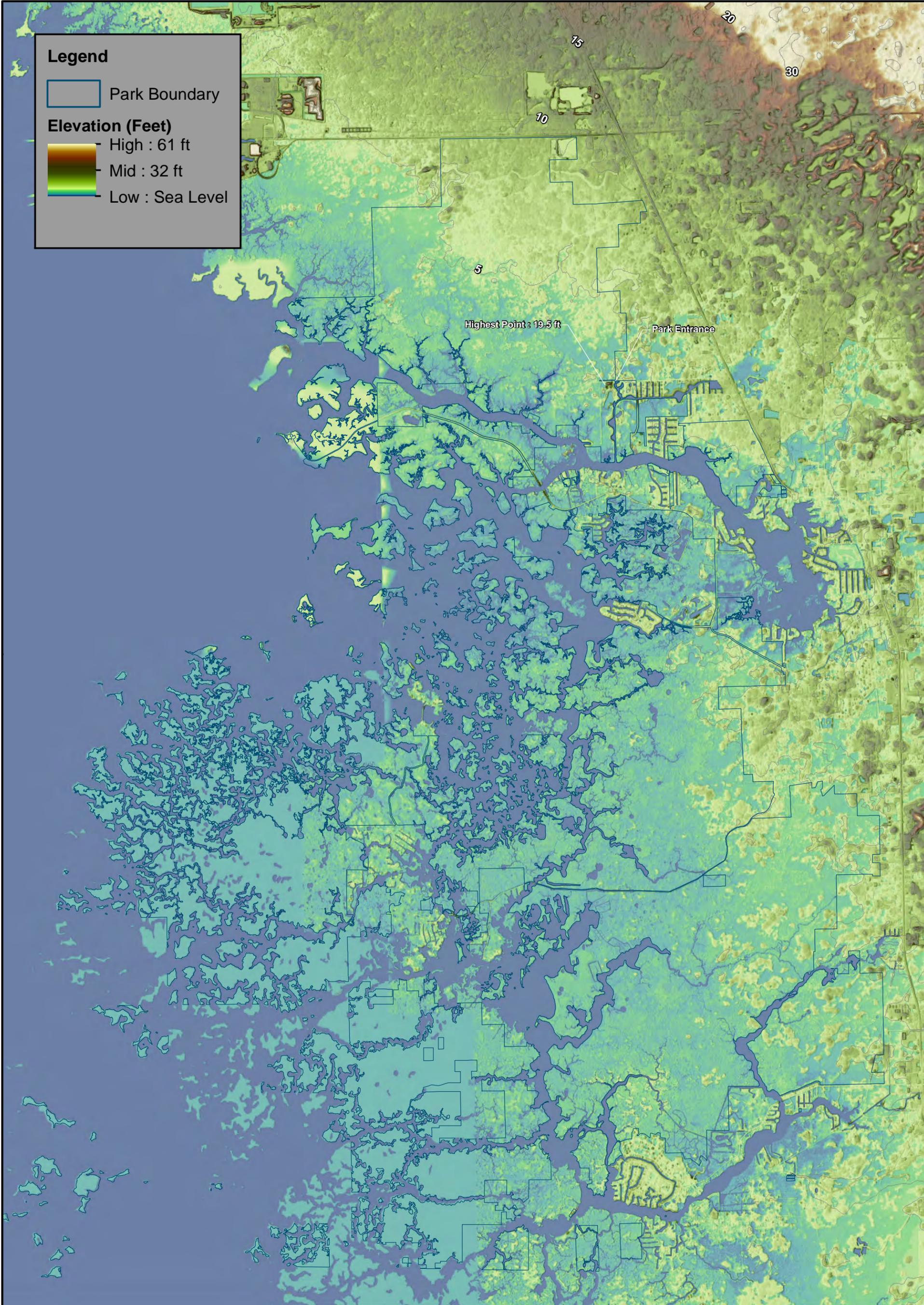
The entire park is divided into management zones that delineate areas on the ground that are used to reference management activities (see Management Zones Map, Addendum 2). The shape and size of each zone may be based on natural community type, burn zone, and the location of existing roads and natural fire breaks. It is important to note that all burn zones are management zones; however, not all management zones include fire-dependent natural communities. Addendum 2 contains the management zones table with the acres of each zone and a corresponding management zones map.

## **Resource Description, Assessment, and Management Program**

### **Natural Resources**

#### **Topography**

Crystal River Preserve State Park (i.e., Crystal River Preserve, or the preserve) is located within the Gulf Coastal Lowlands and Coastal Swamps physiographic divisions of the Central Geomorphic Zone of Florida (White 1970; Rupert and Arthur 1990; Raabe and Stumpf 1996). Characteristic features of these two physiographic divisions include marine terraces of variable thickness, limestone exposures, and remarkable karst topography (Scott et al. 2014). The marine terraces along the Gulf Coast were formed in the Pleistocene when sedimentary materials were deposited and then gradually eroded away as sea levels fluctuated.



**Legend**

Park Boundary

**Elevation (Feet)**

High : 61 ft  
 Mid : 32 ft  
 Low : Sea Level

Highest Point : 19.5 ft

Park Entrance

CRYSTAL RIVER PRESERVE  
STATE PARK

  
 0 0.25 0.5 1 Miles  
Florida Department of Environmental Protection  
Division of Recreation and Parks  
Date of aerial: 2011

TOPOGRAPHY MAP



Two marine terraces, Pamlico and Silver Bluff, characterize the Coastal Lowlands. The Pamlico terrace, which is described as being 8-25 feet above mean sea level (msl), comprises most of the Gulf Coastal Lowlands and consequently much of the preserve. The sandy "high" spots in the preserve represent ancient dunes. In the northwest corner of the preserve are areas where the Silver Bluff terrace is exposed. This terrace, the most recently exposed in the region, contains Pleistocene and Holocene sediments at elevations below eight feet msl (Wolfe 1990). Limestone underlies both the Pamlico and Silver Bluff terraces. Together, the two terraces are often categorized as Coastal Swamps (Puri and Vernon 1964; White 1970).

Most of Crystal River Preserve is basically a flat low-lying carbonate coastline (Williams et al. 1999). Elevations range from about 10 feet msl in the uplands to less than one foot msl in the western salt marsh fringes (see Topographic Map). Portions of the thick layer of limestone bedrock underlying the preserve have gradually dissolved over the millennia as acidic water has percolated through the marsh sediments, causing the surface of the limestone to become pitted in appearance. The karst topography that evolved is responsible for development of the area's characteristic landscape of reticulated tidal creeks and elevated marsh islands. The sediment layer overlying the limestone bedrock is thin, and rock outcrops are scattered throughout the preserve. Given the low elevation nature of this preserve, potential impacts of sea level rise to the parks natural and cultural resources are an important management concern (Scavia et al. 2002; Ellis et al. 2004; Dean et al. 2004).

Topographic alterations that occurred before the state acquired the preserve include several major excavations, numerous above-grade access roads, and spoil deposits in several developed areas. Two sizable pits located in the northern part of the preserve are relicts of limestone mining that once took place at the site. The pits are now filled with water; the larger of the two lacks aquatic vegetation because the water is so deep. Three ditches were dug in the area when plans to construct a waterfront residential area were still under consideration. Other topographic alterations in the preserve include old fire plow scars and man-made ponds.

## **Geology**

Geologic units underlying the Crystal River area consist of Eocene Series deposits of varied origin. In descending order from youngest to oldest the deposits include Ocala Limestone; the Williston, Inglis, and Crystal River Formations; and the Avon Park Formation (Rupert and Arthur 1990; Champion and Starks 2001; Trommer et al. 2009).

The Ocala Limestone is the only formation in the area that has actual surface exposures. Ocala Limestone deposits consist of nearly pure fossiliferous limestones and occasional dolostones. The deposits, which may be up to 88 feet thick, are generally a reliable source of potable water with the exception of areas where saltwater intrusion has occurred. Avon Park deposits, which extend much deeper than the Ocala Limestone, primarily consist of fossiliferous limestone. The uppermost deposits may have a confining layer and also contain potable water.

## **Soils**

Of the seven soil orders that occur in Florida, four are found at Crystal River Preserve - Ultisols, Entisols, Spodosols, and Histosols. A mix of Entisols and Histosols occurs in the coastal marshes, while Histosols underlain by limestone are dominant in the higher elevations of the preserve (Brown et al. 1990). Ultisols and Spodosols are mainly found on some western edges of the preserve. Most soils in the preserve are characterized as poorly drained to very poorly drained. Twenty-nine soil types have been recorded in the preserve (Pilny et al. 1988). A map and complete description of these soils is found in Addendum 3.

Most of the 29 soil types fall within one or the other of two general soil associations: flatwoods soils (i.e., Boca-Broward-Redlevel and Bassinger-EuGallie-Myakka) and coastal swamp, marsh and island soils (i.e., Homosassa-Weekiwachee-Durbin and Rock outcrop-Hallandale-Homosassa) (Pliny et al. 1988). However, remnants of upland ridge soils (i.e., Tavares-Adamsville) occur along the western edge of the preserve and the Homosassa River region contains a unique coastal swamp soil association (i.e., Okeelanta-Lauderhill-Terra Ceia).

The two general soil associations are subdivided into six specific soil associations: Boca-Pineda limestone complex, Myakka-EuGallie limestone complex, Homosassa muck, Weekiwachee-Durbin muck, Hallandale rock outcrop complex and Rock outcrop-Homosassa-Lacoochee complex. Soils in the Boca complex are generally associated with limestone. These soils, found predominantly in the northernmost areas of the preserve, do not reach great depths but are the sandiest of the major series within the preserve. The Myakka-EuGallie soils complex, also associated with limestone bedrock, is found predominately along the western edge of the preserve in coastal cabbage palm flatwoods.

The Homosassa muck series is typically associated with salt marsh. The mucky soils flood daily during high tides. Strongly associated with the Homosassa muck series is the Weekiwachee-Durbin muck series, found in adjacent freshwater tidal marshes. These soils are nearly at sea level, contain a high degree of decomposed organic matter, and are very poorly drained.

Soils in the Hallandale-Rock outcrop complex are poorly drained mineral soils usually adjacent to saltmarsh. The limestone bedrock is no more than 20" from the surface. Tides cause flooding where these soils occur and marsh islands are the typical habitat found there. The islands are overlain by salt marsh or mangrove stands. The easternmost soil association within the preserve is the Rock outcrop-Homosassa-Lacoochee complex. The individual areas of limestone outcrop are generally small and scattered, however exposed large flat surfaces pitted with solution holes can be found.

## **Minerals**

Minerals of commercial interest known to occur within the preserve are limestone, dolomite, and shell deposits. Several old mine excavations and associated ditches

are scattered through the preserve. The largest mine pits are located immediately south of Powerline Road, east of Sailboat Avenue, and along Ozello Trail. The flooded mine pit near Sailboat Avenue, called Mullet Hole, is often used by visitors for sport fishing.

Managers of aquatic systems are beginning to understand that freshwater wetland communities can experience numerous adverse impacts when structural mining of aquifer formations occurs nearby or in the general area (Lewelling et al. 1998; Bacchus 2006; Kinkaid and Meyer 2009). The restoration of open water mine pits can be extremely costly and is very ineffective in terms of recreating the ecological system that previously existed there.

## **Hydrology**

Crystal River Preserve State Park is a significant part of a broad karst-dominated landscape located along a lengthy stretch of relatively undeveloped coastline in western Citrus County. In this area there are numerous spring-fed rivers embedded within a large matrix of hydric hammock, salt marsh, mangrove swamp, seagrass and other nearshore habitats that provide a constant source of freshwater to a relatively stable estuarine environment (Raabe and Stumpf 1996; Mattson et al. 2007). St. Martins Marsh Aquatic Preserve (AP) lies adjacent to and shares a common boundary with much of Crystal River Preserve. Big Bend Sea Grasses Aquatic Preserve and St. Martins Marsh Aquatic Preserve comprise Florida's most significant publicly managed estuary; they contain the largest seagrass beds in the state (FDEP 2014).

Crystal River Preserve is located within the southern extent of Florida's "Big Bend" coastline, but is more specifically within the northern third of the Springs Coast region (Wolfe 1990). This unique region encompasses approximately 2,000 square miles of coastal area from the Waccasassa River in Levy County south to the Anclote River in Pasco County. The Springs Coast region is appropriately named because of its five known springsheds and seven major river systems, including the Crystal and Homosassa rivers, both of which pass through Crystal River Preserve.

The most prominent hydrological features in the preserve are these two spring-fed river systems, each defined by its own springshed, plus plentiful estuarine habitat and an expanse of one of the largest remaining stands of hydric hammock in the state (Simmons et al. 1989). Hydric hammock communities along the west coast of Florida, including those at Crystal River Preserve, have undergone dramatic changes from rising sea levels for at least the past 26 years (Williams et al. 2003; Ellis et al. 2004; Dean et al. 2004).

Scientists that have worked immediately north of Crystal River in Big Bend region over the past three decades have documented that Florida's west coast shorelines have been undergoing a dramatic natural community transformation from previously dominated freshwater systems to one that is predominately salt water (Casteneda and Putz 2007). It is unknown how many freshwater wetlands in the preserve, especially any that might contain groundwater fractures, have converted

into brackish systems as a result of lowered aquifer levels from significant historic droughts, increased groundwater demand or changes associated with global sea level rise (Johnston and Bush 1988; Williams et al. 1999; Raabe et al. 2004; Knight 2015 Williams et al. 2003).

Flows in Crystal River and Homosassa River are derived from large spring complexes situated within an expansive groundwater discharge area fed directly by the Floridan aquifer (Jones et al. 1997; Yobbi and Knochenmus 1989a). The Crystal and Homosassa rivers and St. Martins Marsh Aquatic Preserve are all classified as Outstanding Florida Waters (OFW).

The Crystal River/King's Bay springs complex (Crystal River Springs) is the second largest spring group in the state; it is classified as a Class III waterbody (Jones and Upchurch 1994; Champion and Starks 2001). There are more than seventy springs within the 600-acre King's Bay embayment that constitute the headwaters of Crystal River Springs. All drain westerly for approximately seven miles before entering the Gulf of Mexico (Citrus/Hernando Waterways Restoration Council 2013). The average discharge of this springs group ranges from 878 cubic feet per second (cfs) (473 million gallons per day=mgd) to 1,053 cfs (567 mgd) (Spechler and Schiffer 1995; Champion and Starks 2001; Scott et al. 2004). According to the Southwest Florida Water Management District (SWFWMD), the groundwater contributing area for the Crystal River springshed is about 310 square miles, roughly the northern half of Citrus County (SWFWMD 2015a).

The Homosassa springs complex consists of more than 25 named springs that coalesce to form the Homosassa River, a Class II waterbody that flows westward for nearly eight miles before emptying into the Gulf of Mexico (Leaper et al. 2012). The average discharge of this springs complex ranges from 354 cfs (190 mgd) to 425 cfs (229 mgd) (Jones et al. 1997; Champion and Starks 2001). The groundwater contributing area for the Homosassa springshed is about 270 square miles, roughly the southern half of Citrus County and eastern Hernando County (SWFWMD 2015b).

Minimal surface drainage occurs in the Springs Coast region. The major influences on surface water movement are Gulf of Mexico tides and groundwater flow from the Floridan aquifer (Fretwell 1983; Yobbi 1989; Yobbi and Knochenmus 1989b). The aquifer is unconfined throughout this coastal region and recharge is derived almost entirely from rainfall that occurs within each defined springshed. Groundwater flow is generally from east to west and aquifer discharge to the surface occurs at springs, submarine vents, and lesser known fractures and seeps (Raabe and Bialkowska-Jelinska 2007). The continuous discharge of groundwater into Springs Coast estuaries plays an absolutely essential role in maintaining the health and productivity of the coastal ecosystems (Raabe and Bialkowska-Jelinska 2010). Average annual rainfall for the Springs Coast approaches 56 inches per year (Jones et al. 1997; Fernald and Purdum 1998). Measured rainfall in the preserve over the last ten years has ranged from 28.5 to 65.7 inches per year, with an average of 47.6 inches.

The Floridan aquifer is the principal source of most of the water used in the area (Jones et al. 1997). Sands of varying thickness overlie the limestone and dolomite formations of the Floridan aquifer in the area. A surficial aquifer is not present in the coastal uplands, including within the preserve (Fretwell 1983). In fact, the upper boundary of the Floridan aquifer is at or very near the land surface within the preserve, as evidenced by the predominance of small, scattered karst dissolution features such as limestone outcrops (Raabe and Bialkowska-Jelinska 2010). Sinkholes and small fractures in the exposed limestone are commonplace in the preserve, and crystalline clear blue groundwater is often visible in the openings.

The watersheds of the Homosassa and Crystal rivers contain numerous short, meandering, perennial freshwater creek systems, including Salt, Dolphin, King, Game, Price, Deer, Gomez, and Crab creeks, some of which originate within the preserve. Nearly all of these perennial streams are Class II or Class III waterbodies and exhibit tidal characteristics.

For the most part, surface water drainage within the preserve is poor and large areas often flood. Much of the preserve's upland area drains directly into hydric hammocks and tidal creeks, and eventually to estuarine waters. Tidal fluctuations occur throughout the preserve, transporting large quantities of brackish water through networks of perennial freshwater streams, floodplain marsh creeks, and embayments.

Wetlands are distributed through much of the preserve. By far the most dominant wetland habitat is salt marsh. Prior to their incorporation into Crystal River Preserve, many salt marshes in the area had been altered by canals, ditches and berms for a variety of reasons, including future development. Other ditches, intended to drain wetlands or the US Highway 19 corridor, are located within uplands in the preserve.

The coastal hydric hammock natural community, which occurs inland from the salt marsh, has a significant impact on hydrologic processes within the landscape (Wharton et al. 1977; Vince et al. 1989). During periods of heavy rainfall, hydric hammocks often flood. Surface water travels through this community as sheet flow, eventually entering streams that connect to estuarine waters. Through the temporary storage of surface water, hydric hammock improves water quality and attenuates freshwater pulses into estuarine systems (Vince et al. 1989; Wolfe 1990). For at least 25 years, sea level rise has played a pivotal role in the conversion of several hydric hammock stands on the preserve into salt-dominated communities (e.g., salt marsh/mangrove) (Williams 2003; Ellis et al. 2004).

Numerous karst ponds are scattered throughout the preserve, ranging from brackish to freshwater. Salinity levels associated with particular ponds generally determine the biotic nature (i.e., brackish or freshwater) of these systems (Abbott and Judd 2000). Water sources for the ponds may include the Floridan aquifer, rainfall, and tidal input from the Gulf of Mexico.

## Water Issues

Complex interactions between surface waters and groundwater play a significant role in steering ecological processes in coastal ecosystems of the Springs Coast region (Raabe and Bialkowska-Jelinska 2007). Within the broad interface between estuarine and terrestrial systems in the region, major issues of concern include watershed alteration, groundwater withdrawal, saltwater intrusion, and nutrient enrichment.

*Watershed alteration:* The excavation of mine pits and ditches, disruption or impoundment of natural sheet flow, and withdrawal of groundwater in the region are examples of watershed alterations that could negatively affect natural hydrological regimes in the preserve. Two notable excavations remaining from the limestone mining era in what is now Crystal River Preserve are Mullet Hole (by Sailboat Drive) and Powerline Quarry Pit. The Mullet Hole excavation is probably associated with an artificially created waterway between a local neighborhood development and Kings Bay. Portions of Mullet Hole are currently used for recreational fishing activities in the preserve. The Powerline Quarry Pit is an impoundment/artificial waterbody. Specific water quality parameters for the sites are unknown, however Powerline Quarry Pit appears to have a distinct connection with the Floridan aquifer.

Powerline Quarry Pit essentially consists of two excavations. The larger excavation is a crystalline clear, water-filled impoundment while the smaller one is a shallow pond. The two are separated from each other by an unpaved road. The primary pit, measuring 19.3 acres, is approximately 1300 feet at its widest. Bordered by large limestone boulders, this pit is extremely steep-sided with essentially no littoral shelf. Depths range from 17 to 40 feet. The shallow pit supports some native vegetation that has become established over the years. Prior to being mined, the Powerline Quarry Pit area once supported mesic flatwoods, mesic hammock, basin marsh and dome swamp. There has been some discussion about possibly initiating restoration activities at Powerline Quarry Pit. The main focus of restoration there would be to enhance littoral habitat for the purpose of improving limnologic characteristics of the waterbody.

Several limestone mining operations adjacent to the preserve (e.g., Red Level, Crystal River Quarry, and Inglis Quarry) are currently active, including one located on the northeastern park boundary (i.e., Nature Coast Mine) that was recently issued state approval to proceed. The proposed Nature Coast Mine is adjacent to the preserve's Powerline Quarry Pit. The potential cumulative impacts of these operations on water resources in the preserve are unknown, however water scientists suggest that groundwater mining can adversely influence ecological functions (Lines et al. 2012).

Other wetland alterations in the preserve have caused disruption of natural sheet flow regimes. Access roadways that pass through the preserve in various locations have fragmented the preserve's forested wetlands and tidally influenced communities to varying degrees. Given the preserve's location adjacent to a

moderately sized city, it is not surprising that some areas have become fragmented by roadways. For example, Fort Island Trail and Ozello Trail are major paved highways that pass through large portions of the preserve, bisecting numerous wetland communities. Mitigating the disruptions of natural sheet flow caused by these highways, as well as by unpaved roadways within the preserve, is a major focus of park restoration activities.

Most of the access roads that pass through the preserve were built prior to state acquisition. Many of the roads were raised in elevation by using stockpiled dredge material from canal/ditch excavations. There are also numerous historic ditches/canals scattered throughout the salt marsh areas of the preserve. Some of these excavations are associated with retention ponds or with roadside drainage improvements. It is not uncommon for park personnel to observe flooded conditions along various access roads within the preserve. In fact, certain roads in tidally influenced wetlands are known to be particularly vulnerable to washouts.

To improve drainage in locations where roads have been obstructing natural tidal flows, the preserve staff has installed culverts of appropriate size and shape. For example, natural brackish water fluctuations in at least two tidal creeks in the Hollins Tract (i.e., King's and Dolphin creeks) and in adjacent wetlands were improved in 2002 by the installation of large box culverts. Many other culverts of various sizes have been installed in the preserve and they appear to have reestablished the dynamic tidal equilibrium.

*Groundwater withdrawal:* Many water managers have long been concerned about the unsustainable depletion of groundwater resources in the Floridan aquifer (Bush and Johnston 1988; Grubbs and Crandall 2007; Copeland et al. 2011). Concerns were heightened during the 1998-2002 and 2010-2012 droughts, as water scientists documented significant declines in spring discharge at nearly all of Florida's first magnitude springs, including those along the Springs Coast (Copeland et al. 2011; Pittman 2012). One recent statewide analysis concluded that the drought of 1999-2001 had precipitated significant negative health trends in all the spring systems in the state, including Crystal and Homosassa, because of lowered groundwater levels, significant saline encroachment, and simultaneous increases in groundwater use during one of Florida's worst droughts on record (Verdi et al. 2006).

Whether the evidence indicates that fluctuations in groundwater supply are natural (i.e., due to Atlantic multi-decadal oscillation) or anthropogenic (i.e., due to water supply withdrawals) is still being debated (Kelly 2004; Williams et al. 2011). Nonetheless, coastal springs have experienced significant increases in lateral saline encroachment compared to inland systems because of their proximity to the fresh/saline interface (Marella and Berndt 2005; Hydrogeologic Inc. 2011).

*Saltwater intrusion:* Saltwater encroachment along Florida's coasts has long been recognized as a threat to groundwater quality (Fairchild and Bentley 1977; Fretwell 1983). In the Springs Coast region, a natural saltwater wedge that diminishes in thickness landward extends inland from the Gulf, intruding into the Floridan aquifer.

The depth of the saline wedge ranges from zero at the coast to around 250 feet inland (Fernald and Purdum 1998; Guvanasen et al. 2011). Boundaries of the zone of transition from saltwater (19,000 mg/L chloride) to freshwater (25 mg/L chloride) can fluctuate in response to changes in aquifer recharge and discharge (Fretwell 1983). It is highly probable that saltwater intrusion into the Floridan aquifer contributes to the brackish nature of surface waters within the preserve, and that this phenomenon may alter the water chemistry of freshwater ponds over time.

It has been demonstrated that during periods of low groundwater levels, seawater can move inland through existing dissolution channels and mix directly with waters of the Floridan aquifer (Tihansky 2004; Shaban et al. 2005). In addition to the conduits in the aquifer, the limestone bedrock underlying the Floridan aquifer contains large interconnected fractures and faults that trend either northeast or northwest; these are referred to as “preferential flow pathways” (Lines et al. 2012). Flow pathways have the ability to extend adverse water quality or quantity impacts over a much larger region than just at a local point source. For example, saltwater intrusion in Pinellas County expanded significantly through preferential flow paths when groundwater levels were artificially lowered during localized extractions from water supply fields that were placed too close to the coastline (Tihansky 2004).

A recent statewide analysis of water quantity and quality variables compared groundwater and spring water parameters from 1991 to 2003 (Copeland et al. 2011). Specifically during that period, analysis indicated that the Floridan aquifer’s freshwater “lens” had decreased significantly in volume and that significant saltwater encroachment had occurred throughout most of the state.

*Nutrient enrichment:* Over the past 40 years, the Springs Coast region along much of the eastern boundary of the preserve has experienced rapid development and human population growth. Water scientists now attribute the cumulative effects of increased groundwater consumption, saltwater encroachment, and nutrient enrichment, especially within recognized springsheds, as an explanation for deteriorating estuarine and freshwater resources in this region (Copeland et al. 2011).

One example of the declining health of coastal spring ecosystems is that, as late as the 1970s, spring-run streams found within the Crystal and Homosassa river complexes supported dense and biologically diverse assemblages of submersed aquatic vegetation (SAV) (Odum 1957; Whitford 1956; Frazer et al. 2011, Jacoby et al. 2014). Long-term freshwater springs monitoring in this region has indicated that precipitous declines in SAV abundance occurred over the last decade (Frazer et al. 2007). It is now widely recognized that increased levels of nuisance algae, along with nutrient enrichment, are symptoms of the declining ecological health of springs in Florida (Kolasa and Pickett 1992; Hornsby et al. 2000; Stevenson et al. 2007; Brown et al. 2008; Jones et al. 1997; Munch et al. 2006; Cohen et al. 2007; Albertin et al. 2007; Wetland Solutions Inc. 2010).

In 1989, Crystal River/King's Bay was declared a priority waterbody within SWFWMD's Surface Water Improvement and Management (SWIM) program (SWFWMD 1999). The SWIM plan was extensively updated in 2016 with numerous restoration projects proposed for the springshed of this important spring group (SWFWMD 2016). Because of observed reductions in water clarity, decreases in SAV, and the spread of nuisance aquatic vegetation/algae, water managers established a number of water quality improvement projects in Crystal River and King's Bay that will help to restore historic surface water conditions within these impaired OFWs (Jones and Upchurch 1994; Jacoby et al. 2014). In 2013, the SWFWMD also acknowledged the importance of long-term research and assessment in all known springsheds within the Springs Coast region and pushed forward with a process to classify three additional priority springs (i.e., Homosassa, Chassahowitzka, and Weeki Wachee).

In 1996, the FDEP initiated a formal, statewide monitoring program for surface waters and groundwater, including waters within the Springs Coast region (Maddox et al. 1992; FDEP 2005). These efforts were expanded in 2000. This program, called the Integrated Water Resource Monitoring Program (IWRMP), follows a comprehensive watershed approach based on natural hydrologic units. The 52 hydrologic basins in Florida are on a five-year rotating schedule that allows water resource issues to be addressed at different geographic scales (Livingston 2003). In addition, the IWRMP assigns a waterbody identification number (WBID) to each waterbody. This watershed approach provides a framework for implementing Total Maximum Daily Load (TMDL) requirements to restore and protect waterbodies that are declared impaired (Clark and DeBusk 2008).

Two water quality assessments for waterbodies in the Springs Coast region have already been accomplished (FDEP 2006; FDEP 2008). Several Crystal River/Kings Bay waterbodies have been declared impaired and have had TMDLs assigned to them (Bridger 2014).

## **Hydrological Management Goals, Objectives, and Actions**

**Goal: Protect water quality and quantity in the park, restore hydrology to the extent feasible and maintain the restored condition.**

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 "sheet flow," installing culverts or low-water crossings on roads, and installing water control structures to manage water levels.

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

- Action 1 Continue to cooperate with other agencies and independent researchers in hydrological research and monitoring programs.
- Action 2 Continue to monitor and track surface and groundwater quality issues within the region, especially concerning natural and cultural resource impacts associated with sea level rise.
- Action 3 Continue to monitor land use or zoning changes in the region and offer comments as appropriate.
- Action 4 Continue to cooperate with the SWFWMD to establish meaningful MFLs in order to ensure maintenance of historic flows.
- Action 5 Seek funding for dye trace studies within the two major springsheds to determine groundwater sources for karst features within the preserve.
- Action 6 Conduct dye trace studies within the two major springsheds to determine groundwater sources for karst features within the preserve.

Significant hydrological features within Crystal River Preserve include two major spring complexes and several perennial freshwater creek systems, as well as multiple karst solution features. Preservation of surface water and groundwater quality, and control of erosion and sedimentation into creek systems and karst features, will remain top priorities for the DRP. The following are hydrological assessment actions recommended for Crystal River Preserve.

The DRP will continue its tradition of close cooperation with state and federal agencies and independent researchers engaged in hydrological research and monitoring programs within the preserve and the adjacent Crystal River, and it will encourage and facilitate additional research in those areas. Agencies such as the SWFWMD, USGS, and FDEP will be relied upon to keep the DRP apprised of any declines in surface water quality or any suspected contamination of groundwater in the region. Park and District staff will continue to monitor and document any potential changes within hydric hammock or coastal forest communities as well as any known archeological resources that might be impacted by sea level rise. District 2 staff will continue to monitor Environmental Resource Permit (ERP) and Water Use Permit (WUP) requests for the region in order to provide timely and constructive comments that promote protection of the preserve's water resources. Additional cooperative efforts may include facilitating the review and approval of research permits and providing researchers with assistance in the field. Recommendations derived from the monitoring and research activities will be essential to the decision-making process during management planning.

The proximal sources of flow from the Floridan aquifer to karst features in the preserve are still unknown. To remedy that, Park and District staffs should continue to document any significant karst features within the preserve, especially those that might have a direct groundwater connection. Additionally, the DRP should continue to encourage hydrological studies that are designed to delineate the two major springsheds associated with the preserve (as discussed in the Hydrology section above). Previous dye trace studies in other managed springsheds in Florida have

provided park managers with invaluable information about the various sources of springs and the timing of surface to groundwater interactions that potentially affect important surface water bodies. In order for water managers to be able to protect water quality and potentially restore spring flows to their historic levels, they will need to know the extent of the springshed. To facilitate that process, the DRP should seek funding for dye trace studies to determine the groundwater sources for karst features in the preserve.

Staff will continue to monitor land use or zoning changes within lands bordering the preserve. Major ground disturbances on neighboring properties or inadequate treatment of runoff into local streams could ultimately cause significant degradation of resources in the preserve. When appropriate, District 2 staff will provide comments to other agencies regarding proposed changes in land use or zoning that may affect the preserve. In addition, District 2 staff will closely monitor major limestone mining operations in the watershed upstream of the preserve and watch for significant changes that may adversely affect resources in the preserve.

The DRP will continue to work closely with the SWFWMD to ensure that MFLs developed for the Crystal River Springs complex are implemented conscientiously and that historic groundwater flows are protected.

***Objective B: Restore natural hydrological conditions and functions to approximately 648 acres of salt marsh, 139 acres of freshwater tidal marsh, 213 acres of hydric hammock and floodplain swamp, and 44 acres of wet flatwoods natural communities.***

- Action 1 Conduct an assessment and evaluate the hydrological impacts in the preserve including drainage ditches, and areas where natural sheetflow has been interrupted.
- Action 2 Develop a hydrological restoration plan with prioritized projects for the preserve.
- Action 3 Implement berm removal between zones CR-H24 and CR-H26 (1,045 feet) to improve marsh functions and restore wetland sheetflow.
- Action 4 Implement installation of low-water crossing in zones CR-H71a and CR-H71b (1,245 feet) to improve wetland sheetflow.
- Action 5 Implement installation of low-water crossing between zones CR-H26 and CR-H66 (820 feet) to improve wetland sheetflow.
- Action 6 Implement berm removal and backfill drainage ditches in zones CR-S4 (12,830 feet) and CR-S3 (16,785 feet) to restore wetlands to historic grade.
- Action 7 Evaluate and implement berm removal or convert to low-water crossings in several of the preserve's northernmost zones (ca. 4,050 feet) to improve natural wetland sheetflow.

Staff will initiate hydrological restoration measures for natural systems in the preserve wherever wetland communities have been artificially impounded or ditched and where ecological functions have been disrupted. If the preserve biologist determines that roads passing through wetland communities are

significantly altering natural hydrological regimes, then the DRP, using best management practices, will initiate corrective actions such as installing low water crossings or culverts in appropriate locations. In some cases, complete removal of above-grade roads may be warranted, especially if they no longer serve a useful purpose. These roads should be abandoned and elevations restored to the historic grade of the adjacent natural landscape.

## **Natural Communities**

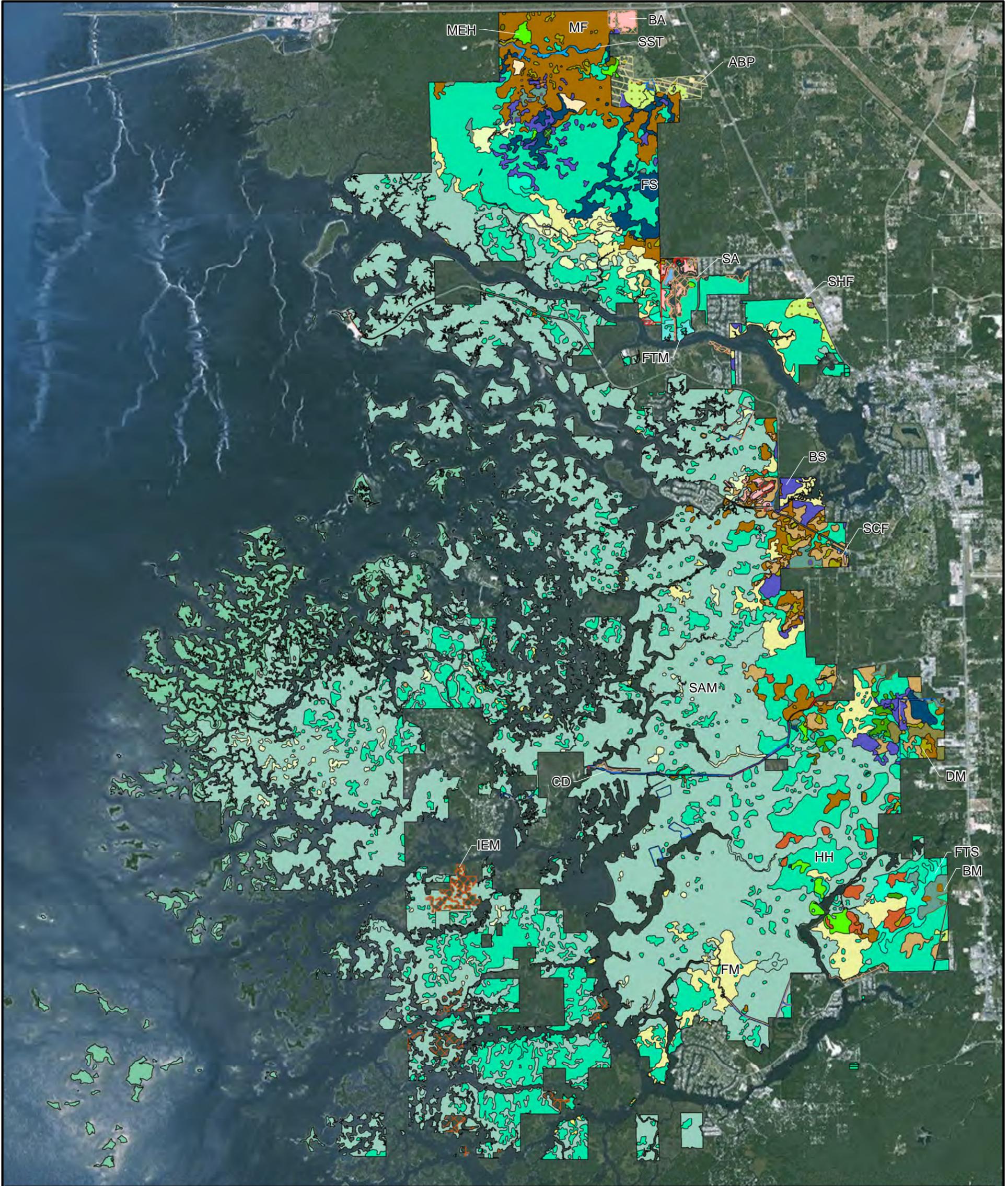
This section of the management plan describes and assesses each of the natural communities found in the state park. It also describes of the desired future condition (DFC) of each natural community and identifies the actions that will be required to bring the community to its desired future condition. Specific management objectives and actions for natural community management, exotic species management, imperiled species management [and population restoration] are discussed in the Resource Management Program section of this component.

The system of classifying natural communities employed in this plan was developed by the Florida Natural Areas Inventory (FNAI). The premise of this system is that physical factors such as climate, geology, soil, and hydrology and fire frequency generally determine the species composition of an area, and that areas that are similar with respect to those factors will tend to have natural communities with similar species compositions. Obvious differences in species composition can occur, however, despite similar physical conditions.

In other instances, physical factors are substantially different, yet the species compositions are quite similar. For example, coastal strand and scrub--two communities with similar species compositions--generally have quite different climatic environments, and these necessitate different management programs. Some physical influences, such as fire frequency, may vary from FNAI's descriptions for certain natural communities in this plan.

When a natural community within a park reaches the desired future condition, it is considered to be in a "maintenance condition." Required actions for sustaining a community's maintenance condition may include; maintaining optimal fire return intervals for fire dependent communities, ongoing control of non-native plant and animal species, maintaining natural hydrological functions (including historic water flows and water quality), preserving a community's biodiversity and vegetative structure, protecting viable populations of plant and animal species (including those that are imperiled or endemic), and preserving intact ecotones that link natural communities across the landscape.

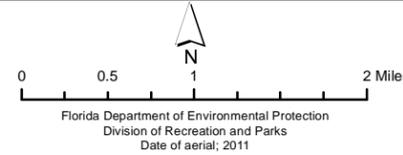
Crystal River Preserve State Park contains 20 distinct natural communities and 10 different altered landcover types (see Natural Communities Map). A list of plants and animals known to occur in the preserve is contained in Addendum 5.



Legend			
LO - Limestone Outcrop - 5.41 ac.	BM - Basin Marsh - 172.78 ac.	MS - Mangrove Swamp - 1671.30 ac.	CD - Canal/Ditch - 46.64 ac.
MF - Mesic Flatwoods - 1205.87 ac.	BS - Basin Swamp - 333.81 ac.	SAM - Salt Marsh - 14465.90 ac.	DV - Developed - 26.17 ac.
MEH - Mesic Hammock - 105.46 ac.	DM - Depression Marsh - 127.08 ac.	SKLK - Sinkhole Lake - 2.54 ac.	IEM - Invasive Exotic Monoculture - 179.21 ac.
SH - Sandhill - 52.74 ac.	DS - Dome Swamp - 11.62 ac.	SST - Seepage Stream - 26.36 ac.	PP - Pine Plantation - 6.72 ac.
SC - Scrub - 56.17 ac.	FM - Floodplain Marsh - 945.21 ac.	ECNS - Estuarine Consolidated Substrate - 11.04 ac.	RNC - Restoration Natural Community - 28.73 ac.
SCF - Scrubby Flatwoods - 342.82 ac.	FS - Floodplain Swamp - 348.01 ac.	EUS - Estuarine Unconsolidated Substrate - 203.05 ac.	RD - Road - 4.65 ac.
SHM - Shell Mound - 40.71 ac.	FTM - Freshwater Tidal Marsh* - 30.81 ac.	ABP - Abandoned Pasture* - 114.88 ac.	SA - Spoil Area - 161.76 ac.
WF - Wet Flatwoods - 236.40 ac.	FTS - Freshwater Tidal Swamp - 187.61 ac.	AP - Artificial Pond - 11.41 ac.	SHF - Successional Hardwood Forest - 120.01 ac.
XH - Xeric Hammock - 119.65 ac.	HH - Hydric Hammock - 5942.49 ac.	BA - Borrow Area - 88.36 ac.	

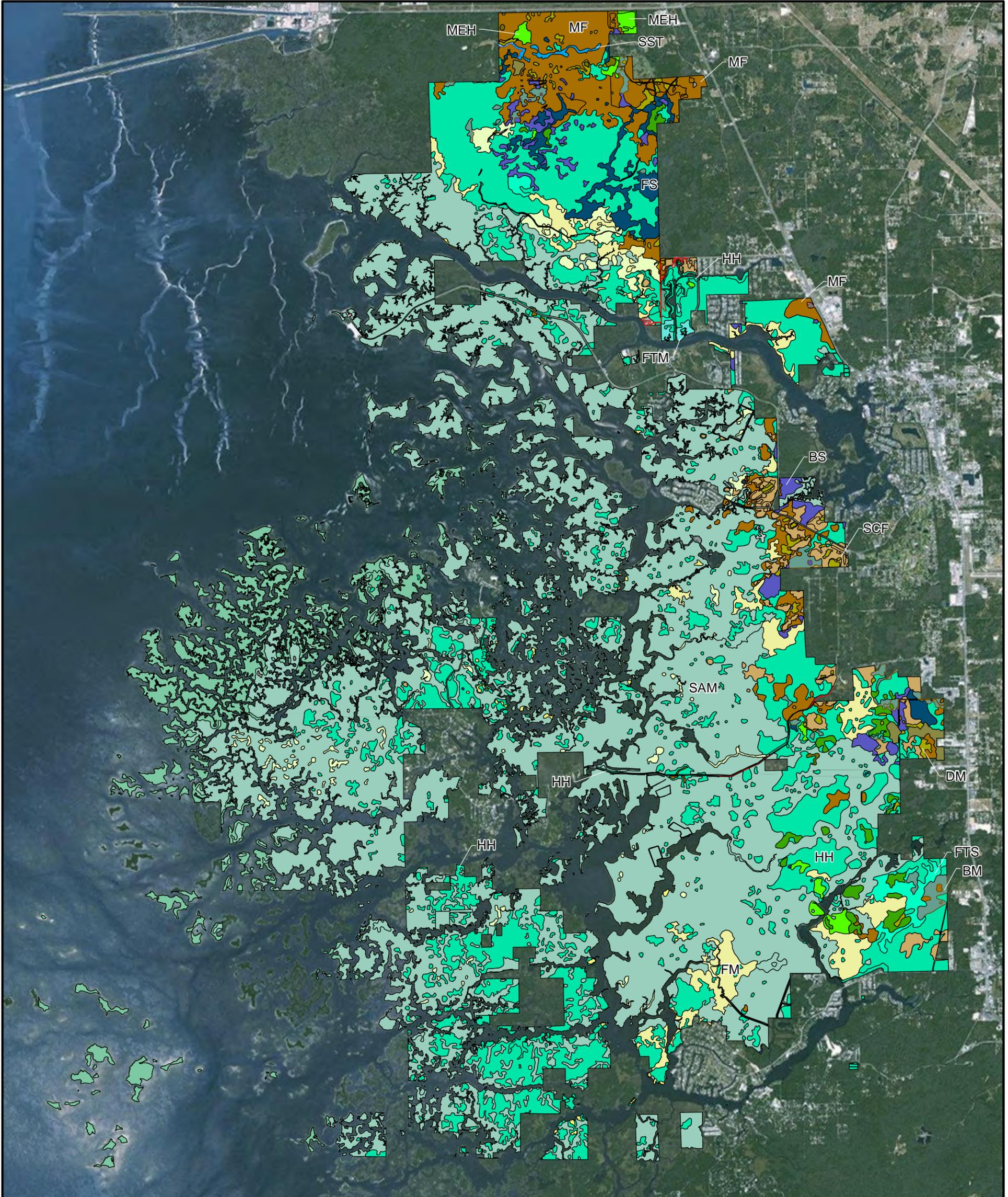
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

CRYSTAL RIVER PRESERVE  
STATE PARK



NATURAL COMMUNITIES  
EXISTING CONDITIONS MAP

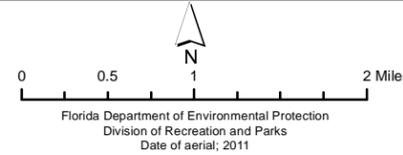




Legend			
LO - Limestone Outcrop - 5.41 ac.	UMW - Upland Mixed Woodland - 30.19 ac.	FS - Floodplain Swamp - 350.26 ac.	SKLK - Sinkhole Lake - 3.07 ac.
MF - Mesic Flatwoods - 1414.16 ac.	WF - Wet Flatwoods - 241.41 ac.	FTM - Freshwater Tidal Marsh* - 32.83 ac.	SST - Seepage Stream - 26.36 ac.
MEH - Mesic Hammock - 138.54 ac.	BM - Basin Marsh - 211.81 ac.	FTS - Freshwater Tidal Swamp - 180.33 ac.	ECNS - Estuarine Consolidated Substrate - 11.04 ac.
SH - Sandhill - 62.49 ac.	BS - Basin Swamp - 320.09 ac.	HH - Hydric Hammock - 6235.44 ac.	EUS - Estuarine Unconsolidated Substrate - 203.05 ac.
SC - Scrub - 169.34 ac.	DM - Depression Marsh - 154.26 ac.	MS - Mangrove Swamp - 1671.30 ac.	AP - Artificial Pond - 0.40 ac.
SCF - Scrubby Flatwoods - 420.35 ac.	DS - Dome Swamp - 13.15 ac.	SAM - Salt Marsh - 14557.75 ac.	DV - Developed - 16.42 ac.
SHM - Shell Mound - 40.71 ac.	FM - Floodplain Marsh - 912.13 ac.	FPLK - Flatwoods/Prairie Lake - 1.85 ac.	RD - Road - 4.65 ac.
			WA - Water* - 5.56 ac.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

CRYSTAL RIVER PRESERVE  
STATE PARK



NATURAL COMMUNITIES DESIRED  
FUTURE CONDITIONS MAP



## Limestone Outcrop

*Desired future condition:* Limestone outcrops are associated with karst topography and are often found within other features such as sinkholes, or as isolated features within mesic hammocks and upland hardwood forests. Various ferns, mosses and smaller herbs typically grow on the limestone surface or in crevices. Characteristic species in north Florida will include partridgeberry (*Mitchella repens*), brittle maidenhair (*Adiantum tenerum*), netted chain fern (*Woodwardia areolata*), jack-in-the-pulpit (*Arisaema triphyllum*), southern shield fern (*Thelypteris kunthii*), and various species of panicgrass (*Panicum* spp.). Other rare fern species may also occur on limestone outcrops.

*Description and assessment:* As might be expected given the karst landscape prevalent in the area, Crystal River Preserve contains numerous limestone exposures. These occur as limestone outcrops situated along the sides of sinkholes and as large limestone boulders. Due to their limited size and erratic distribution, only selected examples of limestone outcrops and boulders are depicted in this plan's natural community map.

The limestone outcrops in the preserve are considered to be in good to excellent condition. Most are located well away from trails or roads or are screened from public view by abundant vegetation or undulating terrain. There are no apparent threats from exotic plant infestations at this time.

*General management measures:* Limestone outcrops in the preserve must be protected from disturbance, especially any that are located near public access areas. Staff should take measures to prevent runoff and erosion from degrading the outcrops, particularly near existing trails or roadways. Personnel involved in the control of exotic plants in sinkholes and upland hardwood or bottomland forests should consider it likely that limestone outcrops or boulders harboring rare plants are nearby, and should minimize ground disturbance and overspray of herbicide as much as possible. Mapping of significant limestone outcrops, accompanied by surveys for imperiled plant species, will be necessary to ensure their long-term protection.

## Mesic Flatwoods

*Desired future condition:* In the typical mesic flatwoods of west central Florida, the dominant pine will usually be longleaf pine (*Pinus palustris*) with occasional stands of south Florida slash (*Pinus elliottii* var. *densa*) in coastal situations adjacent to tidal marsh (Monk 1968, Abrahamson and Hartnett 1990, Stout and Marion 1993). Native herbaceous groundcover will cover at least 50% of the area at a height of less than three feet. Saw palmetto (*Serenoa repens*) will comprise less than 50% of the total shrub cover, also at a height of less than 3 feet. Other common shrub species may include gallberry (*Ilex glabra*), winged sumac (*Rhus copallinum*), fetterbush (*Lyonia lucida*), wax myrtle (*Myrica cerifera*), yaupon holly (*Ilex vomitoria*), running oak (*Quercus pumila*), pawpaw (*Asimina* spp.), dwarf live oak (*Quercus minima*), shiny blueberry (*Vaccinium myrsinites*), coontie (*Zamia pumila*),

bracken fern (*Pteridium aquilinum*) and dwarf huckleberry (*Gaylussacia dumosa*). These shrubs will generally be knee-high or less in height. Few if any large trunks of saw palmetto will run prostrate along the ground. Herbaceous species diversity will be high, vary with site moisture, and may include peas (*Galactia* spp.), goldenrods (*Solidago* spp.), queensdelight (*Stillingia sylvatica*), blackroot (*Pterocaulon virgatum*), foxtail grass (*Setaria parviflora*), wiregrass (*Aristida stricta*), silkgrass (*Pityopsis graminifolia*) and multiple species from the *Liatris* and *Carphephorus* genera. The optimal fire return interval for this community is two to three years (Stout and Marion 1993, Glitzenstein et al. 2003, FWC and FNAI 2007, FNAI 2010).

*Description and assessment:* The mesic flatwoods community in the preserve occurs primarily north of Crystal River at slightly higher elevations than the adjacent hydric hammock and freshwater tidal marsh communities. There are small patches of mesic flatwoods south of the river between Fort Island Trail (SR 44 west) and CR 494. These are relatively untouched and fire excluded, but several hundred acres of flatwoods north of the river, prior to state acquisition, were used by the turpentine/naval store industry, or divided into hunting parcels, or cleared of original tree cover (mostly longleaf pines) and planted with offsite slash and loblolly pines (in 1973-74). Throughout the period before state acquisition, there was a practice of seeding all trails with centipede grass (*Eremochloa ophiuroides*) to minimize mowing needs. This grass has started to invade some zones that are opening up due to timber harvests and prescribed burns.

Since 2001, various management practices including three pine harvests, the reintroduction of fire, elimination of unused trails, control of centipede grass and other turf grasses, and planting of containerized longleaf pine seedlings have encouraged the return of most of these areas from pine plantation to mesic flatwoods in various stages of restoration. One artifact of prior ground prep in pine plantations is that some areas retain light to moderate disturbance features such as linear ridges several inches in height that are typical of machine planting. In addition, saw palmetto cover is atypically light in large areas due to the practice of bulldozing surface vegetation into large linear mounds or windrows prior to planting, roughly every sixth row. Visual evidence of the clearing of this palmetto layer can be seen in historic aerials from the early 1970s. In most areas the mounds of vegetation have long since rotted away or burned, but in zone CR-H33e the excessive depth of the scraping produced several long soil berms up to five feet above grade that still remain.

Past periods of fire suppression and disturbance, particularly prior to state acquisition, caused much of the mesic flatwoods in the preserve to become more overgrown with woody shrubs, cabbage palms and saw palmetto than would have occurred under a natural fire regime. The use of prescribed fire and tree girdling has largely controlled the invasion of flatwoods by offsite hardwoods such as laurel oak and water oak at most sites. The cabbage palm invasion of mesic flatwoods formerly disturbed by silvicultural activities is still a widespread problem, however. This invasion is exacerbated by the aforementioned mechanical removal of saw palmetto in some areas. In the worst areas, the natural community resembles a

form of palm-dominated mesic hammock with some hardwoods and plantation-remnant slash and loblolly pines interspersed. Substantial effort will be required to fully restore these sections to the desired future condition. In certain flatwoods along the coast or in hammock centers, cabbage palms will be tolerated along the fringes as a mid-story component that was present historically.

Past land use practices depleted, or sometimes even eliminated, some of the natural components of the mesic flatwoods in the preserve, particularly the dominant stands of mature longleaf pines, which were all but eliminated. Ground disturbance by feral hogs (*Sus scrofa*) continues to be a problem, degrading the groundcover in many areas, especially in borders between flatwoods and depression marshes or other wetlands, but also within the flatwoods matrix itself. Early efforts at introducing prescribed fire, especially near the north boundary, had greater than desired effects. The resulting fire damage required salvage clear-cutting of several sections in 2001, greatly modifying the structure of the tree canopy in those flatwoods. With reduced competition and less shade, the cabbage palm mid-story in these areas became quite dense.

Conversely, early efforts at cogon grass (*Imperata cylindrica*) control were quite successful, reducing the distribution of this exotic in the mesic flatwoods to a few acres of scattered infestations. Despite heavy disturbance in the past, all the typical vegetative components mentioned above are well represented in the flatwoods here in addition to several notable species such as Cateby's lily (*Lilium catesbaei*), dwarf pawpaw (*Asimina pygmaea*), narrowleaf sunflower (*Helianthus angustifolium*), pine-hyacinth (*Clematis baldwinii*), and atamasco lily (*Zephyranthes atamasco*). Herbaceous groundcover composition and density over many of these areas has responded well to growing season fire and the reduction of the woody mid-story, showing up to a 15-fold increase in groundcover in comparison with non-treated areas. In fact, the mesic flatwoods in zones CR-H17 and CR-H34 have improved to the point that they are now roughly estimated to be at 75% of target condition.

The condition of mesic flatwoods in the preserve ranges from fair to good, depending on past land use practices as well as the degree to which staff have been able to improve their condition using restoration techniques. However, the majority of the mesic flatwoods is considered to be in fair condition.

*General management measures:* Restoration of logged areas in the north end of the preserve has proceeded steadily since 2006, mainly through the use of prescribed fire in varying seasons, herbiciding and mechanical treatment of cabbage palms and turf grasses, and the planting of containerized longleaf pines. These practices should continue as needed. The remaining areas of concentrated planted pines in the mesic flatwoods are quite small and will likely be unsuitable for contract timbering, but they will gradually be thinned through hand-felling and the continued application of prescribed fire.

In coastal sections of flatwoods in zones CR-C3, CR-C4, and CR-C5, mechanical fuel treatments are still needed, as well as additional burning of areas with heavy fuel loads (i.e., areas with a 25+ year absence of fire). Along the south side of the

Seven Mile Loop Trail, coastal slash pines will reseed and eventually attain a density naturally in tune with the frequency of fire application and hydrologic cycles. Ultimately, improvement of areas of mesic flatwoods that are in the worst condition will depend on the continued prevention of exotic plant infestations, establishment of a stronger hog control program, and maintenance of a consistent prescribed fire program. Success will require the ability to introduce fire to sections of flatwoods that have burnable freshwater or salt marsh habitat along their boundaries and that are difficult to access with typical fire control equipment. The more than 475 acres of longleaf pines planted since 2008 will also need to reach maturity before the rating of much of the mesic flatwoods can improve from good condition to excellent, with some semblance of its historic nature restored.

### Mesic Hammock

*Desired future condition:* Mesic hammock is a well-developed evergreen hardwood and/or palm forest that can occur, with variation, through much of peninsular Florida. Live oak (*Quercus virginiana*) will typically dominate the canopy, which is often dense. Cabbage palm (*Sabal palmetto*) may be intermixed in the canopy and in the understory as well. In north-central Florida, southern magnolia (*Magnolia grandiflora*) and pignut hickory (*Carya glabra*) will often be components in both the canopy and sub-canopy, with laurel oak (*Quercus laurifolia*) and water oak (*Quercus nigra*) occurring as well. The shrubby understory may be dense or open, tall or short, and will typically be composed of saw palmetto (*Serenoa repens*), beautyberry (*Callicarpa americana*), yaupon holly (*Ilex vomitoria*), highbush blueberry (*Vaccinium corymbosum*), and sparkleberry (*Vaccinium arboreum*). The groundcover may be sparse and patchy, but it will generally contain panic grasses (*Panicum* spp.), wiregrass, switchgrass (*Panicum virgatum*), and sedges, as well as various forbs and ferns such as bracken fern (*Pteridium aquilinum*). Vines and epiphytes will be abundant on live oaks and on the cabbage palms and other sub-canopy trees. Mesic hammocks will generally have sandy soils with some organic materials mixed in, and there may be a thick layer of leaf litter at the surface. Mesic hammocks are rarely inundated and are not considered fire-adapted communities; typically, they are shielded from fire.

*Description and assessment:* The few areas of mesic hammock found at Crystal River Preserve usually occur on plateaus or slopes above basin marsh, swamp, or hydric hammock. Perhaps the most common variety is the type surrounding the shop area in zone CR-H67. This is positioned above a basin marsh that is part of an ephemeral drainage through adjacent zones. It grades into mesic flatwoods to the north and east, where its boundaries have been defined by frequent fire. Similarly, a strip of mesic hammock separates the hydric hammock west of US19 in zones CR-H5 and CR-H6 from the historical upland pine area near the front of those zones. Development of mesic hammock in this area may have been caused by inadequate fire frequency, perhaps a result of direct suppression. Another variety of mesic hammock in the preserve occupies "islands" of higher ground within floodplain communities (hydric hammock, floodplain swamp and basin swamp) in zones CR-H69 and CR-H73. Though they often contain pines, these small areas are

located where landscape characteristics may greatly hinder the spread of fire from nearby fire-type communities.

Dominant canopy species in the more mature areas of mesic hammock in the preserve include laurel oak, live oak, cabbage palm, southern magnolia, pignut hickory, and loblolly pine (*Pinus taeda*). Other species such as slash pine, red cedar (*Juniperus virginiana*), sugarberry (*Celtis laevigata*) and basswood (*Tilia americana*) are less common. Common understory species may include juvenile cabbage palms, saw palmetto (ranging in density from moderate to high), coastalplain staggerbush (*Lyonia fruticosa*), sparkleberry, deerberry (*Vaccinium stamineum*), highbush blueberry, red bay (*Persea borbonia*), yaupon holly, and American beautyberry. Groundcover is sparse, with bracken fern and low panic grasses occasional.

Mesic hammock in the preserve is fairly limited and well defined with the exception of areas of interface with successional hardwood forest in zone CR-H5 and areas in zone CR-H33e where wetlands transition to uplands. Successive fire treatments in CR-H33e will likely separate true mesic hammock from flatwoods areas upslope. There is evidence that loblolly pines in the transitional areas of CR-H33e were used historically for turpentine and lumber. Saw palmetto and 25-35 year old laurel oak, water oak, and sweetgum (*Liquidambar styraciflua*) are dominant species within much of CR-H33e's hammock. With the exception of the areas described, however, the majority of mesic hammock in the preserve has proven quite tolerant of past uses and currently is in fair to good condition.

*General management measures:* Little active management of mesic hammock is required beyond control of feral hog populations and periodic surveys for invasive exotic plants. The condition of areas in flux will be partially determined and defined by fire management in adjacent areas. In addition, the preserve's maintenance shop and several outbuildings are located in a developed area which retains some hammock over-story but lies within a larger area of intact mesic hammock. A great deal of debris left by the previous owner has been removed from areas near the shop, including car parts and frames. Care must be taken to better define and mark the boundaries of the shop area to ensure that no materials, trash or tools are dumped or stored outside established lines separating the developed area from mesic hammock.

### Sandhill

*Desired future condition:* The dominant tree in the sandhills of north Florida will be longleaf pine. Herbaceous cover, dominated by wiregrass (*Aristida stricta*), will be 80% or greater and reach a height of less than three feet. In addition to the characteristic groundcover species and longleaf pines, the sandhill community will contain scattered individual trees, clumps, or ridges of onsite oak species such as turkey oak (*Quercus laevis*), sand post oak (*Quercus margaretta*), and bluejack oak (*Quercus incana*). In old growth conditions, sand post oaks will commonly be 150-200 years old, and some turkey oaks will be over 100 years old. The optimal fire return interval for this community is two to three years (Stout and Marion 1993, Outcalt 2000, FNAI 2010).

*Description and assessment:* As may be expected in a coastal area, sandhill comprises the smallest upland acreage in the preserve. The sandhill occurs in isolated areas at slightly higher elevations, grading into mesic flatwoods, scrub or hydric hammock. In addition, all of the historic sandhill community in the preserve has been logged of some or all of the original longleaf pine over-story. Some areas are now devoid of pines, and other places were planted in slash pine. After logging operations to thin the slash pines were completed, the sections of sandhill in zones CR-H20, CR-H25 and CR-H72 retain scattered turkey oaks and sand live oaks, but also enough offsite pines to maintain needle drop and carry fire. The sandhills here have little to no sand pines present. Representative sandhill shrubs such as dwarf huckleberry, pricklypear (*Opuntia humifusa*), and gopher apple (*Licania michauxii*) are present, with scattered clumps of saw palmetto and cabbage palms. Herbaceous groundcover components such as narrowleaf silkgrass, bracken fern and blazing stars (*Liatris* spp.) are scattered throughout, with legumes including snoutbean (*Rhynchosia michauxii*), Elliott's milkpea (*Galactia elliotii*), and butterfly pea (*Centrosema virginianum*) also present.

The sandhill in zone CR-H20 (approx. 15.7 acres) was used historically as a dove field and for wildlife openings/food plots, which has greatly hampered the recovery of groundcover species. Zone CR-H20 has a very sparse understory of species similar to those described above, but has been heavily invaded on the east side by centipede grass and bahia grass (*Paspalum notatum*). It retains the over-story slash pine at one third the previous density and was planted at a density of about 200 longleaf pine seedlings per acre in 2013. Since the zone CR-H20 sandhill is in transition, it better fits the description for the altered landcover type, restoration natural community, as described by FNAI in the Guide to the Natural Communities of Florida, Appendix 2 (Florida Natural Areas Inventory 2010).

The sandhill in zone CR-C7 is generally intact, having been lightly used for timber and turpentine, but fire-excluded since long before state acquisition. The sandhill section in zone CR-C7c (12.7 acres) is now a derived over-story of large 40 to 50-foot turkey oaks with very few remnant longleaf pines. The understory in both areas consists of younger individuals of the same species, supplemented by widely scattered sand live oaks (*Quercus geminata*). Sparkleberry and deerberry are representative shrubs, and saw palmetto is occasional. Wiregrass and herbaceous groundcover in all areas is scattered and suppressed by years of thick needle and leaf drop. The area in zone CR-C7c is far enough from target condition (poor condition) that it should also be classified as restoration natural community.

The distribution of the sandhill community in the preserve seems to coincide with slightly thicker (higher), well drained soils, namely Adamsville, Basinger and Boca fine sands. Boca fine sand has a much greater distribution than the other two types, also underlying most of the mesic flatwoods on the north end. The isolated nature of the sandhill in zone CR-C7 has made management there far more difficult than in the remnants occurring in zones CR-H20, CR-H25, CR-H26 and CR-H72 which are adjacent to an extensive flatwoods area with a longer management history.

The condition of the sandhill community in the preserve ranges from poor to moderate. The sandhill that will be easiest to restore will be the sections in zones CR-C7e, C7f, C7g, and C7h as these were thinned to a desired level in 2007 and only require careful application of fire to cycle nutrients, kill invading laurel oaks, and release what groundcover seedbank still persists. The sandhill in the north end of zone CR-H72 is in fair condition, as the shrub layer is still dominant and the restoration pines there are only a few years old. The sandhill in zone CR-H20 is nearly devoid of native groundcover and retains slash pine in the over-story, so it is similarly in fair to poor condition.

*General management measures:* Offsite hardwoods and turkey oaks dominate some of the sandhill in zone CR-C7 that has experienced long-term fire exclusion and has relatively few large longleaf pines remaining. This area will require mechanical thinning of turkey oaks and application of fire to release groundcover species. Zones that require restoration but retain at least some of the typical sandhill groundcover species will be given a higher priority than degraded sites now devoid of characteristic species. Other than that, the continued use (and introduction in some cases) of frequent prescribed fire in the preserve's sandhills will be essential to maintaining community structure and ecological integrity. In areas of sandhill already burned and requiring little tree removal (i.e., zones CR-H20 and CR-H72), removal of turf grasses and groundcover restoration including shrub mowing, planting of wiregrass plugs, longleaf planting, and grass and forb seeding will likely be necessary to restore the areas to near target condition.

Since 2001, logging projects have thinned offsite slash pines and native longleaf pines in five zones containing sandhill. The two sections considered to be in poor condition will require much more restoration work before they will be in good enough condition to support the full range of species that should occur there.

### Scrub

*Desired future condition:* Within scrub habitats, the dominant plant species will include scrub oak (*Quercus inopina*), sand live oak, myrtle oak (*Quercus myrtifolia*), Chapman's oak (*Quercus chapmanii*), saw palmetto (*Serenoa repens*), rusty staggerbush (*Lyonia ferruginea*), and tarflower (*Bejaria racemosa*). There will be a variety of oak age classes and heights between different scrub patches. There will be scattered openings in the canopy with bare patches of sand that support many imperiled and/or endemic plant species; these species will be regularly flowering and replenishing their seed banks. The optimal fire return interval for this community in the preserve is 4-8 years when aiming to achieve a mosaic of burned and unburned areas (Abrahamson 1984, Myers, R. L. 1990, Stout and Marion 1993, FNAI 2010).

*Description and assessment:* The scrub community in Crystal River Preserve is positioned on isolated knolls quite close to, but separated from the tidal river marsh by thin strips of hydric hammock. All scrub patches are difficult to access with motor vehicles due to overgrowth and the absence of trails or firelines. The scrub areas are bordered by and grade into sandhill or mesic flatwoods on the high side.

All are located between Ozello Trail (County Road 494) and US 19 in zone CR-C7. They occur on varying depths of fine sands of the Adamsville, Basinger, Myakka or Eaugallie series, occasionally over limestone substrate.

Scrub habitat at the preserve is extremely overgrown with dense shrubs far above the optimal average height recommendations for managing the Florida scrub jay (*Aphelocoma coerulescens*) or other scrub endemics. The normal bare sand openings and varying shrub height are absent here due to decades of fire exclusion. The sand pine (*Pinus clausa*) scrub variety does not occur at the preserve, leaving these trees notably absent. Though relatively free of exotics and undisturbed by historic land use activities in the region, scrub habitat at the park is only in fair condition due to the lack of management with fire or fuel height treatments.

*General management measures:* Nearly all scrub habitat in the preserve is in dire need of fuel height reduction and prescribed fire. Mechanical treatment could be used to help knock down fuel heights and produce spatial openings that are characteristic of a healthy scrub. Roller-chopping would be the best option to achieve desired results, followed by fire (Weekly et al. 2008). Where fire can move into sawgrass river marsh, caution must be exercised to tie firelines into hydric hammock or another non-fire type community that will create a viable natural break.

### Scrubby Flatwoods

*Desired future condition:* The dominant tree in the scrubby flatwoods of north Florida will usually be longleaf pine (*Pinus palustris*). Mature sand pines (*Pinus clausa*) will typically be absent. A diverse shrub understory will be characteristic, with up to 25 percent bare sand coverage. A scrub-type oak "canopy" will often be present that will vary in height from three to eight feet, and there will be a variety of oak age classes/heights across the landscape. Dominant shrubs will include sand live oak, myrtle oak, Chapman's oak (*Quercus chapmanii*), saw palmetto, rusty staggerbush (*Lyonia ferruginea*), and tarflower (*Bejaria racemosa*). Herbaceous species cover by will often total well below 40 percent. The optimal fire return interval for this community is regionally variable, but coastal scrub has shown an ability to reach fuel height and fire carrying potential faster than interior examples. Areas may be burned as frequently as every 3-8 years when burn prescriptions are designed to achieve a mosaic of burned and unburned areas.

*Description and assessment:* The scrubby flatwoods community in the preserve occurs primarily on sandy knolls of fine sand in the Adamsville, Tavares, Basinger, Eaugallie or Myakka series, some of which are underlain by a limestone substratum complex. These typically grade into and are upslope from mesic to wet flatwoods or hydric hammock. In the absence of regular fire, ecotones between these community types may easily become blurred. All the scrubby flatwoods in the preserve are located on a raised ridge between Kings Bay and the Salt River (zones CR-C5 and CR-C7) or on elevated knolls in the vicinity of County Road 494 in zones CR-C5, CR-C7 or south to zone CR-S4.

According to a revised description of scrubby flatwoods published by FNAI in 2010, the shrub layer of that community consists of one or more species of scrub oak as well as a variety of other shrubs that are also found in mesic flatwoods. In addition to the species mentioned above, other shrub species common in the preserve's scrubby flatwoods include coastalplain staggerbush, garberia (*Garberia heterophylla*), and deerberry.

The scrubby flatwoods canopy in the preserve has a sparse cover of remnant longleaf pines, probably due to prior but unrecorded tree harvests before the state acquired the property. Pond pine (*Pinus serotina*) has become common in some of the areas where fire has been excluded or suppressed for a long time. This condition is especially prevalent in zones CR-C3 and CR-C5 south of the Crystal River where the scrubby flatwoods are surrounded by wet flatwoods that provide the seed source. The initial burn in two zones here has served to top kill or stress many of these pond pines, especially in the driest areas they had invaded. These zones remain in fair condition as they still have a very significant palmetto layer in addition to the remaining pond pine issue. Amidst the scrubby flatwoods in zone CR-C3a are ditch lakes and limerock spoil layers left by early fill removal activities associated with building roads for two local developments (i.e., The Islands and Dixie Shores). In this zone, some of the original scrubby flatwoods will be classed as the altered landcover types impoundment and spoil area. The remainder has been mowed along its perimeter in preparation for burning and is fairly intact despite an excessively thick shrub layer. Areas with moderate prior disturbance tend to be invaded with a higher proportion of red cedars and cabbage palms. There are also cogon grass and air-potato (*Dioscorea bulbifera*) infestations in this zone that are currently under chemical, mechanical and biological treatment regimes.

The other examples of scrubby flatwoods in the preserve are in fair condition. Few invasive exotic problems exist in these areas, with the exotic presence either initially sparse or gradually reduced by preserve staff in the years since DRP assumed management in 2004. These areas have a thick, tall shrub layer of saw palmetto, scrub oaks and lyonia due to decades of fire absence.

The condition of the scrubby flatwoods in the preserve ranges from poor to moderate, depending on the success of prescribed fires at thinning invading pond pines and controlling woody shrubs. Roughly two thirds of the scrubby flatwoods have yet to experience prescribed fire due to their difficult position in the landscape far from trails and within a large matrix of non-fire type communities.

*General management measures:* Restoration of overgrown scrubby flatwoods to a more characteristic condition through prescribed fire alone will probably not be possible. Though initial treatments with fire have proven effective at controlling some pond pines and a majority of the scrub oaks, some oaks remain too large to be affected and the excessive saw palmetto coverage cannot be reduced in this manner. It will be necessary to mechanically treat overgrown sites to lower the fuel structure and thin palmettos prior to returning prescribed fire to these sites. The

preferred fire return interval for the scrubby flatwoods in the preserve is 5-12 years.

### Shell Mound

*Desired future condition:* Shell mounds in coastal north peninsular Florida will be composed of a thick layer of calcareous soil with individual weathered shells still visible. These areas were developed by generations of Native Americans discarding the shells and bones of various food items (primarily oysters) to build a raised area along creeks, lagoons, or bays. Due to the action of the water and salt influence, the sides of these elongated middens facing the water tend to be vegetation free, exposing bare shell fragments until the top of the mound is reached. On rare interior mounds found within the preserve complete vegetation cover is possible. This thick calcareous soil layer supports a diverse assemblage of hardwood trees and shrubs including saffron plum (*Sideroxylon celastrinum*), red cedar, yaupon holly (*Ilex vomitoria*), marsh elder (*Iva microcephala*), and palms. Other plants seen include coontie (*Zamia pumila*), prickly pear cactus (*Opuntia humifusa*), and Spanish bayonet (*Yucca aloifolia*). The ideal condition will be stable and undisturbed by storm action, looting or casual collection of potential artifacts.

*Description and assessment:* Shell mounds within the preserve are smaller, more scattered and more isolated than the organized mound complexes found in the adjacent Crystal River Archaeological State Park. They do, however, largely contain the same basic materials including discarded oyster shells and broken tools such as conch hammers and pottery. They are present along the marsh and hammock boundaries of the Salt River, Crystal River, and Homosassa River as well as along various other lesser creeks and marsh-hammock islands in the region. Many have live or dead (depending on management history) invasive Brazilian pepper (*Schinus terebinthifolius*) on them in addition to the species mentioned above. Due to historical occupation and coastal erosion, the mound areas occurring west of Ozello Trail in the WI zones are the most degraded and have yielded the least information about prehistoric human activity in the region, while others in zones CR-C2, CR-C3, CR-C5, and CR-C6 (east of SR 494) are slightly better with about 40% of sites in good condition and containing significant resources. All shell mound sites in the preserve are in areas that are dynamic in the sense that they are highly affected by tidal action and sea level rise in general. They can also be protected by rooting of plants such as marsh elder when they are positioned against the surge, but excessive root development can disturb the shell heap integrity when pulled out by storm or human disturbance. Despite this, the overall condition of the mounds in Crystal River Preserve is fair to good, but likely to decline over time (Ellis and Dean 2004).

*General Management Measures:* The Shell Mound areas that still have significant cultural resources on site should be monitored at least yearly to evaluate both the stability of the mound and any trends in vegetation loss/erosion or human disturbance. Brazilian pepper and other exotics will continue to be removed in such a way as to not disturb any subsurface resources. Dead trees will be dealt with similarly to limit ground disturbance. Locations of sites should be made known to

law enforcement and their presence encouraged as much as possible to protect these resources. Finally, staff can make law enforcement more effective if they mark many perimeter sites with official signage identifying the site as a state preserve.

### Wet Flatwoods

*Desired future condition:* Dominant pines will usually be slash pine (*Pinus elliottii*), pond pine, and/or loblolly pine (*Pinus taeda*). Longleaf pine will be rare in these communities at Crystal River Preserve. The canopy will be open, with pines being widely scattered and of variable age classes. Native herbaceous cover is dense and includes pitcherplants (*Sarracenia spp.*), hairawn muhly (*Muhlenbergia capillaris*), sawgrass (*Cladium jamaicense*), various sedges (*Carex spp.*) and other plants such as terrestrial orchids may be present and abundant in some areas. Common shrubs will include fetterbush (*Lyonia lucida*), large gallberry (*Ilex coriacea*), and wax myrtle. The wet flatwoods here most closely match the Cabbage Palm Flatwoods variant in the 2010 FNAI Natural Communities Guide. Due to the calcareous nature of the soils, cabbage palm (*Sabal palmetto*) will be common in the mid-story. The optimal fire return interval for this community is 2-4 years.

*Description and assessment:* The cabbage palm flatwoods in the preserve occur along Ozello Trail, Fort Island Trail and in isolated patches along the Seven Mile Loop Trail in the Hollins Tract. They generally occur adjacent to and grade into flatwoods, basin marsh, river marsh or hydric hammock and are dominated by pond pine or loblolly. The wet flatwoods in zones CR-H72, CR-H73 and CR-H35 were planted with offsite slash pine in 1973 (FDEP 2004). Fire has thinned some of the excessive over-story there, but these areas were not deemed suitable for a timber harvest operation. In zone CR-C5, the wet flatwoods occur downslope from the scrubby flatwoods ridges. Less than half of the wet flatwoods outside of the Hollins tract have seen fire. This fire exclusion has caused the shrub layer to be highly developed to the point where the herbaceous layer is reduced. Chinese tallowtree (*Triadica sebifera*) has been an issue in some of these wet areas but is currently reduced to maintenance status. The overall condition of wet flatwoods in the preserve is fair.

*General management measures:* The remainder of the wet flatwoods in the preserve that have not yet been burned need to be prepped and divided into small enough sections to burn safely. Once the fuel loading is reduced, fire should be applied regularly to begin the process of limiting woody mid-story development and encouraging the herbaceous layer characteristic of this community type.

### Basin Swamp

*Desired future condition:* Basin swamps are forested basin wetlands that are highly variable in size, shape, and species composition and often hold water most days of the year. While mixed species canopies are common, the dominant trees in north Florida will be pond cypress (*Taxodium ascendens*) and swamp tupelo (*Nyssa sylvatica* var. *biflora*). Other canopy species will typically include slash pine, red

maple (*Acer rubrum*), dahoon holly (*Ilex cassine*), sweetbay (*Magnolia virginiana*), loblolly bay (*Gordonia lasianthus*), and sweetgum (*Liquidambar styraciflua*). Depending upon fire history and hydroperiod, the understory shrub component will be distributed throughout or concentrated around the perimeter. Shrubs will include a variety of species including Virginia willow (*Itea virginica*), swamp dogwood (*Cornus foemina*), wax myrtle, and titi (*Cyrilla racemiflora*). The herbaceous component will also be variable and may include a wide variety of species such as maidencane (*Panicum hemitomon*), ferns, arrowheads (*Sagittaria* spp.), lizard's tail (*Saururus cernuus*), false nettle (*Boehmeria cylindrica*), and sphagnum moss (*Sphagnum* spp.). Soils will typically be acidic nutrient-poor peats, often overlying a clay lens or other impervious layer.

*Description and assessment:* Basin swamps in the preserve occur adjacent to mesic flatwoods and positioned along river marshes that border Kings Bay or tributary tidal creeks of the Salt and Crystal rivers. There are also several sections that are simply lower depressions with longer hydroperiods within the larger hydric hammock area in the central management zones at the north end of the preserve, namely zones CR-H73, CR-H69, CR-H30 and CR-H25.

Cypress trees are notably absent from most of the basin swamps on the preserve, possibly due to historic harvest, which was common throughout this area. Swamp bay is quite common, but the vast majority of adult specimens have been decimated by laurel wilt (*Raffaelea lauricola*) disease transmitted by the redbay ambrosia beetle (*Xyleborus glabratus*). Plantation pines occur in the edges of some of the swamps that grade into mesic hammock. Overall, however, the basin swamps are in moderate to good condition and the continued use of fire, will help reestablish proper community boundaries.

*General management measures:* Prescribed fires should be allowed to burn into the edges of basin swamps to maintain the natural ecotone between them and surrounding flatwoods. Removal of offsite loblolly pines may be necessary to improve the condition of some of the basin swamps.

### Depression Marsh

*Desired future condition:* Depression marshes in coastal north Florida characteristically will be smaller open vista wetlands dominated by low, emergent herbaceous and shrub species. Trees will be few, and if present, will occur primarily in the deeper portions of the community. There will be little accumulation of dead grassy fuels due to frequent burning. The soil surface will often be visible through the vegetation when the community is not inundated. Dominant vegetation will typically include sawgrass, panicgrasses (*Panicum* spp.), cutgrass (*Leersia* sp.), sand cordgrass (*Spartina bakeri*), pickerelweed (*Pontederia cordata*), arrowheads (*Sagittaria* spp.), common buttonbush (*Cephalanthus occidentalis*), St. John's-wort (*Hypericum tetrapetalum*), and coastalplain willow (*Salix caroliniana*). The optimal fire return interval for this community is two to ten years depending on the fire frequency of adjacent communities.

*Description and assessment:* Depression marshes in the preserve occur as small, scattered, isolated and mainly herbaceous wetlands. These marshes are shallow and often do not fit FNAI's standard description in that they may not be rounded, sometimes do not have concentric bands of marsh vegetation around them, and may lack deeper portions containing open water. Recurring drought events from 1998 through 2012 have caused these marshes at Crystal River Preserve to experience generally lower water levels. Typically the marshes are dry most of the year. Depression marshes are important as ephemeral wetlands for many amphibian and invertebrate species (Moler and Franz 1987).

Invasion of the depression marshes by wax myrtle, red maple and coastal plain willow is normally kept in check by prescribed burning and natural flooding. However, adaptable invaders such as slash pine and pond pine remain in some of the depression marshes despite the application of fire. In some cases the ability of trees and shrubs to compete is enhanced by ditching along roads or some other artificial manipulations that prevent the marsh from maintaining a higher water level that would help to exclude these species. Reductions in the regional water table may lead to more frequent droughts and additional incursions by hardwoods, and may eventually encourage succession of some marshes to mesic hammock. The depression marshes at the preserve are currently in good condition.

*General management measures:* Where appropriate, the park should burn depression marshes at the same time as adjacent fire-type natural communities. Maintenance of a natural ecotone is important, as is keeping the marshes free of invasive exotic species. Removal of well-established slash pines and other hardwoods that have resisted fire may require additional measures such as felling or herbicide control.

### Dome Swamp

*Desired future condition:* Dome swamp is an isolated, forested depression wetland occurring within a fire-maintained matrix such as mesic flatwoods. The characteristic dome appearance is attributable to the growth of smaller trees on the outer edge (shallower water and less peat) and larger trees in the interior. Pond cypress will typically dominate, but swamp tupelo (*Nyssa sylvatica* var. *biflora*) may also form a pure stand or occur as a co-dominant. Sub-canopy species in north Florida will generally include red maple (*Acer rubrum*), dahoon holly (*Ilex cassine*), swamp bay (*Persea palustris*), sweetbay (*Magnolia virginiana*), and loblolly bay. Shrubs will be absent to moderately common (a function of fire frequency), and may include Virginia willow (*Itea virginica*), fetterbush, buttonbush, wax myrtle, and titi. Herbaceous cover will be absent to dense and include ferns, maidencane (*Panicum hemitomon*), sawgrass (*Cladium jamaicense*), sedges (*Carex* spp.), lizards tail, and sphagnum moss (*Sphagnum* spp.). Vines and epiphytes will be common. Maintaining the appropriate hydrology and fire frequency will be critical for preserving the structure and species composition of the community. Dome swamps should generally burn on the same frequency as adjacent fire-type communities, with fires being allowed to burn across ecotones naturally. Fires in

dome swamps should be appropriately planned for intervals of two to ten years to avoid buildup of high fuel loads.

*Description and assessment:* Zones CR-H17, CR-H19, CR-H23 and CR-H71w contain three areas where classic dome swamp historically existed. Currently, none of these domes has a cypress over-story component, but swamp bay and swamp tupelo persist, along with a typical array of understory plants. It is likely that the cypress was logged out decades ago, before state ownership. Other than the lack of cypress, these three areas are in good condition, having had little recent disturbance except for occasional hog rooting. An example of dome swamp that still has its cypress intact occurs in zone CR-C7e between two areas of sandhill.

*General management measures:* These few examples of dome swamp should be protected from unnatural disturbances. However, prescribed burners will allow fires conducted in adjacent fire-maintained natural communities to burn through the ecotone into the dome swamp periodically, under conditions appropriate for restoring the natural transition zone and maintaining the natural fire regime essential to dome management. Removal of offsite loblolly pines may be beneficial in some areas, in addition to removal of feral hogs. Preserve staff will regularly monitor the dome swamps for the appearance of invasive exotic plants and will remove any found.

### Floodplain Marsh

*Desired future condition:* A variant of floodplain marsh, namely freshwater tidal marsh, is present at Crystal River Preserve. Freshwater tidal marsh is characterized as including emergent low herbaceous and shrubby species, which are dominant over most of the area. An open vista will be typical, with few trees present. If trees do occur, they will primarily be found in the deeper portions of the community. There will be little accumulation of dead grassy fuels due to frequent burning. One will often be able to see the soil surface through the vegetation when the community is not inundated. Sawgrass will dominate this system. Other vegetation found in the freshwater tidal marsh at Crystal River Preserve will include sand cordgrass (*Spartina bakeri*), panicgrasses (*Panicum* spp.), cutgrass (*Leersia* sp.), pickerelweed (*Pontederia cordata*), arrowheads (*Sagittaria* spp.), St. John's wort, cabbage palm (*Sabal palmetto*) and coastal plain willow (*Salix caroliniana*). Needlerush (*Juncus roemerianus*) will occur in small patches at transitions to salt marsh and where tidal flow brings saltier water from the estuary into a freshwater sheet flow situation through the upper fenestrations of the aquifer. Other herbaceous species here will include bladderworts (*Utricularia* spp.), saltmarsh morning-glory (*Ipomoea sagittata*), saltmarsh mallow (*Kosteletzkya virginica*) and bacopa (*Bacopa monnieri*). The optimal fire return interval for this community is 2-10 years depending on the fire frequency in adjacent communities.

*Description and assessment:* Freshwater tidal marsh in the preserve typically borders tidal creeks that feed one of the rivers forming the estuary. They lie between the hydric hammocks and the tidal creeks, mostly on Homosassa Mucky Fine Sandy Loam or Okeelanta Muck. They occur throughout the preserve and

transition to salt marsh where the average salt content favors that community but are strongly affected by tidal push of brackish water on salt water, rising and falling with an interplay of tide and rainfall events. In some areas such as the crossing of the marsh on the Loop Trail (zones CR-H73 to CR-H37), lateral ditching along the trail and limited flow under the trail may inhibit flows to the lower marsh. In addition to these minor flow issues, fire exclusion for many decades has allowed red cedar and cabbage palm to invade these marshes, adding to the expected thickets of willow. This along with many years of reduced rainfall and fire exclusion have made many of these marshes less open than they were historically. 1973 aerial photographs show many small thickets of shrubs scattered in this system, but a generally open condition prevailed, dominated by grass.

*General management measures:* Establishment of low water crossings or increased flow structures where roads interface with the marsh will aid in maintaining a natural sheet flow situation in the freshwater tidal marsh. Where appropriate, the preserve should burn river marsh at the same time as adjacent fire-type natural communities, or as the dominant community depending on size. Maintenance of a natural ecotone is important, as is keeping the marshes free of invasive exotic species. Removal of well-established woody shrubs and small trees may require additional measures such as mowing, which must be done by hand or with specialized equipment. Access to creek boundaries of burn units with airboats or tracked vehicles will be key to long term fire maintenance of these communities.

### Floodplain Swamp

*Desired future condition:* Floodplain swamp in Florida occurs in low-lying areas along streams and rivers; it will frequently or permanently be flooded. Soils will consist of a mixture of sand, organics, and alluvial materials. In coastal north-central Florida, the closed canopy will typically be dominated by black gum (*Nyssa sylvatica*) and sweetbay (*Magnolia virginiana*), as well as water hickory (*Carya aquatica*), red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*) and swamp bay (*Persea palustris*). Trees bases will typically be buttressed. Buttonbush (*Cephalanthus occidentalis*), dahoon holly (*Ilex cassine*), and cabbage palm (*Sabal palmetto*) will be present in the mid-story. The understory and groundcover will usually be sparse but will include leather fern (*Acrostichum danaeifolium*), dotted smartweed (*Polygonum punctatum*), string lily (*Crinus americanum*), lizard tail (*Saururus cernuus*), and royal fern (*Osmunda regalis*). Poison ivy (*Toxicodendron radicans*) is frequent.

*Description and assessment:* Floodplain swamps in the preserve occur in floodways within the deepest parts of hydric hammocks, serving as transitional water storage areas for surrounding uplands, both within and outside the preserve. These drainages ultimately feed freshwater tidal marshes and creeks. As such, some of these swamps will be more properly identified as freshwater tidal swamps. They experience some tidal action, including occasional brackish water pulses, but ultimately they share many of the same species. Where this community transitions to open marsh, small patches of sawgrass can be found in the understory along with increased occurrence of leather fern. Cypress is notably absent from these

swamps, but that is not uncommon along the coast. If prior logging activities were responsible for the loss of the cypress, little evidence of that remains today. As in all the swamps in the preserve, laurel wilt disease has killed a majority of the adult swamp bays. Exotic plants have had very little impact on the floodplain swamp areas. Feral hog impacts have been more severe in the shallower sections of the swamp but are considered moderate. Existing causeways and roadbeds that cross narrow strands of floodplain swamp may negatively affect the natural hydrological regime. Aside from these minor impacts, due to the fact that the swamps in the preserve were not used in timber management, mining or other land altering programs prior to state acquisition, they are in good to excellent condition.

*General management measures:* Floodplain swamps require little active management other than erosion protection and control of invasive exotic species, including hogs. Preserve biological staff will continue to monitor trails crossing the floodplain swamp for erosion issues and will mitigate impacts as needed, including installing low water crossings along sections of trail. Staff will also monitor the swamps regularly for signs of invasive exotic plants and animals, including feral hogs.

#### Hydric Hammock

*Desired future condition:* Hydric hammock is characterized as a closed canopy, evergreen hardwood and/or palm forest with a variable understory dominated by palms and with a sparse to moderate groundcover of grasses and ferns. Typical canopy species in the Springs Coast region will include laurel oak (*Quercus laurifolia*), pignut hickory (*Carya glabra*), southern magnolia (*Magnolia grandiflora*), cabbage palm, sugar hackberry (*Celtis laevigata*), live oak, sweetbay (*Magnolia virginiana*), red cedar (*Juniperus virginiana*), swamp tupelo (*Nyssa sylvatica* var. *biflora*), American elm (*Ulmus Americana*), red maple and other hydrophytic tree species. Yaupon holly (*Ilex vomitoria*) and needle palm (*Rhapidophyllum hystrix*) will be among the sparse understory components. Soils will be poorly drained but only occasionally flooded. Hydric hammock will occasionally burn when fires are allowed to spread naturally across ecotones from adjacent upland natural communities. A variant of hydric hammock, called coastal hydric hammock by FNAI, is also present in the Springs Coast region. It typically occurs in strips adjacent to salt marsh or other coastal communities. It is similar to hydric hammock in that it forms a closed canopy evergreen forest, but its canopy species are generally limited to salt tolerant types including cabbage palm, live oak (*Quercus virginiana*), and red cedar. Fire occurrence will be rare to occasional depending upon several factors including the adjacent community type.

*Description and assessment:* Hydric hammock is the second most abundant community in the preserve, covering nearly 3,600 acres. Hydric hammock areas are located on the eastern side of the preserve and are typically positioned between an upland community such as mesic flatwoods and a larger strip of freshwater tidal marsh. Hydric hammocks play a critical role in the regional hydrology (Simmons et al. 1989). They serve the important function of temporarily storing water in high rainfall periods, but typically retain scattered small pockets of standing water up to

70 days per year. Hydric hammocks occur on a variety of sand to muck soils, but are always low lying and situated over a limestone substratum that occasionally projects above ground as exposed outcrops or bare rock areas. Soil depth can be as little as 20 cm in these areas. In areas further west where there is a greater salt influence, the subtype of hydric hammock called coastal hydric hammock plays a similar role in the landscape. Larger areas of hydric hammock frequently interface with or are divided by floodplain swamp drainages that lead to one or the other of several tidal creeks in the preserve.

Hog rooting and wallowing have the greatest negative effect on hydric hammock in the preserve. Especially in dry periods when mast production is highest (October-December), large areas of hammock may be impacted. This can alter the understory while removing mast and other forage for native species. Infestations of exotics such as air-potato, skunkvine (*Paederia foetida*), Chinese tallowtree, and Brazilian pepper have been under constant management in these hammocks, but they persist in scattered pockets at very low densities. There are also a few zones where historic ditching associated with road or trail construction has cut into the hammock substrate, interrupting natural sheet flow. This has occurred most extensively in sections between zones CR-H38, CR-H73, and CR-H72 along the south loop trail. Finally, there are about 24 acres of hydric hammock in the northwest section of zone CR-H73 that historically have had loblolly pines planted in them. These pines should be thinned or removed so that the natural limits of the hammock can be reestablished through regular prescribed burning.

The coastal hydric hammock in the preserve is dominated by red cedars and cabbage palms, with remnant live oaks or loblolly pines occasionally present toward the center of the hammock, depending on the profile and degree of tidal over-wash. These hammocks are situated where limestone outcrops project slightly above the level of the marsh. Continued sea level rise threatens these distinct upland hammock areas, though outright tidal over-wash is rare. Rather the gradual effect of the rising water has been a long-term die-off of canopy trees near the hammock edges over several decades, slowly converting these areas to driftwood-littered salt flats or outright salt marsh (Williams et al 1999)

Over the past 25 years researchers have documented the gradual recession of the hydric hammock and a conversion of coastal hydric hammock islands to salt-dominated communities (Ellis et al. 2004). A comparison of aerial photography graphically illustrates the die-off of sabal palms, oaks, and red cedars on islands within the salt marsh, however there has not been a complete analysis of these changes within the preserve.

The presence of mature individuals of red cedar, which is not fire tolerant, may indicate that the community has a long fire return interval. However, many of the older red cedars in the coastal hammocks were once subjected to harvesting for shingles, furniture and other uses. As early as 1882, there was a mill in Crystal River that produced pencil blanks, sourcing wood from coastal hydric hammocks in the region (Bash 2006). Consequently, the vast majority of red cedars on this coast

are second growth individuals that currently reach a maximum of 30-40 feet in height.

The understory in coastal hydric hammock is sparse, as in regular hydric hammock, but common shrubs include Florida coontie, wild coffee (*Psychotria nervosa*) and yaupon holly. Thick patches of other shrubs and trees such as myrsine (*Myrsine cubana*) and saffron plum occur in some places but are not widely distributed. Where the land is low and open there may be large patches of leather fern, and cabbage palm may be the only tree in the canopy. At the transition of coastal hydric hammock to hydric hammock, other hardwood trees appear and typical salt intolerant understory plants become more diverse. At the transition to salt marsh, typical shrubs include Christmas berry (*Lycium carolinianum*), saltwater false willow (*Baccharis angustifolia*), saltbush (*Baccharis halimifolia*), and buttonwood (*Conocarpus erectus*). This system rarely if ever experiences fire. Lightning strikes within this community typically burn out very small areas (<0.5 acre) and extinguish on their own.

The overwhelming factor leading to the degraded condition of coastal hydric hammock in the preserve is the Brazilian pepper infestation. Due to the sheer density of Brazilian pepper trees and the exclusion of typical over-story species there, several sections of this community subtype have been classified as the altered landcover type, Invasive Exotic Monoculture. Most of the infestations, however, range from maintenance condition to a 50-60% coverage that can be handled by conventional exotic management tactics.

*General management measures:* A general reduction of hog numbers within the preserve would greatly benefit the hydric hammock and many other natural communities. Staff will continue to monitor hydric hammocks for the presence of exotic plants. Planted pines in wetter areas should be felled by hand over time if there are no safety concerns as the areas are not suitable for contract logging. Staff should continue to allow fires to burn into the fringes of hydric hammock in order to push its boundaries back to historic limits. Three sections of the Seven-Mile Loop trail may be suitable for placement of low water crossings that would benefit hydric hammock and other nearby communities by achieving a more natural sheet flow. Details about any improvement activities planned for hydric hammock in the preserve are contained in the Resource Management Program section of this plan, in Goals and Objectives listed under the heading, Natural Communities Management.

Management of the coastal hydric hammock in the preserve must continue to feature the long-term, organized eradication of invasive exotic plants such as Brazilian pepper, skunkvine, Sprenger's asparagus-fern (*Asparagus aethiopicus*) and other exotics to counteract the heavy seed production and resilience of these exotic species. Most of the exotics management will consist of targeted basal bark treatment using appropriate herbicides. The occasional cutting of cedar trees by persons camping illegally on some hammock islands has proven to be a minor issue that will be dealt with as encountered.

## Mangrove Swamp

*Desired Future Condition:* Mangrove swamp occurs as a dense forest along relatively flat, low wave energy, marine and estuarine shorelines. The dominant over-story will typically include red mangrove (*Rhizophora mangle*) and black mangrove (*Avicennia germinans*), while white mangrove (*Laguncularia racemosa*), and buttonwood are rare components of some swamps. These species may occur in mixed stands, or often in differentiated, monospecific zones based on varying degrees of tidal influence, levels of salinity, and types of substrate. Red mangroves will typically dominate the deepest water, followed by black mangroves in the intermediate zone, with white mangroves and buttonwoods in the highest, least tidally influenced zone. Mangroves will typically occur in dense stands with little to no understory, but may be sparse, particularly in the upper tidal reaches where saltmarsh species predominate. Soils will generally be anaerobic and are saturated with brackish water at all times, becoming inundated at high tides. Mangrove swamps along the Citrus County coast occur primarily above solid limestone rock outcrops of the Homosassa-Lacoochee complex. In older mangrove swamps containing red mangroves, a layer of peat may build up over the soil from decaying plant material (primarily red and black mangrove roots).

*Description and assessment:* The mangrove swamps in the preserve occur in zone CR-WI1 and in the St. Martin's Keys. They are often surrounded by good quality seagrass beds or by bare substrate (i.e., estuarine unconsolidated substrate). Mangrove swamps can grade into adjacent salt marsh, but they more often occur as separate islands of vegetation. Larger, more developed islands may contain all four mangrove species, but the understory component of islands situated in deeper water can be completely inundated at all tides. The mangroves provide critical habitat for a variety of fish and wildlife and provide roosting and rookery areas for coastal bird species. The mangrove swamps in the preserve have not been subjected to storm or freeze damage in recent years and are in excellent condition.

*General management measures:* As with salt marsh, mangrove swamps require little active management other than periodic checks for damage from storms or human activity.

## Salt Marsh

*Desired future condition:* Salt marsh is a largely herbaceous community that occurs in the portion of the coastal zone affected by tides and seawater and protected from large waves. Salt marsh typically will have distinct zones of vegetation based on water depth and tidal fluctuations. In the Springs Coast region, needle rush (*Juncus roemerianus*) will dominate the seaward edge, the area most frequently inundated by tides. Saltgrass (*Distichlis spicata*) will dominate the higher, less frequently flooded areas. Other characteristic species will include saltmarsh cordgrass (*Spartina alterniflora*), saltmeadow cordgrass (*Spartina patens*), Carolina sea lavender (*Limonium carolinianum*), perennial saltmarsh aster (*Symphotrichum tenuifolium*), wand loosestrife (*Lythrum lineare*), and shoreline seapurslane (*Sesuvium portulacastrum*). A landward border of salt-tolerant shrubs including

groundsel tree (*Baccharis halimifolia*), saltwater falsewillow (*Baccharis angustifolia*), marshelder (*Iva microcephala*), and Christmasberry (*Lycium carolinianum*) may occur. Soil salinity and flooding will be the two major environmental factors that influence salt marsh vegetation. While there is little data on natural fire frequency in salt marsh, fire probably will occur there sporadically and in a mosaic pattern, given the patchiness of the fuels and the influence of creeks and salt flats.

Salt flat, a subtle variant of salt marsh, is embedded within the salt marsh throughout the preserve. A salt flat differs from salt marsh in that it occurs within areas of slightly higher elevation. It will flood only when storms or extremely high tides occur. It is isolated from sources of freshwater and becomes very saline and desiccated due to constant evaporation. One characteristic of salt flats in the Springs Coast region is that they tend to have large areas of exposed limerock which are washed free of soil due to the exclusion of thick vegetative cover. These areas will be dominated by species that can tolerate the extreme salinity, including saltwort (*Batis maritima*), annual glasswort (*Salicornia bigelovii*), perennial glasswort (*Sarcocornia ambigua*) and bushy seaside oxeye (*Borrchia frutescens*) or short grasses, such as saltgrass (*Distichlis spicata*), seashore paspalum (*Paspalum vaginatum*), and shoregrass (*Monanthochloe littoralis*).

*Description and assessment:* Salt marsh, including the salt flat variant, is by far the largest natural community by acreage in the preserve, and it is most definitely a defining feature. Salt marsh represents the seaward extent of the preserve in many places, with only tidal mangrove swamps extending further into the Gulf. Salt marsh is typically bordered by freshwater tidal marsh or coastal hydric hammock, but also occasionally by scrubby flatwoods. Large islands of salt marsh have formed on the seaward side of the Salt River. These islands range in size from less than an acre to a few hundred acres and are frequently dotted with patches of coastal hydric hammock. The salt marsh islands have become established on muck soils that were transported by constant river outflow and deposited in the estuary. The extent of the muck can vary from nonexistent in salt flat rock outcrops to more than two meters in depth elsewhere, frequently overlaying rock outcrop or substratum.

The quality of the salt marsh in the preserve is slightly compromised by the presence of historic mosquito and drainage ditches in zone CR-S3 and by various disturbances incurred during construction of highways SR 44 west and CR 494. In addition, the occasional airboat and vehicle trails that traverse the marsh have scarred some areas, creating sites of semi-permanent damage where the vegetation has been completely removed. Preserve staff have installed boulders in places where people have illegally driven trucks or ATVs into the marsh, and they have placed boundary signs as well, all of which has had the desired effect of lessening the severity of damage. Educational signage created by preserve staff is now present at all boat ramps in the area. The signs outline the importance of not running airboats over salt marsh vegetation. However, impacts such as those described above affect only a tiny fraction of the total area of salt marsh in the preserve, and the overall quality of this community is still excellent.

*General management measures:* In general, salt marsh is quite resilient and requires little active management. The areas that contain historical ditching could be returned to grade by pushing the adjacent berms into the low areas. This type of program will require long term development and funding as well as the cooperation of the SWFWMD. Staff will continue to exclude all vehicles from the high marsh, using a variety of deterrents including barriers and signage. Law enforcement agencies should be made aware of the long term detrimental effect of airboats that take short cuts and create trails across the salt marsh, and they should be encouraged to maintain enough presence to keep this damage from occurring on a regular basis.

### Sinkhole Lake

*Desired future condition:* Sinkhole lakes are relatively permanent, typically deep lakes formed in depressions in a limestone base. These lakes characteristically contain clear water with a high mineral content. Vegetation may be completely absent from some sinkhole lakes, while in others the vegetative cover may range from a fringe of emergent species to complete coverage by floating plants. Typical plant species will include smartweed, duckweed (*Lemna* spp.), bladderwort, and rushes (*Juncus* spp.). Important management goals include limiting disturbances that may cause unnatural erosion and sedimentation, and minimizing possible sources of pollution that might affect the connected aquifer system.

*Description and assessment:* Because of the extent of underlying limestone, Crystal River Preserve is dotted with numerous limestone-based features characteristic of karst topography. Some sinkhole lakes maintain a direct connection to the Floridan aquifer. Lakes that are close to hiking trails can be subject to littering, soil compaction, and disturbance of vegetation. In general, the sinkhole lakes in the preserve are in excellent condition.

*General management measures:* Management of sinkhole lakes must emphasize protection. The edges of sinkhole lakes need to be protected from impacts that could accelerate erosion and sedimentation. Increased erosion can cause a decline in water quality, especially if a karst window is present. Access to most of the sinkhole lakes is usually restricted except for legitimate research purposes or park management activities. An additional management need is protection of the quality and quantity of groundwater and surface waters feeding the sinkhole lakes.

### Seepage Stream

*Desired Future Condition:* A seepage stream can be characterized as a narrow, relatively short perennial or intermittent stream formed by percolating water from adjacent uplands. Water color will be clear to slightly colored, with a fairly slow flow rate and fairly constant temperature. Bottom substrate is typically sandy, but may include gravel or limestone.

*Description and assessment:* Seepage streams are numerous within the northern management units (i.e., Hollins Tract) as small creeks that drain the upland areas

along the eastern boundary of the preserve. One such stream flows through the currently undeveloped Nature Coast Mine property and enters the preserve at zone CR-H19. As of 2016, mine operations had not begun, but necessary permits are in place for this development to proceed, including a significant alteration (i.e., channelization and ditching) of the natural hydrology of this seepage stream. Upstream of the preserve, this seepage system is in poor condition because it receives untreated local stormwater runoff. However, downstream of the mine and within the preserve, this seepage stream is in good condition. Similar seepage streams are found in this region of the preserve. Stormwater runoff from areas outside of the preserve can impact these seepage systems.

*General management measures:* Protection of the watersheds of seepage streams is important in maintaining and enhancing water quality and quantity. Dramatic changes can occur to down grade wetland systems from impacts associated with un-attenuated stormwater runoff.

#### Estuarine Consolidated Substrate

*Desired Future Condition:* Estuarine consolidated substrates are mineral based natural communities generally characterized as expansive, relatively open areas of subtidal, intertidal, and supratidal zones which lack dense populations of sessile plant and animal species. Due to the difficulties of mapping these subtidal and intertidal natural communities individually, they are lumped for mapping purposes as salt marsh, but are listed separately to identify the types found within the preserve.

This consolidated substrate community consists of open, relatively unvegetated areas, with solidified rock or other substrate typically composed of limerock, or shell conglomerate materials. Limerock-based substrates primarily occur as outcrops of bedded sedimentary deposits consisting primarily of calcium carbonate. These substrate areas are important because they form the foundation for the development of other estuarine natural communities when conditions become appropriate. Some planktonic, pelagic, or other plants may be sparsely present. Desired conditions include minimizing disturbance attributed to placement of fill material, vehicular traffic, or the accumulation of pollutants.

*Description and assessment:* Estuarine-based limestone outcrops are common along tidal creeks, salt marshes and coastal shore habitats of the preserve. These outcrops are important since shellfish, particularly oysters, often colonize them. The full extent of this community within the preserve is unknown at this time. Where this community type is observed, it is in good to excellent condition and is important for wildlife such as marine turtles that use the preserve as nursery grounds.

*General Management Measures:* Like salt marsh, this community is fairly resilient and requires little active management other than periodic checks for damage from storms or human activity.

## Estuarine Unconsolidated Substrate

*Desired Future Condition:* Estuarine unconsolidated substrates are mineral based natural communities generally characterized as expansive, relatively open areas of subtidal, intertidal, and supratidal zones which lack dense populations of sessile plant and animal species. Due to the difficulties of mapping these subtidal and intertidal natural communities individually, they are lumped for mapping purposes as salt marsh, but are listed separately to identify the variety of community types found within the preserve.

This unconsolidated substrate community consists of expansive unvegetated, open areas of unconsolidated mineral based substrate composed of shell, marl, mud, and/or sand. These substrates are important in that they form the foundation for the development of other estuarine natural communities when conditions become appropriate. Unconsolidated substrate communities are associated with and often grade into salt marsh, mangrove swamp, and mollusk reef.

This community may support a large population of infaunal organisms as well as a variety of transient planktonic and pelagic organisms such as tube worms, sand dollar (*Clypeasteroidea*), mollusks, isopods, amphipods, burrowing shrimp (*Thalassinidea*), and an assortment of crabs. While these areas may seem relatively barren, the densities of infaunal organisms in subtidal zones can reach the tens of thousands per meter square, making these areas important feeding grounds for many bottom feeding fish, such as red drum (*Sciaenops ocellatus*), southern flounder (*Paralichthys lethostigma*), spot (*Leiostomus xanthurus*), and sheepshead (*Archosargus probatocephalus*). The intertidal and supratidal zones are extremely important feeding grounds for many shorebirds and invertebrates. Desired conditions include preventing soil compaction, dredging activities, and disturbances such as the accumulation of pollutants.

*Description and assessment:* Although some estuarine unconsolidated substrate communities within the preserve have limited amounts of sand deposition from adjacent uplands, most of this community along this low energy coastline is dominated by mud deposits. Most upper reaches of tidal creeks within the preserve commonly have extensive mud flats that are important feeding areas for wading birds and shorebirds. Additionally, when these areas are tidally inundated, they can be used as resting/feeding grounds for other wildlife such as ornate diamond-back terrapins (*Malaclemys terrapin macrospilota*) and the three species of marine turtle known from the preserve. This community type is in good to excellent condition.

*General Management Measures:* Like salt marsh, this community is fairly resilient and requires little active management other than periodic checks for damage from storms or human activity. Heavy pollution disturbance such as an accumulation of toxic levels of heavy metals, oils, or pesticides within these unconsolidated substrates can become problematic and impact the local food web. Significant amounts of these compounds in the sediments can kill infaunal organisms, thereby eliminating a food source for certain fishes, birds, and other organisms.

## Altered Landcover Types

Most of the preserve has only been under the active management of the Florida Park Service and the CAMA division of DEP before that since the late 1990s. Land use in various parts of the preserve before state acquisition included naval stores/turpentine industry, cattle ranching, silviculture including harvest and planting of cedars and pines, hunt parcel leases, and dragline dredging for road building and lime rock mining. Most of these activities occurred after 1897 (Hollins 2016; Dunn 1989). These activities produced on much of the preserve alterations in the natural land cover from mild to severe.

The dramatic changes that took place in the landscape between 1944 and today are clearly evident in historical aerial photographs. By 1944, small sections of flatwoods near the current Ecowalk Trailhead (i.e., in zone CR-H71e) had been converted to improved pasture. Ditching to drain the US 19 corridor had directed water into the preserve just west of there, but little additional development other than the building of Fort Island Trail and Ozello Trail had occurred. Much of the original old growth longleaf pine in the driest flatwoods sections had been cleared from the site following turpentine operations early in the 20<sup>th</sup> century. Ditching for marsh drainage, road building or mosquito control in the marsh south of Ozello Trail and borrow pit mining for limerock and developments occurred in the 1960s. Prominent mine pits are found off Powerline Road in zones CR-H70e and CR-H70w and off Fort Island Trail in zones CR-C3a and CR-C3k. Miles of canals used for access and drainage were installed between 1965 and 1972. In 1973 and 1974, over 675 acres of flatwoods and adjacent communities were converted to either loblolly or slash pine plantations. Much of the plantation that was placed in marginal habitats such as river marsh has since succumbed to extremes of salt and inundation. The restoration process for plantations in the preserve has progressed significantly since 2006, when major offsite slash pine harvests and growing season burning was first introduced. Even areas of the preserve that had an established history of burning have dramatically improved during that time span due to an increased commitment to more frequent burning, particularly growing season burns.

### Abandoned Pasture

*Desired future condition:* The long-range plan for the abandoned pastures in the preserve is to restore them to the natural community that originally occurred there, in this case mesic flatwoods. The desired future condition, after the initial phase of what will be an extended period of restoration, will be a very basic version of flatwoods community (as defined by FNAI) that contains a modest assortment of representative species such as longleaf pine, saw palmetto, shiny blueberry (*Vaccinium myrsinites*) and wiregrass, and that has had pervasive wax myrtle and saltbush reduced or removed. Cabbage palms that have proliferated here will be eliminated from the restoration area. Large live oaks that remain here will be unmanaged except for the effect that repeated fires and age will have on them (refer to the Desired Future Conditions Map in the Natural Resource Management, Natural Community Restoration section of this plan).

*Description and assessment:* The abandoned pasture in the preserve covers the majority of zones CR-H71w and CR-H71e. There are also roughly 37 acres that were once in improved pasture dominated by bahia grass that will be classified as semi-improved. The remainder of this altered landcover type has had various ditching, clearing and berm building projects from the 1940s to the 1970s that have altered the sheet flow and contributed to the abundance of wax myrtle, dog fennel (*Eupatorium capillifolium*) and dewberry (*Rubus trivialis*).

Small pockets of abandoned pasture contain vegetative remnants of their former natural community such as the occasional pawpaw (*Asimina reticulata*), meadowbeauty (*Rhexia spp.*) or atamasco lily. Exotic species such as cogon grass, purple sesban (*Sesbania punicea*), rattlebox (*Crotalaria spp.*), Chinese tallowtree, and nutgrass (*Cyperus spp.*) have all taken up residence in disturbed pasture areas and are under various stages of control. This problem is exacerbated by the presence and influence of feral hogs. Prescribed fire has assisted in management of the shrub layer here and in control of some exotics. Northern bobwhite (*Colinus virginianus*), deer (*Odocoileus virginianus*) and American kestrel (*Falco sparverius*) are among the desirable species that the pasture areas still support when well managed for an open condition.

*General management measures:* These two zones should continue to be burned and cabbage palm should continue to be removed as much as possible to aid in fire application and general restoration. Reduction of feral hog impacts will also be key to limiting ongoing disturbance in the pasture areas. Mowing of wax myrtle has produced variable results, but should continue to assist in shrub control. A restoration plan that includes elimination of all turf grasses and other exotic plants coupled with restoration of the natural grade and native groundcover needs to be developed.

### Canal/Ditch

*Desired future condition:* If restoration becomes a possibility, the desired future condition for various sections of the ditch described below will likely be salt marsh, river marsh or hydric hammock, depending on the location.

*Description and assessment:* Ditches were cut in various places in the preserve historically for drainage or to borrow material for road building. These occur adjacent to existing roads and trails that cut through the preserve along the 7-mile Loop Trail and along public roads traversing the park. In addition there were access canals cut in the vicinity of River Haven development in zone CR-S4. Lastly, sometime between 1944 and 1973, 2.45 miles of canals were cut as part of an unknown development south of Ozello Trail in zone CR-S3. The ditches extant in the preserve appear to be standard dragline ditches where the material was either removed, laid next to the canal in a spoil bank or used to build up the adjacent road bed. The ditches vary in width from only a few feet to over 15 feet.

*General management measures:* No active management is necessary other than occasional survey for exotic plants and treatment as needed. Given the extent of

the ditching, restoration would require the drafting of a detailed restoration and monitoring plan involving SWFWMD personnel.

### Developed

*Desired future condition:* There are no current plans to convert any of the developed areas back to their original natural community.

*Description and assessment:* Crystal River Preserve has various developed areas including the Office/Visitor Center complex in zone CR-CR-H1, five trailheads, one visiting scientist office area in zone CR-H71e and the shop complex in zone CR-H67. The shop area includes two residences, three shop and fire equipment buildings and many smaller shed and storage areas. The largest developed trailheads are at the Eco-Walk and Churchhouse Hammock trails. The trailhead area at Eco-Walk includes two buildings that house Gulf Archaeological Research Institute (GARI) with its visiting scientist.

*General management measures:* Resource management in the developed areas will focus on removal of all priority invasive exotic plants (i.e., Florida Exotic Pest Plant Council (FLEPPC) Category I and II species) and replacement of landscaping with native species where possible. Other management measures will include maintenance of proper storm water and waste water management facilities and the designing of future development so that it is compatible with prescribed fire management in adjacent natural areas. Shop area boundaries will be set and enforced to prevent accumulation of materials outside the designated area in the surrounding hammock.

### Impoundment/Artificial Pond

*Desired future condition:* Due to the high water table and coastal influence, all borrow pit areas of any depth over a foot hold water year round and will be classed as artificial ponds. For the restorable borrow pit sites within the two parks, the desired future condition will be mesic flatwoods, basin marsh or scrubby flatwoods depending on location. Some pits are too large to entertain ideas of full restoration, but may be improved in some other way. Details are provided below.

*Description and assessment:* Small scale borrow pit ponds occur throughout the park with a concentration along the north end and in the Dixie Shores area (zones CR-C3 and CR-C5). Another isolated borrow pit holding brackish water occurs off of Ozello Trail. Most borrow pits appear along roadways and were likely used as sources of road base and fill during original construction. Due to the rocky geology of the coast, most of the deeper pits have a limerock bottom, with shallower areas having a disintegrated marl substrate. Vegetation varies from native emergent marsh vegetation such as sawgrass to mats of submerged native and exotic weeds such as water-milfoil (*Myriophyllum heterophyllum*).

The large Dixie Shores borrow pits and spoil areas in zone CR-C3 were created as part of the Suncoast City Developments beginning in 1962 (Dixie Shores Property

Owners Association 2016). These borrow areas were part the master plan for the development of additional residential lots that were never fully implemented. The soil and limerock material from these borrow pits was used for fill on house lots in low lying areas of the development. Most of the borrow areas were abandoned and now remain as partially vegetated, open water limerock pits. There is at least one borrow pit that has a connection to the salt marsh and thus receives periodic tidal flows, however the majority are not connected. Nearly all of these open water borrow pits are vegetated and do support various wildlife including fish. A long pit in zone CR-C5c behind Connel Heights Fire Station is shallower than those described above and occurs in deeper soils. Much of the vegetation there is the same as is found in basin marshes in the area, but is dominated by emergent vegetation such as arrowhead (*Sagittaria latifolia*).

The largest and deepest borrow area is actually a 19.4-acre mine pit lake that was excavated for limerock in the very early 1970s. It is adjacent to a two smaller pits and a 5.3-acre scraped area that is approximating a depression marsh function with almost total sawgrass coverage. The pit water depth is from 17 to just over 40 feet. It is bermed along the edges with spoil material and vegetation including cabbage palm and wax myrtle, but it contains very little aquatic vegetation due to the depth.

*General management measures:* Artificial pits/ponds/lakes located within pyrogenic communities should be incorporated into the fire treatment area when burns are conducted. Exotic species should be removed where possible. All pits should be evaluated for feasibility of restoration. Shallower pits are likely to be restorable to grade, but some of the larger pits will require that a plan to make them most functional as some sort of wetland or lake community be drawn.

### Invasive Exotic Monoculture

*Desired future condition:* These areas will be converted back to coastal hydric hammock.

*Description and assessment:* 48 acres of hammocks that fit this Community description exist in zones CR-S5 and CR-S6. These coastal hydric hammocks are isolated by water and marsh, requiring boat travel to access. They are completely infested with adult Brazilian pepper that constitutes nearly 100% cover. There is little native vegetation once the transitional zone from salt marsh is passed.

*General management measures:* The conversion of these areas to native vegetation will not be easy, requiring a plan that involves mechanically clearing access trails through the vegetation, chemical treatment of the Brazilian pepper and retreatment of the future sprouts emerging from the heavy seed layer in the bottom of the hammock. When this has been accomplished, the state of the hammock will need to be evaluated for reestablishment of native vegetation such as the palms, cedars and other plants characteristic of this area.

## Pasture – Semi-Improved

*Desired future condition:* The long-range plan for the semi-improved pastures at the preserve is to restore them to the natural community that originally occurred there, in this case mesic flatwoods. The desired future condition, after the initial phase of what will be an extended period of bahia grass removal, will be a very basic version of flatwoods community that contains a modest assortment of representative species such as longleaf pine, saw palmetto, shiny blueberry and wiregrass (see Desired Future Conditions Map in the Natural Resource Management, Natural Community Restoration section of this plan).

*Description and assessment:* The semi-improved pasture in the preserve occurs as patches within the matrix of the abandoned pasture type in zones CR-H71e and CR-H71w along with natural communities of mesic flatwoods, basin swamp and depression marsh. There are also roughly 37 acres of this improved pasture cover that are dominated by bahia grass. Occasional wax myrtle, dog fennel, and dewberry occur as well. Natives such as atamasco lily or starrush (*Rhynchospora colorata*) occur in response to fire and hydrological regimes. Staff has attempted to restore the flatwoods groundcover on three acres of this community in zone CR-H71e as a demonstration plot; results were mixed.

*General management measures:* A restoration plan that includes elimination of all turf grass and other exotic plants coupled with restoration of the native groundcover needs to be developed.

## Road

*Desired future condition:* There are no plans to abandon the paved road and restore it to its original natural community. If any unpaved roads are deemed unnecessary and are abandoned in the future, their desired future condition will be reversion to whatever natural communities they pass through.

*Description and assessment:* A paved road extends from the main park entrance and accesses the Mullet Hole fishing area, Crystal Cove trails and the Visitor Center/Office complex situated on the Crystal River. The paved shop road off of Powerline Road accesses the shop and two residence buildings. Numerous unpaved roads serve double duty as trails and fire breaks within the park and along boundaries. Over 2.9 miles of unpaved trails have been eliminated since 2006 by combining management units, removing centipede grass and closing to all traffic. Other unpaved road sections at the preserve are raised with fill; these will be classed as a spoil area to facilitate removal or conversion (See Spoil Area treatment below). The condition of the paved roads from a transit standpoint is good to fair; each will require resurfacing in the next few years.

*General management measures:* Other unpaved roads not in use will be eliminated via the previous methods or by restoring to grade.

## Restoration Natural Community

*Desired future condition:* The desired future condition for the restoration natural community sites described below will be sandhill.

*Description and assessment:* There are two former sandhill sites in the preserve that fit the FNAI description for an altered landcover type recently defined as restoration natural community. One site is located in zone CR-H20 and the other is in CR-C7C.

The CR-H20 site, about 15.7 acres in size, is situated directly south of the preserve's shop area. Much progress has been made, but the restoration process is still underway. This area suffers from previous heavy land uses including turpentine operations, cattle ranching, conversion to a wildlife food plot/dove field, and commercial timber operations. Currently, the groundcover expected to occur in a healthy sandhill is sparse to absent. Invasive turf grasses as described above are present over approximately five acres at roughly 25% density. Offsite planted pines still dominate the over-story and native turkey, post and sand live oaks are sparse. Though this area has been burned twice and had 200 longleaf pines per acre planted in 2012, it is still in need of major groundcover restoration efforts.

The CR-C7c site, about 12.7 acres in size and located just west of U.S. Highway 19 off Arber Court, is a native longleaf sandhill section that was clear-cut prior to state acquisition. 1949 aerial photos show that there was no evidence then of an access road or other activity there, including turpentine or tree harvesting.

*General management measures:* Zone CR-H20 requires much more restoration work, including additional herbicide treatment, groundcover plantings and further application of prescribed fire. Other than that, the most important factor will be the continued use of frequent prescribed fire, which is essential to maintaining community structure and ecological integrity.

## Spoil Area

*Desired future condition:* In the event that restoration becomes a possibility, the desired future condition for various sections of spoil at the preserve will be scrubby flatwoods, mesic flatwoods, salt marsh, or coastal hydric hammock, depending on the original natural community.

*Description and assessment:* In multiple areas, historic limerock mining, road building and other development from 1962-1973 left deposits of soil and limestone boulders in many areas of the preserve. These almost always occur as deposits adjacent to canals, old mine pits and larger limerock borrow areas described above under Artificial Pond heading. These spoil mounds can be as high as 22 feet above the natural grade. Usually a subset of the plants inhabiting the closest community of the same elevation take up there, along with various native and exotic weed species, including highly invasive plants. Cabbage palms, red cedar, and sugar hackberry favor these calcareous disturbed sites as well as other species including

beauty berry, foxtail grass (*Setaria parviflora*), prickly pear, and beggarticks (*Bidens alba*). Coastal spoils are particularly prone to having invasive exotics including lantana (*Lantana camara*) and Brazilian pepper infesting them.

*General management measures:* No active management is necessary other than occasional survey for exotic plants and treatment of these as needed. This plan will not cover the scope of project necessary to restore even the most modest spoil areas on the preserve.

### Successional Hardwood Forest

*Desired future condition:* The long range plan for the now heavily hardwood-invaded 31 acre area in zones CR-H5/ CR-H6 (i.e., Churchhouse Hammock) is to restore it to the natural community that originally existed there, in this case a transitional area that included elements of sandhill, flatwoods and mesic hammock. Analysis of a 1952 aerial photo revealed that this area looked very open and appeared similar to some of the mesic to dry flatwoods on the Hollins Tract. It will have species typical of flatwoods in this area, including wiregrass, shrubby oaks, and open groundcover. The flatwoods fringe along the mesic hammock will contain a pine over-story with winged sumac and saw palmetto in the shrub layer and groundcover typical of what is described for this community above. Most of the invading hardwoods (e.g., laurel oak, black cherry (*Prunus serotina*)) will be eliminated from the restoration area (see the Desired Future Conditions Map in the Natural Resource Management, Natural Community Restoration section of this plan).

*Description and assessment:* The area above in Churchhouse Hammock has remnant pines present, longleaf pines at the trailhead area and some loblollies further back. Catface scars, nails and sheet metal fragments characteristic of turpentine operations are present on many of the pines here. The entire site has been heavily invaded by laurel oaks up to 14" in diameter. In addition, a thick coverage of cabbage palm has developed here. Trees characteristic of adjacent mesic and hydric hammock communities are also present, including pignut hickory and magnolia. Other remnants of the pine community that once existed here are present in the form of sand post oak, wiregrass, gopher tortoise (*Gopherus polyphemus*) and six-lined racerunner (*Aspidoscelis sexlineata*). This area has had its first prescribed fire, but it needs repeated fires to remove the bulk of the fuel load that has built up over several decades.

*General management measures:* Substantial effort will be required to restore pyrogenic natural communities in areas that have changed to successional hardwood forest. Such areas will generally not be targeted for intensive restoration activities such as offsite hardwood removal until the natural communities that are still relatively extant in the parks have been restored to the desired degree. However, prescribed burning of the altered areas will continue. Limited removal of palms and laurel oaks will continue after each fire cycle to open the pine dominated areas.

## **Special Natural Features**

Florida's Gulf Coast is often referred to as "one of the least polluted coastal regions of the continental United States" (Mattson et al. 2007). The Gulf Coast region from the St. Marks River south to the Homosassa River contains the state's largest remaining stretch of high quality hydric hammock natural community, with Crystal River Preserve itself protecting nearly 4,000 acres. More than half of the original extent of this rare coastal ecosystem throughout its former range has been lost, with roughly 36,000 acres remaining (Desantis et al. 2007; FWC Legacy 2012). Public lands, including those in the preserve, protect nearly 75% of this existing hammock, but external threats such as alterations in historic groundwater flows and natural community changes due to climate variability could dramatically alter these figures (Raabe and Stumpf 1996; Castaneda and Putz 2007). Hydric hammocks play a critical hydrological role in natural surface water detention and subsequent freshwater releases to downslope communities such as estuaries (Simmons et al. 1989). The timing, volume and duration of natural sheetflow groundwater discharge through hydric hammocks into the estuarine systems is of critical ecological importance. Even a small perturbation such as a two inch drop in groundwater level during a dry season can dramatically alter the hydric hammock at Crystal River Preserve.

## **Natural Communities Management Goals, Objectives, and Actions**

### **Goal: Restore and maintain the natural communities/habitats of the park.**

The DRP practices natural systems management. In most cases, this entails returning fire to its natural role in fire-dependent natural communities. Other methods to implement this goal include large-scale restoration projects as well as smaller scale natural communities' improvements. Following are the natural community management objectives and actions recommended for the state park.

#### Prescribed Fire Management

Prescribed fire is used to mimic natural lightning-set fires, which are one of the primary natural forces that shaped Florida's ecosystem. Prescribed burning increases the abundance and health of many wildlife species. A large number of Florida's imperiled species of plants and animals are dependent on periodic fire for their continued existence. Fire-dependent natural communities gradually accumulate flammable vegetation; therefore, prescribed fire reduces wildfire hazards by reducing these wild land fuels.

All prescribed burns in the Florida state park system are conducted with authorization from the FDACS, Florida Forest Service (FFS). Wildfire suppression activities in the park are coordinated with the FFS.

**Objective A: Within 10 years, have 2,235 acres of the park maintained within the optimum fire return interval.**

- Action 1 Update annual burn plan.
- Action 2 Manage fire dependent communities by burning between 664 and 1,468 acres annually.
- Action 3 Incorporate 655 fire-type acres into new burn zones that will raise burnable acres in the preserve from 73% to 95% via installation of firebreaks, fuel mowing projects and use of specialized equipment as necessary to meet DRP standards.

Table 1 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>Table 1. Prescribed Fire Management</b>		
<b>Natural Community</b>	<b>Acres</b>	<b>Optimal Fire Return Interval (Years)</b>
Sandhill	99	1-3
Mesic Flatwoods	1,203	2-4
Wet Flatwoods	233	2-5
Scrubby flatwoods	307	3-8
Scrub	52	4-10
Sawgrass Marsh	878	2-5
Abandoned pasture	194	2-3
Annual Target Acreage	664-1,468	

Prescribed fire is planned for each burn zone on the appropriate interval. The park’s burn 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 burn objectives. Each annual burn plan is developed to support and implement the broader objectives and actions outlined in this ten-year management plan.

Crystal River Preserve has many fire adapted natural communities, with the greatest acreages represented by mesic flatwoods and freshwater marshes. The marshes include basin marsh, depression marsh, and the freshwater tidal marsh variant of floodplain marsh, all of which are dominated by sawgrass. There are also several hundred acres of scrubby flatwoods found primarily along Fort Island Trail and small pockets of scrub and sandhill, all requiring fire application to maintain optimum ecosystem health. Between 664 and 1,468 acres should be burned annually to restore and maintain the fire dependent communities in the preserve.

All the burn zones north of the Crystal River (Hollins Tract) have been burned one to four times since 2004. They are adapting well to the conversion of over 430 acres of former plantation back to a form of mesic flatwoods.

Over much of these zones, excessive cabbage palm invasion has resulted in very hot fires, but thinning of the palms has gradually improved herbaceous groundcover response and allowed for more manageable fire operations. During the preparation of burn zones, park management has made it a priority, for safety purposes, to significantly reduce the number of cabbage palms that are growing adjacent to firelines. Cabbage palms are notorious for torching and causing spot fires during prescribed burns. From 2006 to 2008, preserve staff implemented three major projects to establish new burn zones along the Fort Island Trail section of the preserve, including over 20,250 feet of new fireline constructed and 19.5 acres of overgrown scrub mowed (in zones with CR-C3x and CR-C5x designations). As of 2016, management projects like these have allowed preserve staff to burn 122 acres of a total of 385 fire-type acres along the Fort Island Trail. However, the untreated scrub continues to be backlogged and remains an obstacle to full success of the fire program at the preserve. Additional mowing will likely be required to make the remaining scrub zones safe to burn.

Remaining fire-type acres in the preserve occur within scattered hammocks adjacent to salt marsh or along the eastern third of Ozello Trail in a matrix of hydric hammock and swamps. These backlogged areas have yet to be carved into burn zones, but planning toward this goal has begun. While some mowing has occurred within zones CR-C5e and CR-C7b, most of the backlogged areas will need major fireline work before they can be classified as bona fide burn zones.

The Sterchi Tract (zones CR-C7c & CR-C7h), located behind the closed Pro-Line boats factory at the end of Arber Court west of Highway US 19, contains 197 acres of fire-type community (sandhill, scrub and mesic flatwoods), 15 acres of which has been burned to date. Much of the remaining area is ready to burn, only needing the correct condition range. The scrub in the western part of this area (CR-C7c) is overgrown and should be mechanically treated prior to burning.

Fire dependent wildlife species in the preserve include the gopher tortoise, indigo snake, and eastern diamondback rattlesnake (*Crotalus adamanteus*). All of these species favor areas that support vegetation and prey that are enhanced by regular burning (Means and Campbell 1982, Morin 2005, Steen et. Al 2013). There are no recent records for Sherman's fox squirrel or Florida mouse from the preserve. These species have occupied portions of the preserve historically, remain in the region, and may return if correct habitat conditions are promoted and maintained with fire. In all of these cases, it will be modification of the structure of remaining overgrown areas with mechanical treatments and frequent fire that will reveal the potential for recovery of the open, diverse groundcover that these species depend on.

In order to track fire management activities, the DRP maintains a statewide burn database. The database allows staff to track various aspects of each park's fire management program including individual burn zone histories and fire return intervals, staff training and experience, backlog, etc. The database is also used for annual burn planning which allows the 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 towards meeting annual burn objectives.  
Natural Community Restoration

In some cases, the reintroduction and maintenance of natural processes is not enough to reach the desired future conditions for natural communities 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 community 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 will 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 exotic plants, and small-scale vegetation management.

Following are the natural community/habitat restoration and maintenance actions recommended to create the desired future conditions in altered landcover types such as successional hardwood forest, restoration natural community and exotic invasive monoculture (see Desired Future Conditions Map).

***Objective B: Conduct habitat/natural community restoration activities on 18.4 acres of restoration natural community.***

- |          |   |
|----------|---|
| Action 1 | Develop/update a site-specific restoration plan for converting 18.4 acres (CR-H20=5.7 ac; CR-C7c=12.7 ac) of restoration natural community back to the original sandhill.   |
| Action 2 | Implement the restoration plan, including but not limited to: <ul style="list-style-type: none"><li>• Removal of nonnative turf grass on approximately 5.7 acres in zone CR-H20.</li><li>• Thinning of adult turkey oaks on 12.7 acres in zone CR-C7c.</li><li>• Burning of sites and planting of native groundcover species, including wiregrass.</li><li>• Reestablishment of longleaf pine as the dominant over-story tree by planting 300-400 seedlings per acre.</li></ul> |
| Action 3 | Biennially conduct groundcover surveys similar to previous surveys in the preserve to assess percent target condition reached.  |

Staff will initiate habitat restoration measures for natural systems in the preserve wherever natural communities have been artificially impacted and where ecological

functions have been disrupted. Due to the rare occurrence of sandhill in the preserve, this project is first priority among Objectives B - F.

***Objective C: Conduct habitat/natural community restoration activities on 31 acres of successional hardwood forest.***

- Action 1      Develop/update a site-specific plan to restore 31 acres of successional hardwood forest in zones CR-H5 and CR-H6 to mesic flatwoods.
- Action 2      Implement the restoration plan, including but not limited to:
- Removal of invasive cabbage palms over the extent that was historically open flatwoods.
  - Protection of cat-faced adult pines from fire damage during prescribed fire operations.
  - Girdling of laurel oaks within the restoration target area.
  - Mowing of thickets of smaller oaks to open up the sites before initiating prescribed burn operations.
  - Continuing to limit the coverage of native/nonnative vines (i.e., air-potato) in the restoration area by using accepted control methods.
- Action 3      Continue photo-point monitoring and begin biennial groundcover surveys to determine success of restoration activities.

Staff will initiate habitat restoration measures for natural systems in the preserve where natural communities have been impacted and where ecological functions have been disrupted. This project is second priority among Objectives B - F.

***Objective D: Conduct habitat restoration on 193 acres of pasture areas.***

- Action 1      Develop a site-specific plan to restore 193 acres (37 ac. semi-improved pasture; 156 ac. abandoned pasture) in zones CR-H71a and CR-H71b. (Initial restoration to begin with 50 acres described below)
- Action 2      Implement the restoration plan to a 16-acre section of semi-improved pasture in zone CR-H71a to restore basic mesic flatwoods conditions including but not limited to:
- Successive herbicide treatments of bahia grass monoculture areas to achieve a minimum 90% kill rate.
  - Establishment of appropriate groundcover components through collection of native seeds in other zones and planting of native shrubs.
  - Planting of 300-400 longleaf pine seedlings per acre to establish appropriate over-story cover.
- Action 3      Implement the restoration plan for a 34-acre section of abandoned pasture in zone CR-H71b to restore basic mesic flatwoods conditions including but not limited to:
- Mowing of large areas of invasive wax myrtle.
  - Herbicide treatment of bahia grass and dewberry covered sections to achieve a minimum 90% kill rate.
  - Establishment of appropriate groundcover components through collection of native seeds and planting of native shrubs.

- Planting of 300-400 longleaf pine seedlings per acre to establish appropriate over-story cover.
- Action 4 Through biennial vegetation surveys, determine success of the restoration projects by evaluating percent increase in native species coverage.

Staff will initiate habitat restoration measures for natural systems in the preserve wherever natural communities have been artificially impacted and where ecological functions have been disrupted. This project is third priority among Objectives B - F.

***Objective E: Conduct habitat/natural community restoration activities on 48 acres of exotic invasive monoculture.***

- Action 1 Develop/update a site-specific plan to restore 48 acres of exotic invasive monoculture (i.e., Brazilian pepper) in zones CR-S4 and CR-S5 to coastal hydric hammock.
- Action 2 Implement the restoration plan, including but not limited to:
- Cut-stump herbicide treatments on lines of Brazilian pepper trees to provide access into hammocks.
  - Sequential treatment of adult Brazilian pepper, section by section, until 95% control of adults is achieved on 48 acres.
  - Surveying of zones within two years of initial treatment and treatment of re-sprouting juveniles with foliar chemical application.
  - Removal of dead adult trees as necessary.
- Action 3 Continue vegetation surveys to determine percent cover of native species remaining.

Staff will initiate habitat restoration measures for natural systems in the preserve wherever natural communities have been artificially impacted and where ecological functions have been disrupted. Due to recent progress in removing exotics in surrounding areas, this is considered the lowest priority among the restoration projects.

Natural Community 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 preserve.

***Objective F: Conduct natural community/habitat improvement activities on 153 acres of mesic flatwoods natural community.***

- Action 1 Remove excessive cabbage palm coverage on 153 acres of mesic flatwoods in the Hollins Tract through mechanical and chemical means.
- Action 2 Thin over-story plantation pines to historic levels (ca. 30-40 basal area) on remaining 113 acres of mesic and wet flatwoods in zones CR-H33e, CR-H30, CR-H72, and CR-H73.

Action 3 Plant 300-400 longleaf pines per acre to restore the appropriate over-story component on remaining 69 acres of former plantation in zones CR-H24, CR-H29, and CR-H15.

Staff will initiate habitat improvement measures for natural systems in the preserve wherever natural communities have been artificially impacted and where ecological functions have been disrupted.

### **Imperiled Species**

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

Thirteen imperiled plant species and 40 imperiled animal species have been recorded at Crystal River Preserve (see Table 2 below). Given the wide variety of natural communities in the preserve, it is not surprising that there is a high diversity of imperiled plants and animals there as well.

One of the more notable imperiled plants in the preserve is the manyflowered grasspink (*Calopogon multiflorus*). This endangered orchid was documented in 2003 from a single observation by preserve staff. It is a fire-maintained species with populations that generally consist of only a few plants. The single plant documentation occurred in a zone that last burned in 2012. Continued use of prescribed fire, maintenance of natural hydroperiods, and protection of wetlands from impacts of park operations and recreational activities are all vital tools for conserving this and several other imperiled plants in the park, including Cateby's lily, yellow-flowered butterwort (*Pinguicula lutea*), blueflower butterwort (*Pinguicula caerulea*), gypsy-spikes (*Platanthera flava*), and spiked crested coralroot (*Hexalectris spicata*).

Restoration measures (e.g., fire and selective hardwood removal) that are effective at reducing canopy density in fire dependent natural communities will ultimately benefit groundcover species that require full sunlight (Kirkman et al. 2001). In fact, many of the preserve's flowering plants have already responded dramatically to recent restoration efforts, especially prescribed fire. However, herbiciding of invasive hardwoods to open up the canopy must be done very carefully to ensure that imperiled groundcover species are not harmed. Other potential threats to imperiled plants in the preserve include alteration of wetlands, plant poaching, and ground disturbance caused by rooting animals such as armadillos and feral hogs.

Imperiled animal species should also benefit from the prescribed fire program at the preserve. The specific effects of fire on most invertebrate assemblages is largely unknown, but the retention of unburned refugia within suitable habitats and adjustments to the frequency and seasonality of prescribed burns may be critical elements for continued survival of imperiled butterflies (Schweitzer et al. 2011).

Crystal River Preserve currently harbors a greater number of imperiled bird species (26) than any other class of vertebrates. The preserve is an important stopover point for many migrants, and its diverse wetlands provide suitable nesting habitat for imperiled residents such as the brown pelican (*Pelecanus occidentalis*), little blue heron (*Egretta caerulea*), snowy egret (*Egretta thula*), tricolored heron (*Egretta tricolor*), and yellow-crowned night heron (*Nyctanassa violacea*). Marian's Marsh Wren (*Cistothorus palustris marianae*) is an imperiled bird that inhabits salt marsh areas in the preserve. The population status of this species is still relatively unknown (Kale 1996; Sauer et al. 2014). A recent biological review of this species conducted by the FWC concluded that increased monitoring efforts were needed because of ongoing threats to salt marsh habitat along the Gulf Coast and a trend of declining marsh wren populations in the area (FWC 2011).

Another notable record for the preserve is the Florida scrub jay. This Florida endemic was last recorded in the preserve in the late 1990s, but it is now locally extirpated for unknown reasons. The substantial bird list for the preserve is the result of multiple organized bird counts over the years including Audubon Christmas Bird Counts since 1987, focused surveys along the Great Florida Birding Trail, and annual North American Migration counts.

Several imperiled reptiles occur within the preserve. The gulf salt marsh snake (*Nerodia clarki clarki*) has been found throughout the salt marsh and mangrove swamp communities of the preserve. This species is known to have a wide zone of intergradation throughout Citrus County and Levy County with a southern form known as the mangrove water snake (*Nerodia clarki compressicauda*).

The ornate diamond-back terrapin is an important and highly vulnerable species of greatest conservation need that forages and nests within estuarine habitats of Crystal River Preserve and the adjacent aquatic preserve (FWC 2012). The eastern indigo snake (*Drymarchon corais*) is a federally listed upland species that is becoming increasingly rare throughout its range due to loss and fragmentation of its critical habitat (Enge et al. 2013). Indigo snakes utilize gopher tortoise burrows as refugia and for thermoregulation, especially during periods of cold weather. An additional imperiled reptile species is the common kingsnake (*Lampropeltis getula*) which has also experienced significant population declines in recent decades. Populations appear to still exist in the Gulf Hammock region of the Florida Gulf Coast, based upon recent sightings.

The gopher tortoise is one of the better known imperiled reptiles in Florida. It is recognized as a keystone species of critical importance because hundreds of commensal species, mostly invertebrates, utilize their burrows as refugia (Jackson and Milstrey 1994). Tortoises typically inhabit well-drained sandy soils in a variety of upland habitats such as sandhill, mesic flatwoods, upland mixed woodland, and scrubby flatwoods. Because of its keystone status, the gopher tortoise is considered an indicator of upland natural community health. Prescribed fire is a vital tool used by managers to maintain tortoise habitat. In the absence of frequent fire, hardwood trees invade upland communities and shade out herbaceous plants required by tortoises for forage. The FWC has adopted a statewide protocol for monitoring

gopher tortoises based on a line transect distance sampling method (LTDS) (Smith et al. 2009). Any assessments of the status of gopher tortoise populations in the preserve should consider using this standard protocol.

Four species of marine turtle occur within the preserve's estuaries and adjacent waters of the Gulf of Mexico, namely Kemp's Ridley sea turtle (*Lepidochelys kempi*), hawksbill sea turtle (*Eretmochelys imbricata*), loggerhead sea turtle (*Caretta caretta*) and green sea turtle (*Chelonia mydas*). The life history for each of these marine turtles is complex. Nonetheless, it is well known that nearshore estuarine habitats adjacent to the park are extremely important as "early-age" feeding grounds for these species. The estuarine resources of the Springs Coast region are exceptionally diverse with lush beds of submerged aquatic vegetation (SAV) and highly productive benthic macroinvertebrate communities that attract young marine turtles year round. The constant pulses of freshwater into estuaries that are characterize this region are critical to maintaining natural hydrology and sustaining water quality and quantity in the lush SAV and benthic communities.

Imperiled mammal species known to occur in the preserve include the Sherman's fox squirrel (*Sciurus niger shermani*), Florida black bear (*Ursus americanus floridanus*), West Indian manatee (*Trichechus manatus latirostris*), and Florida mouse (*Podomys floridanus*). Other rare mammal residents include southeastern myotis (*Myotis austroriparius*) and Gulf salt marsh mink (*Neovison vison halilimnetes*).

In 2013, a Sherman's fox squirrel was recorded as a road-killed specimen on Fort Island Trail where it passes through a portion of the preserve, indicating that the species at least occasionally enters the preserve. Park staff have noted additional road-killed fox squirrels in areas adjacent to the preserve.

Although occasional signs of Florida black bear (*Ursus americanus floridanus*) have been noted in Crystal River Preserve, apparently no bears are permanent residents there. One of Florida's smallest bear populations exists in the area immediately south of the preserve near the Chassahowitzka River (Maehr et al. 2003). Research suggests that habitat fragmentation has played a detrimental role by isolating this group of bears from neighboring populations (Cox et al. 1994). In the early 2000s, wildlife biologists released and tracked a radio-collared black bear that was struck by a car on a road bordering the preserve. This individual almost immediately turned south and returned to the Chassahowitzka region.

Florida manatees are year-round residents of Kings Bay adjacent to the preserve. They are attracted to Kings Bay's abundant freshwater springs and associated SAV assemblages (Hauxwell et al. 2003). In fact, the manatee is one of the biggest tourist draws in the City of Crystal River, especially during winter months when manatees crowd into the relatively warm, aquifer-fed springs of the Kings Bay/Crystal River system. Manatees, however, do not seem inclined to enter the smaller tidal creeks and shallow estuarine waters that are actually within the official boundaries of Crystal River Preserve. Consequently, there are no known sightings of

manatees within the preserve itself and the Florida manatee is not listed in Table 2 below.

Table 2 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 Addendum 6.

<b>Table 2. Imperiled Species Inventory</b>						
<b>Common and Scientific Name</b>	<b>Imperiled Species Status</b>				<b>Management Actions</b>	<b>Monitoring Level</b>
	<b>FWC</b>	<b>USFWS</b>	<b>FDACS</b>	<b>FNAI</b>		
<b>PLANTS</b>						
Golden leather fern <i>Acrosticum aureum</i>			ST		10,13	Tier 1
Manyflowered grasspink <i>Calopogon multiflorus</i>			ST	G2G3, S2S3	1,2,10, 13	Tier 2
Chapman's sedge <i>Carex chapmanii</i>			ST	G3,S3	1,2,10, 13	Tier 1
Peninsula sedge <i>Carex paeninsulae</i>				G2G3, SNR	9,10, 13	Tier 1
Spiked crested coralroot <i>Hexalectris spicata</i>			SE		1,2,10, 13	Tier 2
Catesby's lily <i>Lilium catesbaei</i>			ST		1,2,10, 13	Tier 1
Cardinal flower <i>Lobelia cardinalis</i>			ST		2,10,1 3	Tier 1
Shell-mound pricklypear <i>Opuntia stricta</i>			ST		2,10, 13	Tier 1
Blueflower butterwort <i>Pinguicula caerulea</i>			ST		1,2,10, 13	Tier 1
Yellow-flowered butterwort <i>Pinguicula lutea</i>			ST		1,2,10, 13	Tier 1
Gypsy-spikes <i>Platanthera flava</i>			ST		1,2,10, 13	Tier 2

**Table 2. Imperiled Species Inventory**

Common and Scientific Name	Imperiled Species Status				Management Actions	Monitoring Level
	FWC	USFWS	FDACS	FNAI		
Giant wild pine <i>Tillandsia utriculata</i>			SE		10,13	Tier 1
Rainlily <i>Zephyranthes atamasco</i>			ST		1,2,10,13	Tier 1
<b>INVERTEBRATES</b>						
Mourning cloak <i>Nymphalis antiopa</i>				G5,S2	1,13	Tier 1
<b>REPTILES</b>						
American alligator <i>Alligator mississippiensis</i>	FT(S/A)	FT(S/A)		G5,S4	4,10,13	Tier 1
Loggerhead sea turtle <i>Caretta caretta</i>	FT	FT		G3,S3	4,13	Tier 1
Green turtle sea turtle <i>Chelonia mydas</i>	FT	FT		G3,S2S3	4,13	Tier 1
Eastern indigo snake <i>Drymarchon couperi</i>	FT	FT		G3,S3	1,10,13	Tier 2
Hawksbill sea turtle <i>Eretmochelys imbricata</i>	FE	FE		G3,S1	4,13	Tier 1
Gopher tortoise <i>Gopherus polyphemus</i>	ST			G3,S3	1,6,7,8,10,13	Tier 2
Common kingsnake <i>Lampropeltis getula</i>				G5,S2S3	10,13	Tier 2
Kemp's ridley sea turtle <i>Lepidochelys kempii</i>	FE	FE		G1,S1	4,13	Tier 1
Gulf salt marsh snake <i>Nerodia clarkii clarkii</i>				G4T3,S2	4,13	Tier 1
Suwannee cooter <i>Pseudemys concinna suwanniensis</i>				G5T3,S3	4,8,13	Tier 1
<b>BIRDS</b>						
Scott's seaside sparrow <i>Ammodramus maritimus peninsulae</i>	ST			G4T3Q,S3	2,4,9,13	Tier 2
Florida scrub jay <i>Aphelocoma coerulescens</i>	FT	FT		G2,S2	1,3,6,7,13	Tier 2

**Table 2. Imperiled Species Inventory**

Common and Scientific Name	Imperiled Species Status				Management Actions	Monitoring Level
	FWC	USFWS	FDACS	FNAI		
Limpkin <i>Aramus guarauna</i>				G5,S3	4,9,13	Tier 2
Short-tailed hawk <i>Buteo brachyurus</i>				G4G5, S1	13	Tier 2
Rufa red knot <i>Calidris canutus rufa</i>	FT	FT		G4T2	4,9,13	Tier 2
Wilson's plover <i>Charadrius wilsonia</i>				G5,S2	4,8,9, 10,13	Tier 2
Marian's marsh wren <i>Cistothorus palustris marianae</i>	ST			G5T3, S3	2,4,9, 13	Tier 2
Little blue heron <i>Egretta caerulea</i>	ST			G5,S4	4,9,13	Tier 2
Snowy egret <i>Egretta thula</i>				G5,S3	4,9,13	Tier 2
Tricolored heron <i>Egretta tricolor</i>	ST			G5,S4	4,9,13	Tier 2
Swallow-tailed kite <i>Elanoides forficatus</i>				G5,S2	13	Tier 2
White ibis <i>Eudocimus albus</i>				G5,S4	4,9,13	Tier 2
Merlin <i>Falco columbarius</i>				G5,S2	13	Tier 2
Peregrine falcon <i>Falco peregrinus</i>				G4,S2	13	Tier 2
Magnificent frigatebird <i>Fregata magnificens</i>				G5,S1	13	Tier 2
Whooping crane <i>Grus americana</i>	FXN	E,XN		G1,SN R	4,9,13	Tier 2
Florida sandhill crane <i>Grus canadensis pratensis</i>	ST			G5T2G 3,S2S3	4,9,13	Tier 2
American oystercatcher <i>Haematopus palliatus</i>	ST			G5,S2	2,4,8,9 10,13	Tier 2
Black rail <i>Laterallus jamaicensis</i>				G3G4, S2	2,4,9, 13	Tier 2

**Table 2. Imperiled Species Inventory**

Common and Scientific Name	Imperiled Species Status				Management Actions	Monitoring Level
	FWC	USFWS	FDACS	FNAI		
Wood stork <i>Mycteria americana</i>	FT	FT		G4,S2	4,13	Tier 2
Brown pelican <i>Pelecanus occidentalis</i>				G4,S3	4,13	Tier 2
Roseate spoonbill <i>Platalea ajaja</i>	ST			G5,S2	4,13	Tier 2
American avocet <i>Recurvirostra americana</i>				G5,S2	4,13	Tier 2
Black skimmer <i>Rynchops niger</i>	ST			G5,S3	4,9,10,13	Tier 2
Least tern <i>Sterna antillarum</i>	ST			G4,S3	4,8,9,10,13	Tier 2
Sandwich Tern <i>Thalasseus sandvicensis</i>				G5,S2	4,13	Tier 2
<b>MAMMALS</b>						
Florida mouse <i>Podomys floridanus</i>				G3,S3	1,6,8,13	Tier 2
Sherman's fox squirrel <i>Sciurus niger shermani</i>	SSC			G5T3,S3	1,2,6,7,13	Tier 1
Florida black bear <i>Ursus americanus floridanus</i>				G5T2,S2	10,13	Tier 1

**Management Actions**

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

## **Imperiled Species Management Goals, Objectives, and Actions**

### **Goal: Maintain, improve or restore imperiled species populations and habitats in the park.**

The 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 other native species or seriously compromise park values.

In the preparation of this management plan, DRP staff consulted with staff of the FWC's Imperiled Species Management or that agency'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 park 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 state park system is necessary to meet the DRP's 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 action and those that will provide management guidance through regular monitoring are addressed in the objectives below.

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

Additional surveys for imperiled plant and animal species are needed at Crystal River Preserve State Park to ensure that all imperiled species are documented. The DRP will enlist the assistance of academic researchers and staff from other agencies during development of species occurrence inventory lists, especially where necessary for certain taxonomic groups.

***Objective B: Monitor and document 4 selected imperiled animal species in the park.***

- Action 1      Develop monitoring protocols for 6 selected imperiled animal species including the gopher tortoise, eastern indigo snake, common kingsnake, Scott's seaside sparrow, Marian's marsh wren, and Sherman's fox squirrel.
- Action 2      Implement monitoring protocols for the 6 imperiled animal species listed in Action 1.

As upland natural community restoration and improvement projects proceed, particularly prescribed burning, it will be increasingly important to track gopher tortoise numbers. A GPS-based LTDS census of gopher tortoise burrows will be conducted prior to 2017 to track population trends and burrow distribution. Documentation of sightings of eastern indigo snakes and common kingsnakes will provide important information about the status of these declining species in the preserve. Additionally, documentation of Sherman's fox squirrels within the preserve is needed, so staff will record any new sightings of this species. Monitoring of Scott's seaside sparrow and Marian's marsh wren will be conducted through cooperative survey efforts with the FWC.

Crystal River Preserve serves as one of the primary monitoring locations for the annual National Audubon Christmas Bird Count (CBC) in the Crystal River area. The Citrus County CBC, which has been conducted for over 25 years, uses the same monitoring protocol every year and provides data on long-term population trends. Many of the imperiled bird species are documented annually during the CBC.

***Objective C: Monitor and document 3 selected imperiled plant species in the park.***

- Action 1      Develop monitoring protocols for 3 selected imperiled plant species including spiked crested coralroot, manyflowered grasspink, and gypsy-spikes.
- Action 2      Implement monitoring protocols for 3 imperiled plant species including those listed in Action 1 above.

Three imperiled plant species will be surveyed and documented periodically to detect the presence of any new populations that may have appeared in the park and assess their condition. These imperiled plants include spiked crested coralroot,

manyflowered grasspink, and gypsy-spikes, all indicator species of fire-dominated pine communities. Specific protocols will be developed and implemented for these species in cooperation with the Florida Natural Areas Inventory.

### **Exotic and Nuisance Species**

Exotic species are plants or animals not native to Florida. Invasive exotic species are able to out-compete, displace or destroy native species and their habitats, often because they have been released from the natural controls of their native range, such as diseases, predatory insects, etc. If left unchecked, invasive exotic plants and animals alter the character, productivity and conservation values of the natural areas they invade.

Exotic 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 exotic animals, the DRP actively removes exotic 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 venomous snakes or raccoons and alligators that are in public areas. Nuisance animals are dealt with on a case-by-case basis in accordance with the DRP's Nuisance and Exotic Animal Removal Standard.

Crystal River Preserve State Park has substantial infestations of invasive exotic plants (see Table 3 below). The primary means by which exotic plants spread into the preserve are escapes from adjacent private properties, dispersion by birds, and storm surges. Brazilian pepper and Chinese tallowtree, in particular, owe their dispersal to frugivorous birds. Sprenger's asparagus-fern is a popular groundcover plant that is still sold legally in Florida. It is seen in areas where landscape debris is dumped, although it is also carried by birds to offshore hammocks. Japanese climbing fern (*Lygodium japonicum*) is most often spread by floodwaters or by contaminated equipment or soil. Cogon grass sources typically include infested logging equipment, mowers, tractors and contaminated soil or limerock.

All management zones in the preserve have been surveyed for invasive exotic plants, and staff will continue to survey for them on a regular basis. At the time of this plan, approximately 744 infested acres covering approximately 3,430 gross acres of the preserve are being tracked as part of the invasive plant management program. Since 2004, about 2,305 gross acres of invasive exotic plants have been treated at Crystal River Preserve. Annual treatment has ranged from 44 to 388 acres depending on staff availability, contract funding levels, and weather conditions. Treatments have greatly reduced the density and coverage of exotics infestations in many areas. A complete Exotic Invasive Plant Integrated Management Plan has been drafted by the preserve biologist (FDEP 2012).

This plan describes in detail the exotic weeds of concern, treatment methods, and tactics for a multi-pronged approach to management including biological, mechanical, and chemical means of treatment and volunteer and educational methods of management. The plan is updated on a biennial basis.

In addition to FLEPPC Category I and Category II exotic species, the preserve contains invasive grasses such as centipede grass and bahia grass. These species persist on some trails and firebreaks as well as in the semi-improved pasture described above. They are invading some areas where fire and logging have opened up the groundcover layer.

The most significant exotic animal in the preserve is the feral hog. Hogs are plentiful in the preserve and cause significant damage to marshes and other seasonally wet areas.

Table 3 contains a list of the Florida Exotic Pest Plant Council Category I and II invasive, exotic plant species found within the park (FLEPPC, 2015). 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. For an inventory of all exotic species found within the park, see Addendum 5.

<b>Table 3. Inventory of FLEPPC Category I and II Exotic Plant Species</b>			
<b>Common and Scientific Name</b>	<b>FLEPPC Category</b>	<b>Distribution</b>	<b>Management Zone(s)</b>
<b>PLANTS</b>			
Brazilian pepper <i>Schinus terebinthifolius</i>	I	1	CR-C1, CR-C3, CR-C3a, CR-C4, CR-C5, CR-C6, CR-C7, CR-H1, CR-H4, CR-H72, CR-H73, CR-S2, CR-S3, CR-WI2, CR-WI3, CR-WI4e
Brazilian pepper <i>Schinus terebinthifolius</i>	I	2	CR-C1, CR-C3, CR-C4, CR-C5, CR-C5d, CR-C6, CR-H37, CR-H38, CR-S1, CR-S2, CR-S3, CR-S6, CR-S7, CR-S9, CR-S10, CR-WI2, CR-WI3, CR-WI4

Table 3. Inventory of FLEPPC Category I and II Exotic Plant Species			
Common and Scientific Name	FLEPPC Category	Distribution	Management Zone(s)
Brazilian pepper <i>Schinus terebinthifolius</i>	I	3	CR-C1, CR-C4, CR-C6, CR-S1, CR-S2, CR-S3, CR-S4, CR-S5, CR-S6, CR-S7, CR-S8, CR-S9, CR-S10, CR-WI2
Brazilian pepper <i>Schinus terebinthifolius</i>	I	4	CR-C3, CR-C6, CR-S1, CR-S2, CR-S3, CR-S6, CR-S7, CR-S8, CR-S9, CR-WI2, CR-WI3, CR-WI4
Brazilian pepper <i>Schinus terebinthifolius</i>	I	5	CR-S1, CR-S5, CR-S6,
Sprenger's asparagus-fern <i>Asparagus aethiopicus</i>	I	2	CR-C4, CR-C5, CR-WI2
		3	CR-C6
Camphor Tree <i>Cinnamomum camphora</i>	I	2	CR-C1, CR-C3a, CR-H2
Air-potato <i>Dioscorea bulbifera</i>	I	3	CR-H5, CR-H6, CR-C3a
Caesarweed <i>Urena lobata</i>	I	2	CR-H6b
Cogon grass <i>Imperata cylindrica</i>	I	2	CR-H71a, CR-H71b, CR-H70e,
		3	CR-H5, CR-H33
		4	CR-H4, CR-H5, CR-H76
Japanese climbing fern <i>Lygodium japonicum</i>	I	1	CR-H1, CR-H2, CR-C5
Torpedo grass <i>Panicum repens</i>	I	2	CR-H1
Mimosa <i>Albizia julibrissin</i>	I	2	CR-H5, CR-H6
Chinese tallowtree <i>Triadica sebifera</i>	I	1	CR-H71b, CR-H23, CR-C7h
		2	CR-C5c, CR-C3C, CR-H6
Wild taro <i>Colocasia esculenta</i>	I	2	CR-H6b

<b>Table 3. Inventory of FLEPPC Category I and II Exotic Plant Species</b>			
<b>Common and Scientific Name</b>	<b>FLEPPC Category</b>	<b>Distribution</b>	<b>Management Zone(s)</b>
Skunkvine <i>Paederia foetida</i>	I	1	CR-C1
		2	CR-C5c, CR-H4
Flamegold tree <i>Koelreuteria elegans</i>	II	2	CR-C3a
Paper mulberry <i>Broussonetia papyrifera</i>	II	2	CR-C1
Chinese ladder brake <i>Pteris vittata</i>	II	3	CR-H1, CR-H73
Rattlebox <i>Sesbania punicea</i>	II	2	CR-H71a

**Distribution Categories**

- 0 No current infestation: All known sites have been treated and no plants are currently evident.
- 1 Single plant or clump: One individual plant or one small clump of a single species.
- 2 Scattered plants or clumps: Multiple individual plants or small clumps of a single species scattered within the gross area infested.
- 3 Scattered dense patches: Dense patches of a single species scattered within the gross area infested.
- 4 Dominant cover: Multiple plants or clumps of a single species that occupy a majority of the gross area infested.
- 5 Dense monoculture: Generally, a dense stand of a single dominant species that not only occupies more than a majority of the gross area infested, but also covers/excludes other plants.
- 6 Linearly scattered: Plants or clumps of a single species generally scattered along a linear feature, such as a road, trail, property line, ditch, ridge, slough, etc. within the gross area infested.

**Exotic Species Management Goals, Objectives, and Actions**

**Goal: Remove exotic and invasive plants and animals from the park and conduct needed maintenance control.**

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

**Objective A: Annually treat 60 acres of exotic plant species in the park.**

- Action 1 Annually develop/update an exotic plant management work plan that includes desired, externally funded, contract treatment areas.
- Action 2 Implement the annual work plan by treating 45-70 acres in the preserve annually and continuing maintenance and follow-up treatments as needed.
- Action 3 Complete exotic plant surveys on a minimum of 1,715 acres of the preserve annually in order to stay current with conditions.

Continuous updates of exotic plant coverage surveys will guide future treatment locations and priorities. In general, there will continue to be an emphasis on retreatment of existing treatment zones and only incremental and small expansion into zones never before treated. In any given year, approximately 75% of the treatments executed by staff should be in previously treated areas, 15% should be in new treatment areas with the goal of eliminating seed sources adjacent to prior treatments, and 10% or less should be on county or private ROWs and other lands with permission.

In addition, each year staff will develop maps and scopes of work to execute contract treatment of zones that will serve the overall goal of expanding the areas in maintenance condition. Education and volunteer activities associated with exotic plant and animal species are discussed in the Exotic Invasive Plant Integrated Management Plan (2012).

***Objective B: Implement control measures to remove a minimum of 150 exotic feral hogs in the park annually.***

- Action 1      Establish and maintain at least one no-pay hog contract to assist staff in removal of feral hogs with an emphasis on protection of restoration areas and areas with significant cultural resources.
- Action 2      Repeat the established 18-station feral hog survey biennially to determine relative abundance in the preserve.

**Cultural Resources**

This section addresses the cultural resources present in the park that may include archaeological sites, historic buildings and structures, cultural landscapes and collections. The Florida Department of State (FDOS) maintains the master inventory of such resources through the Florida Master Site File (FMSF). State law requires that all state agencies locate, inventory and evaluate cultural resources that appear to be eligible for listing in the National Register of Historic Places. Addendum 7 contains the FDOS, Division of Historical Resources (DHR) management procedures for archaeological and historical sites and properties on state-owned or controlled properties; the criteria used for evaluating eligibility for listing in the National Register of Historic Places, and the Secretary of Interior's definitions for the various preservation treatments (restoration, rehabilitation, stabilization and preservation). For the purposes of this plan, significant archaeological site, significant structure and significant landscape means those cultural resources listed or eligible for listing in the National Register of Historic Places. The terms archaeological site, historic structure or historic landscape refer to all resources that will become 50 years old during the term of this plan.

**Condition Assessment**

Evaluating the condition of cultural resources is accomplished using a three-part evaluation scale, expressed as good, fair and poor. These terms describe the present condition, rather than comparing what exists to the ideal condition. Good

describes a condition of structural stability and physical wholeness, where no obvious deterioration other than normal occurs. Fair describes a condition in which there is a discernible decline in condition between inspections, and the wholeness or physical integrity is and continues to be threatened by factors other than normal wear. A fair assessment is usually a cause for concern. Poor describes an unstable condition where there is palpable, accelerating decline, and physical integrity is being compromised quickly. A resource in poor condition suffers obvious declines in physical integrity from year to year. A poor condition suggests immediate action is needed to reestablish physical stability.

### **Level of Significance**

Applying the criteria for listing in the National Register of Historic Places involves the use of contexts as well as an evaluation of integrity of the site. A cultural resource's significance derives from its historical, architectural, ethnographic or archaeological context. Evaluation of cultural resources will result in a designation of NRL (National Register or National Landmark Listed or located in an NR district), NR (National Register eligible), NE (not evaluated) or NS (not significant) as indicated in the table in Addendum 7.

There are no criteria for determining the significance of collections or archival material. Usually, significance of a collection is based on what or whom it may represent. For instance, a collection of furniture from a single family and a particular era in connection with a significant historic site would be considered highly significant. In the same way, a high quality collection of artifacts from a significant archaeological site would be of important significance. A large herbarium collected from a specific park over many decades could be valuable to resource management efforts. Archival records are most significant as a research source. Any records depicting critical events in the park's history, including construction and resource management efforts, would all be significant.

The following is a summary of the FMSF inventory. In addition, this inventory contains the evaluation of significance.

#### Prehistoric and Historic Archaeological Sites

*Desired future condition:* All significant archaeological sites within the park that represent Florida's cultural periods or significant historic events or persons are preserved in good condition in perpetuity, protected from physical threats and interpreted to the public.

*Description:* Crystal River Preserve State Park has 111 archaeological sites and 3 resource groups recorded with the FMSF. Several sites have a historic component overlaying earlier prehistoric occupations. Addendum 7 contains a table of those sites complete with site numbers, the significance of each site, and site condition assessments. Archaeological research indicates the region has been occupied by prehistoric aboriginal people for the past 12,000 years, and perhaps earlier.

The site inventory for Crystal River Preserve includes a wide range of resources that cover a considerable span of Florida's prehistory up to the period of historic contact, including Archaic (Orange and Transitional), Woodland (Deptford, Swift Creek, and Weeden Island), and late prehistoric (Safety Harbor) sites. Site types may include habitations, villages, shell mounds, middens, and resource acquisition sites. Several of the large prehistoric complexes within the park extend onto adjacent private properties or onto other DEP-managed lands. Of the latter, Crystal River Mounds (CI00001) and the Roberts Island complex (CI00037-41) are managed as part of the adjacent Crystal River Archaeological State Park.

The prehistoric sites are unevenly distributed across Crystal River Preserve and may be found in nearly every coastal physiographic context. However, the majority are located in the coastal lowlands and marshes, on marsh islands or along tidal creeks leading out to the Gulf of Mexico. The level of field survey within those coastal contexts is high. Extensive field surveys have already been conducted on Crystal River and its adjacent marshes out to the Gulf, along Salt River and Homosassa River, on portions of Roberts Island, in the outer island group including Mullet Key, and within the Ozello Archipelago and the inner island group. Most of the island and tidal creek bank sites have an underwater component evidencing inundation due to sea level change over the past six thousand years. These site contexts are the most vulnerable to rising waters and impacts from storm surge and flooding.

Since 1992, the Gulf Archeology Research Institute (GARI) has conducted surveys and cultural resource inventories in specific tracts within what is now Crystal River Preserve State Park and within the adjacent St. Martin's Marsh Aquatic Preserve, whose saltmarsh and marsh islands closely intermesh with the western fringes of the state park (Dean et al. 2004; Ellis et al. 2001, 2002), as well as in other parts of western Citrus County (Ellis et al. 1993, 1995). The purpose of the GARI surveys was to gain a better understanding of the lifeways of residential populations along the Gulf Coast through time. Unfortunately, the dynamic coastal environment has not been kind to the archaeological record, and what remains represents only a small fraction of the whole. Sea level rise (and the accompanying drop in the water table), land subsidence, wave and tidal action, storm surge, and other environmental perturbations have killed hammock vegetation, scoured limestone platforms, eroded soils and displaced or totally swallowed large numbers of archaeological sites. Some regions have fared worse than others, depending on their topographic and sedimentary environments. For example, site loss in the Ozello Archipelago has been catastrophic. Despite these issues, the number of sites successfully identified by GARI has been high, basically by using natural-cultural modeling that incorporates parameters such as natural resources potential, topography, sea level change through time, and vegetation.

The Springs Coast region was heavily utilized by prehistoric human populations during the Middle/Late Archaic, Deptford, and Weeden Island periods (Miller 1973; Bullen 1951; Bullen and Bullen 1961). Lithic scatters occur on Pleistocene aeolian dunes or relict tidal bar features. Shell midden sites occur in all physiographic regions but are concentrated on limestone islands within the salt marsh, on offshore islands, or along river banks. Burial mounds usually occur inland, and

mound-village complexes are known to be located at the mouth of the Withlacoochee River, around Kings Bay and along the Crystal River, and at Roberts Island. Few prehistoric sites have been found in the local flatwoods regions, and these are usually located on scattered elevated sand "islands."

The subtle locational differences among site types, along with differential spatial and temporal distributions in lithic, shell and ceramic resources, suggest that several settlement pattern shifts occurred through time in response to environmental perturbations. In the early Deptford through Weeden Island periods, the mesic hammocks in and around the estuaries and saltmarshes were heavily utilized. Several constellations of midden sites on offshore islands that are potential fishing/hunting communities (i.e., coastal villages) (Bullen and Bullen 1961; Dean et al. 2004). It was also during the Deptford period when the large ceremonial complexes such as at the Crystal River site began to emerge. The environmental constraints (e.g., topography of the bedrock) for the location of these communities and complexes, as well as differences in artifact types among them, hint at the possibility that affiliations between sites and villages may be able to be determined as more investigations take place.

Achieving an understanding of the temporal affiliations and functions of the many sites in the extremely skewed coastal archaeological record is greatly hindered by the lack of systematic excavations and absence of radiometric dates. Within and adjacent to Crystal River Preserve, the only sites that have been professionally excavated are the Crystal River site (CI00001) (Ellis et al. 2003; Weisman and Marquardt 1988) and the Wash Island site (CI00042) (Bullen and Bullen 1961, 1963). Recent work at the adjacent Crystal River site (Pluckhahn et al 2009), as well as the Roberts Island shell mound complex, has greatly contributed to the understanding of this underreported site. Wash Island is a +75m long shell midden on the north bank of the Crystal River that is notable for the earliest cord-marked sherds on the central Gulf Coast, the high number of Hernando points, and the diverse array of pottery types that include several Transitional period types. A 5 x 10 ft. stratigraphic test excavated by the Bullens in 1963 demonstrated that the midden was constructed over three occupations and included a Safety Harbor zone (0-9"), a Weeden Island zone (9-27"), and an earlier post Orange/early Deptford zone (Bullen and Bullen 1963). Pasco Plain and sand-tempered plain pottery dominated the assemblage, but other types included decorated Pasco and Perico wares. Other artifacts included Hernando and Citrus points, a limestone cup, steatite vessel fragments, Busycon whelk and crown conch shell tools, and faunal remains consisting of nearshore fish, sea and terrestrial turtles, and deer.

This assemblage at Wash Island hints at a shared cultural tradition with the Crystal River site. Reconnaissance surveys by the GARI in other parts of the park have documented numerous post-late archaic midden sites that are located in similar environmental locations and contain similarly stratified deposits. These deposits are marked by a dominance of Pasco pottery wares, a high number of conch shell tools, and heavy utilization of local marsh fauna. Additional excavation at select sites should enable an enhanced degree of resolution that will clarify the subtle material differences enmeshed within these regional and more static culture traits.

From this brief review of archaeological trends in the Crystal River region of the Gulf Coast, a few predictions can be made about probable future survey results:

- The presence of two major mound-village complexes just south and east of Crystal River Preserve, along with the findings of numerous archaeological surveys along the coast, indicate that a large aboriginal population and a high number of sites are to be expected in the area. Archaeological sites within the coastal marshes today are usually situated in cabbage palm hammocks, on limestone highs around artesian wells, and on relict dunes and tidal bars. That is not necessarily an ancient context and it is one of continuing research. The survey area within Crystal River Preserve consists of marshlands rimming a shelf embayment near the mouth of the Crystal River that is undergoing rapid change due to sea level rise, land subsidence, and wave/tidal action. It is expected that landform modifications in the form of hammock loss and scouring of limestone islands will cause severe loss of archaeological sites in the future. The surviving sites will probably be in the more stable or elevated areas. There should be gaps in the cultural history represented by sites that were once located on elevated areas but are now inundated or scoured clean. The western half of the survey area is likely to be the most severely affected because the Crystal River is widest there and the limestone islands are scattered and less elevated. Secondarily deposited sites derived from the original ones may be found in nearby solution holes, sand bars, and tidal stream channels.
- Paleoindian and Archaic sites, most likely represented as lithic scatters, are expected to be few in number in Crystal River Preserve and may not be discovered unless relict features (e.g., sinks, Pleistocene dunes) are present. Pottery dating to the Safety Harbor Period is not well represented in local collections; therefore sites of this period may be difficult to identify. Shellfish remains will likely be the most prominent surviving cultural material present at the sites. Oyster is expected to dominate all sites, but marsh clam, mussel, crown conch, Busycon, and quahog will also be common. The latter three species are commonly modified into gouges, picks, hammers and other tools. Shell midden sites are likely to be the dominant site type. These can vary considerably in size, composition and organization, ranging from light scatters of shell containing no artifacts to stratified earth and shell middens that represent procurement and tasking stations or single- and multi-family habitation camps. These sites would likely occur on the limestone highs within the saltmarsh and in the large mesic hammocks east of the marshlands.
- Although mound-village complexes have not been recorded within Crystal River Preserve itself, they do occur on nearby lands to the east and south, including Crystal River Archaeological State Park. It is logical to assume that portions of the residential populations that historically were served by the Crystal River Mounds site or the Roberts Island complex will have occupied locales within what is now Crystal River Preserve State Park. The artifact assemblages within the preserve may therefore reflect affinities to these complexes.

- Burial sites in the region, including the Crystal River Mounds, are generally of sand or oyster shell construction and are located away from shell midden villages. They are low and fragile and are highly susceptible to damage from bioturbation and erosion. In many cases, they are not recognizable until discovered via erosional exposure or field testing. Though rarely discovered, burial sites require extra protection against looting and continuing erosion. The current inventory for Crystal River Preserve contains several burial site candidates among its potentially significant sites.
- In future surveys, coastal communities will probably have to be defined on the basis of a constellation of small and large midden sites in close proximity to one another that can be culturally linked via similar artifact assemblages or unique stratigraphic sequences. Site distribution within these communities is geared to the topography of the bedrock, but should be somewhat linear along the Crystal River. It is expected that the degree of erosion across the limestone elevations closest to the Gulf, however, will reduce researchers' abilities to locate small sites or even clusters of sites.
- The majority of the shell midden sites probably will lack diagnostics. If they do contain pottery, the most common types are expected to be sand-tempered plain (probably Deptford) and limestone-tempered plain (probably Pasco Plain). Therefore, cultural affiliations defined for sites will be broad (e.g., Transitional through Weeden Island periods).
- Where diagnostic lithic artifacts do occur, they will likely fall into a temporal range similar to that of the pottery (i.e., post-Late Archaic through Weeden Island II). At the Wash Island and Crystal River sites, the most common point types include Citrus and Hernando projectiles. At the Crystal River site, a bluish black chert was commonly used (Ellis et al. 2003). This chert appears to be derived from a local source, now inundated, and it will likely be the major type found in the middens of this time period. Earlier (Archaic) sites may contain chert from the Tampa Bay region. Other lithic artifacts to be expected include limestone tools (e.g., plummets) and pieces of coral.
- Finally, the vertebrate remains that are recovered are likely to be dominated by local species, including sea and terrestrial turtles, nearshore fish, deer, and small mammals of upland and mesic coastal plain habitats.

Of the 111 archaeological sites in Crystal River Preserve, only one is currently National Register listed (NRL), but some archaeological surveyors suggest that at least seven additional sites may be National Register eligible (NR). The sole NRL site is Mullet Key (CI00022), which is a prehistoric shell midden/campsite located about 4.5 miles south of the mouth of Crystal River. The horseshoe-shaped island has a maximum elevation of about two meters at low tide, making it considerably higher than the neighboring mangrove and grass islands. Despite modern day use by fishermen and boaters and threats posed by wave action and rising sea levels, the site is considered to be in good condition. Ceramics recorded at the site date from about 500 BC to AD 1500 and include Deptford, Weeden Island, and Safety

Harbor components. According to the FMSF, Mullet Key may contain unmarked human remains.

Artifacts collected at various Crystal River sites considered to be possibly NR-eligible indicate that a broad range of aboriginal cultures are represented including Deptford, Weeden Island I, Weeden Island II, and Safety Harbor. Some of the sites have deteriorated since the original site forms were filed with the FMSF and may no longer be NR-eligible. One site that has remained in good condition, however, is Spice Key (CI00224). Located on the eastern edge of the Suncoast Keys southwest of the mouth of the Salt River, it contains a one-meter high shell midden that was once vegetated with cabbage palms and cedars but is now covered with halophytic shrubs. Ceramics from the Deptford Island and Weeden Island I cultures have been recorded there. The midden shell is very compacted on Spice Key, so the site may be able to maintain its integrity for the near future despite increased threats from wave and tidal action.

Another NR-eligible site that is still in good condition is Sickle Midden (CI01197), which is described in the FMSF as a 0.75 m high, stratified shell midden located in salt marshes southwest of the mouth of the Salt River. In contrast with Spice Key, this midden has retained much of its characteristic vegetation in the form of a cedar and cabbage palm hammock. Ceramics recorded at the site represent the Deptford and Weeden Island cultures. Sickle Midden is similar to Spice Key in that it contains compacted and cemented shell, making it somewhat resistant to wave action. No looting or vandalism has been detected at the site.

Despite the apparent stability of some of the more important sites in Crystal River Preserve, at least for the time being, the ever-increasing threat of significant site perturbation seems to warrant additional precautions, including the encouragement of additional archaeological evaluations. All sites that Phase I survey has recommended as potentially NR-eligible should receive comprehensive Phase II archaeological evaluations if they are subject to immediate/short term impacts.

A functioning predictive model for Crystal River Preserve was completed in 2012. As part of the modeling project, a team from the University of South Florida's Alliance for Integrated Spatial Technologies used LIDAR remote sensing imagery, historic aerial photographs, historic survey maps, and existing archaeological research maps in developing a map of the preserve showing areas of high, medium, and low sensitivity for archaeological resources (Collins 2012). This map will be consulted whenever any ground disturbing activities or archaeological studies are planned for the preserve. The modeling team calculated that approximately 1,376 acres (5%) of the preserve should be considered as areas of high sensitivity for archaeological resources and 442 acres (1.6%) as areas of medium sensitivity. Although no actual ground-truthing took place, analysis of various types of imagery enabled the team to correct the spatial boundaries for 12 sites previously recorded in the preserve (i.e., CI00224, CI00418, CI00576, CI00578, CI00586, CI001066, CI001193, CI001201, CI001202, CI001217, CI001303, and CI001312).

Over 50% of the surface area of Crystal River Preserve has undergone thorough archaeological survey, focusing on areas of high public use, highly threatened areas (natural and anthropogenic threats), remote but accessible islands, and Crystal River itself. This work covered high and low probability areas to facilitate actual modeling.

*Condition Assessment:* Crystal River Preserve State Park is located in the midst of the Nature Coast area of Florida, and its many acres of coastal lands and islands attract a considerable amount of pedestrian day use. Because the cultural materials and archaeological deposits within the preserve are spread across such a large geographic area, there is ample opportunity for visitors to engage in casual or even purposeful artifact collecting. Moreover, the consequence of public pedestrian use and occasional digging for artifacts is a continual movement of mounded shell deposits downslope toward the water's edge, where the materials are further shifted by tidal and surge action. In fact, these deposits are often situated in the primary effect zone for coastal surge and local sea level change. Because of the concomitant impacts of public use and natural processes, coastal and estuarine archaeological sites within the preserve are especially vulnerable and their threat level is high.

Crystal River Preserve's cultural resource inventory is assessed annually by visiting scientists from GARI. During these visits, archaeologists assess site conditions and local natural contexts and evaluate threats to effective preservation. The prioritization of threatened natural and archaeological contexts constitutes a fundamental part of the preserve's cultural resource management practice. Actions recommended for archaeological sites may be of a remedial, essential, or emergency nature.

*General Management Measures:* The management of cultural resources within an expansive coastal context becomes even more complicated when exacerbating influences such as rising sea level, climate change, and increased exposure to pedestrian impacts are factored in. Cultural resources often represent the last surviving constituency of physical evidence for a long prehistoric past; they are irreplaceable and extremely vulnerable to disturbance. The park manager and staff at Crystal River Preserve routinely consult with cultural resource professionals in the GARI and with visiting scientists who have conducted the majority of the primary field work and research within the preserve as well as along the west central Gulf Coast of Florida. These experts in turn consult with Bureau of Natural and Cultural Resources (BNCR) and Division of Historical Resources (DHR) professionals to effect optimally phased archaeological studies consistent with the nature of their environmental setting. Before the initiation of projects proposed for the preserve, all activities related to land clearing or ground disturbance, and all major repairs or additions to historic structures listed or eligible for listing in the National Register of Historic Places, are coordinated with the BNCR prior to being submitted to the DHR for review and comment.

Most of the archaeological sites in the preserve are situated along a coastline which is experiencing not only a significant rise in sea level but also burgeoning

population growth. Sites are currently subject to greater wave action, higher tidal surges, and ever increasing numbers of recreational users. The primary treatments for significant archaeological sites in the preserve are preservation and stabilization. Site preservation in the preserve primarily consists of protection from vandalism or looting, monitoring use, and reducing visitation if necessary. The use of educational signage may be appropriate at some sites. Site stabilization techniques used in the preserve include monitoring of protective vegetation and revegetating of site surfaces if needed. A recommended treatment for each site is indicated in the cultural sites table in Addendum 7. In addition, GARI archaeologists recommend that 56 of the preserve's sites be formally tested for the NRHP.

### Historic Structures

*Desired future condition:* All significant historic structures and landscapes that represent Florida's cultural periods or significant historic events or persons are preserved in good condition in perpetuity, protected from physical threats and interpreted to the public.

*Description:* There are no historic structures at Crystal River Preserve State Park.

### Collections

*Desired future condition:* All historic, natural history and archaeological objects within the park that represent Florida's cultural periods, significant historic events or persons, or natural history specimens are preserved in good condition in perpetuity, protected from physical threats and interpreted to the public.

*Description:* Crystal River Preserve State Park does not have any archaeological collections. To guide future park management, however, a Scope of Collections Statement should be prepared indicating that the park currently does not have a collection and does not accept or acquire items for any collection. Items brought to the park office are noted for site attribution and, after consultation, are shipped off to the DHR for curation.

Detailed management goals, objectives and actions for the management of cultural resources in this park are discussed in the Cultural Resource Management Program section of this component. Addendum 7 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 cultural sites table in Addendum 7 also summarizes each site's level of significance, existing condition and recommended management treatment. An explanation of the codes is provided following the table.

## **Cultural Resource Management Goals, Objectives, and Actions**

Cultural resources are individually unique, and collectively, very challenging for the public land manager whose goal is to preserve and protect them in perpetuity. The DRP will implement the following goals, objectives and actions, as funding becomes

available, to preserve the cultural resources found in Crystal River Preserve State Park.

**Goal: Protect, preserve and maintain the cultural resources of the park.**

The management of cultural resources within an expansive coastal context may be complicated due to the natural consequences of changing sea levels, climate and exposure to pedestrian impacts. Cultural resources often represent the last surviving constituency of physical evidence for a long prehistoric past that are irreplaceable and extremely vulnerable to disturbances. The land manager and staff at CRPSP consult routinely with cultural resource professionals with the Gulf Archaeology Research Institute, visiting scientists for the CRPSP, who have conducted the majority of the primary field work and research within the park and West Central Florida Gulf Coast.

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 FDOS, Division of Historical Resources (DHR) for review and comment prior to undertaking the proposed project. Recommendations may include, but are not limited to concurrence with the project as submitted, pre-testing of the project site by a certified archaeological monitor, cultural resource assessment survey by a qualified professional archaeologist, modifications to the proposed project to avoid or mitigate potential adverse effect. In addition, any demolition or substantial alteration to any historic structure or resource must be submitted to the DHR for consultation and the 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 the DHR.

***Objective A: Assess and evaluate 114 of 114 recorded cultural resources in the park.***

- Action 1 Complete 114 assessments/evaluations of recorded cultural sites, prioritizing sites most in need of preservation and stabilization projects.
- Action 2 Continue to employ a long-term protocol for tracking condition changes, testing to determine National Register eligibility, and prioritize sites that need preservation and stabilization at each archaeological site.
- Action 3 Improve and implement the plan for more frequent surveillance of archaeological sites that have been looted in the past and those subject to the impacts from pedestrian access

Action 4 Improve and implement the plan for more frequent surveillance of archaeological sites that are currently and have been impacted by natural coastal forces, climate effects, and sea level changes; implement the plan. [Long Term and Continuous]

Park personnel, GARI staff, and other cultural resource professionals currently visit all cultural sites within the preserve on a regular basis. This formalized process continually generates baseline and comparative information for each site. The preserve will develop and implement an enhanced plan for more frequent surveillance of archaeological sites that have been looted in the past. Vetted preserve volunteers will provide needed assistance.

Archaeological sites along the coastline are currently subject to greater wave action, higher tidal surges, and ever-increasing numbers of pedestrian users, particularly boaters and fishermen. The threat of significant disturbance of many of the sites is growing and additional precautions may be needed, including encouragement of additional archaeological evaluation.

GARI is currently working under a Department of Interior National Conservation Preservation Training and Technology grant to develop a rapid midden assessment program to facilitate tracking the condition of coastal sites. This program within the preserve will address cultural resources that have undergone damage, potential impacts, as well as assess the physical and ecological context of the site. Doing so allows for a systemic and multi-resource management approach. This detailed study is due for submission in July 2018 and will likely serve as the model for coastal resource modeling.

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

- Action 1 Ensure all known sites, including newly found ones, are recorded or updated in the Florida Master Site File.
- Action 2 Conduct Phase I archaeological survey in all priority areas identified by the 2012 predictive model or by other studies.
- Action 3 Conduct comprehensive Phase II archaeological evaluations of sites that have National Register potential and are subject to immediate or short-term impacts.
- Action 4 Develop and adopt a Scope of Collections Statement.
- Action 5 Conduct additional research about prehistoric settlement and other patterns pertinent to cultural lifeways within the preserve and how they relate to broader cultural patterns in the region and the adjacent Big Bend.

The locations of all known archaeological sites in the preserve have been mapped using GPS technology. If new sites are found, their boundaries will also be mapped. As this information is compiled, staff will update the FMSF forms for the sites and forward the information to the FMSF. All new sites will be recorded with the FMSF as they are discovered.

Research within Crystal River Preserve about prehistoric settlement and other cultural patterns through time and how they relate to broader settlement patterns in the region has been underway continuously since the 1960s owing to sustained interest in the unique Crystal River mound complex (CI00001) located in the adjacent Crystal River Archaeological State Park. This range of research has continued with each successive archaeological study such that the fundamental cultural sequence and relevant behavior of prehistoric populations are better known for the Crystal River area than for the remainder of the west central Gulf Coast. Several important archaeological sites that exist on private property (i.e., Shell Island) and non-park DEP properties to the north could contribute valuable information to an expanded archaeological study of the area.

The preserve needs additional, comprehensive Phase I survey, with priority given to lands west of the Ozello Archipelago and immediately north of the Homosassa River, as well as coastal marshlands and remnants of the near coastal plain east of the Salt River between the Homosassa River and the north boundary of the Inner Island group. Survey to date has included sites of all sizes and types without regard to any specific resource type. Areas representing ancient or historic human activity/behavior have been recorded. Recommendations for additional survey of specific management zones will be guided by a research design grounded on previous research and models and based on prioritized needs or threats, or both.

Phase II archaeological evaluation is needed at threatened sites that Phase I survey has indicated have the potential to be National Register eligible. Phase II survey is particularly necessary at Wash Island (CI00042) to confirm the site's eligibility for the National Register and to determine the means necessary for protecting it against environmental and anthropogenic impacts. This site has deteriorated to the point that terrestrial archaeology methods must now be supplemented by wet site methods. Two recent tropical storm events have dramatically reduced riverbank midden deposits. The site is distressed and needs immediate attention.

Even though the preserve currently does not have any collections, a Scope of Collections Statement should be prepared to guide management in the future. The statement should indicate that the preserve does not have a collection and does not accept or acquire items for any collection.

***Objective C: Bring 3 of 114 recorded cultural resources into good condition.***

- Action 1 Design and implement regular monitoring programs for 114 cultural sites.
- Action 2 Create and implement a cyclical maintenance program for each cultural resource.
- Action 3 Investigate the Wash Island, Camp Island, and Mullet Key sites and improve their protection from natural and anthropogenic impacts.

Crystal River Preserve annually conducts a simple repeatable protocol for tracking changes at each archaeological site, preferably consisting of a geocoded baseline

photograph and a condition checklist sheet. Photographs are taken regardless of whether a change in condition occurred at a site.

If remedial action is recommended for a cultural site, then monitoring of vegetation loss or changes that are affecting the natural community and/or the preservation of archaeological resources is warranted. This is a routine monitoring function. Essential action warrants stabilization of the natural context or archaeological site via revegetation of native plants, and/or posting of additional protection or educational signage, and/or possibly limiting or prohibiting pedestrian use. Emergency action warrants immediate protective measures to prevent the loss of natural or cultural context. The latter action may be through direct mitigation using coastal erosion control measures or archaeological data recovery excavation, or both. Recommendations may be subject to change depending on the results of ongoing monitoring.

Perhaps three of the sites in the preserve now considered to be in fair or good condition may be able to be upgraded to good condition, or kept in good condition, if visitation is kept at reasonable levels and some revegetation is attempted. The exposure of sequential deposition at Wash Island (CI00042) and its location along the Crystal River make it a daily destination for day use and camping, as well as casual looting. Pending systematic archaeological work, this site may be sealed over and revegetated with saltwater tolerant plants. Camp Island (CI01193) is well used by campers and day visitors, and the pedestrian traffic and collecting is degrading the site surface and banks. Either public use should be barred on the island or visitation restricted to areas away from the prehistoric midden. Mullet Key (CI00022) is a nearshore site that is migrating due to coastal surge forces. It is a popular venue for kayakers, and the cumulative impacts of pedestrian and natural stressors have severely weakened the remaining shell midden. Low growing salt tolerant vegetation should be planted on Mullet Key and signage installed that indicates pedestrian access is restricted.

### **Special Management Considerations**

#### **Timber Management Analysis**

If the DRP determines that timber management does not conflict with the primary management objectives of the land, on all parcels larger than 1,000 acres, Florida Statutes - Chapters 253 and 259 require:

- 1) An analysis of the multiple-use potential of the parcel. Such analysis shall include the potential of the parcel to generate revenues to enhance the management of the parcel.
- 2) An assessment of the feasibility of managing timber resources for conservation and revenue generation purposes through a stewardship ethic that embraces sustainable forest management practices in land management plans.

Crystal River Preserve State Park is designated as a single-use park. The feasibility of harvesting timber at CRPSP during the period covered by the UMP was considered pursuant to the DRP statutory responsibilities to analyze the park's resource needs and values.

The long-term management goal for forest communities in the state park system is to maintain or re-establish old-growth characteristics to the degree practicable, except in those forest communities specifically managed as early successional. Timber management is utilized for the specific purpose of helping restore or improve current habitat conditions and enhance the overall integrity of the natural community. Revenue generation from timber management is not the goal but rather, a by-product of taking such actions to help restore/improve target conditions of specific natural communities. In all situations, forest/stand/timber management activities undertaken will adhere to the current Florida Silvicultural Best Management Practices and Florida Forestry Wildlife Best Management Practices for State Imperiled Species.

Many of the natural communities evaluated at CRPSP had over-story stocking levels at, or above, the upper limits for corresponding FNAI Reference Sites. A subset of these stands has overstocked conditions in the preferred pine component while the remainder have overstocked conditions in the non-preferred pine or hardwood components. This overstocked condition makes over-story thins a potential management tool which should be considered. Activities related to stand improvement, including palmetto and mid-story reduction, are ongoing and still needed in many areas.

The Timber Management Analysis found in Addendum 8 provides additional details. This analysis has been evaluated and found to be consistent with the park's resource management program.

### **Coastal/Beach Management**

The DRP manages over 100 miles of sandy beach, which represents one-eighth of Florida's total sandy beach shoreline. Approximately one-quarter of Florida's state parks are beach-oriented parks and account for more than 60 percent of statewide park visitation. The management and maintenance of beaches and their associated systems and processes is complicated by the presence of inlets and various structures (jetties, groins, breakwaters) all along the coast. As a result, beach restoration and nourishment have become increasingly necessary and costly procedures for protecting valuable infrastructure. Beach and inlet management practices affect beaches for long distances on either side of a particular project. DRP staff needs to be aware of and participate in the planning, design and implementation of these projects to ensure that park resources and recreational use are adequately considered and protected.

In Citrus County, less than one half mile of open sandy beach has been measured as available shoreline (Clark 1993). Crystal River Preserve, with its multitude of coastal islands adjacent to the Gulf of Mexico, includes very little open beach

habitat, none of which is considered critically eroded. There are no beaches in the preserve that are accessible to the public. Several imperiled species depend upon these isolated areas of the preserve as well as its estuarine tidal creek and salt marsh communities for protection, resting and feeding. Three species of marine turtle, numerous avifauna and the Florida manatee are a few examples of imperiled wildlife that use these discrete coastal resources. Crystal River Preserve uses interpretive signage at key public access points to educate visitors about these sensitive coastal resources.

As part of the effort to implement the goal of restoring and maintaining natural communities and habitats within Crystal River Preserve, the following special management objectives for coastal systems are recommended.

***Objective A: Continue to assist federal, state and local agencies with active monitoring of erosion and accretion cycles and assessment of beach and shoreline conditions following natural disasters.***

Action 1            Continue to cooperate with federal, state and local agencies and researchers in the monitoring and assessment of shoreline erosion within the preserve, particularly as related to coastal resources.

The FDEP Bureau of Beaches and Coastal Systems (BBCS) is responsible for the protection and management of coastal systems in the State of Florida. With nearly 800 miles of shoreline and several miles critically eroded, BBCS has developed a statewide Strategic Beach Management Plan to help prioritize its responsibilities and effectively implement necessary management actions (FDEP 2007).

This statewide BBCS program also supports comprehensive shoreline surveys and monitoring, development of regulatory systems, and detailed documentation of weather-related impacts along all sandy beach ecosystems in Florida. Each year this bureau obtains routine aerial photography that covers over one quarter of the state, thereby gathering every four years a complete photographic collection of Florida's shorelines (FDEP 2016a). The BBCS also documents and has extensive records of topography and nearshore bathymetry for all critical erosion regions of the state.

All critically eroded beaches in Florida are also periodically assessed for long-term changes and trends, especially those that are related to significant weather events such as hurricanes (Absalonsen and Dean 2010, FDEP 2012). Beginning in 1981, BBCS also established a series of coastal reference landmarks (i.e., range monuments) at strategic eroded locations in order to delineate shoreline areas for comparative measurements. Citrus County currently has no range monuments (FDEP 2016b).

There has been some research evaluating coastal changes in the lower Big Bend region (Raabe et al. 2004). Conclusions from that work suggest that a significant loss of coastal forest occurred during the time period from the late 1800s to the 1990s. Within the Springs Coast region, and specifically within Levy, Citrus, and

Hernando counties, experts have documented significant changes in coastal forests that are undergoing die-off events. Retreating forests are highly symptomatic of the inland migration of the intertidal zone. Several hypotheses are provided, but further work is needed.

***Objective B: Continue to partner with federal, state and local agencies to fund, design, permit, improve and maintain coastal and beach management programs consistent with the mission of the Division.***

Action 1            Continue to coordinate with federal, state and local agencies and researchers in the improvement and maintenance of coastal management programs pertinent to Crystal River Preserve.

Crystal River Preserve State Park borders several other publicly managed properties, e.g., Chassahowitzka National Wildlife Refuge, Homosassa Springs Wildlife State Park, and the St. Martins Marsh and Big Bend Seagrasses aquatic preserves. All the managing agencies conduct numerous natural resource studies throughout the region. Additionally, several non-governmental institutions, including the Florida Public Archaeology Network (FPAN) and Gulf Archaeology Research Institute, provide professional expertise in researching, protecting, and interpreting the rich cultural resources of the region. Field offices for these two entities are conveniently located in the headquarters area of Crystal River Preserve State Park, which provides a unique opportunity for preserve staff to coordinate management activities with experts on a regular basis. The proximity of such diverse agencies has cultivated a strong resource network that has resulted in an ecosystem management approach that has strongly benefited sensitive coastal resources.

**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. Treatment methods including larviciding and ground adulticiding (truck spraying in public use areas) are typically allowed. Aerial adulticiding can be allowed through an agreed upon control plan. The DRP does not authorize new physical alterations of marshes through ditching or water control structures. Mosquito control plans temporarily may be set aside under declared threats to public or animal health, or during a Governor’s Emergency Proclamation.

An Arthropod Management Plan for Crystal River Preserve State Park was updated in 2016 by the Division of Recreation and Parks and Citrus County Mosquito Control District.

**Sea Level Rise**

Potential sea level rise is now under study and will be addressed by Florida’s

residents and governments in the future. The DRP will stay current on existing research and predictive models, in coordination with other DEP programs and federal, state, and local agencies. The DRP will continue to observe and document the changes that occur to the park's shorelines, natural features, imperiled species populations, and cultural resources. This ongoing data collection and analysis will inform the Division's adaptive management response to future conditions, including the effects of sea level rise, as they develop.

At Crystal River Preserve, sea level rise has dramatically influenced both natural and cultural resources of the park as described above under the hydrology, natural communities and cultural sections of this plan.

Sea level rise, substantial changes to the Floridan aquifer, salt water intrusion and abnormal storm surge events have all contributed to a regional vegetation die-off's within the coastal hydric hammock communities of the preserve. As these important upland habitats are lost and limestone platform base soils are scoured and eroded through natural forces, large numbers of archaeological sites have been and will continue to be displaced or destroyed. Specific alterations that are occurring are hydric hammock communities being converted into salt-dominated communities, conversion of freshwater wetlands into brackish systems, and erosion and loss of important archeological resources.

Planning efforts concerning these changes will need well thought out monitoring and research initiatives in order for park staff to best preserve, protect and conserve these resources at risk.

### **Resource Management Schedule**

A priority schedule for conducting all management activities that is based on the purposes for which these lands were acquired, and to enhance the resource values, is located in the Implementation Component of this management plan.

### **Land Management Review**

Section 259.036, Florida Statutes, established land management review teams to determine whether conservation, preservation and recreation lands titled in the name of the Board of Trustees are being managed for the purposes for which they were acquired and in accordance with their approved land management plans. The considered recommendations of the land management review team and updated this plan accordingly. The DRP's response to the recommendations provided by the land management review can be found in Addendum 9.

Crystal River Preserve State Park was subject to a land management review on July 20, 2012. The review team made the following determinations:

- The land is being managed for the purpose for which it was acquired.
- The actual management practices, including public access, complied with the management plan for this site.

## **LAND USE COMPONENT**

### **Introduction**

Land use planning and park development decisions for the state park system are based on the dual responsibilities of the Florida Department of Environmental Protection (DEP), Division of Recreation and Parks (DRP). These responsibilities are to preserve representative examples of original natural Florida and its cultural resources, and to provide outdoor recreation opportunities for Florida's citizens and visitors.

The general planning and design process begins with an analysis of the natural and cultural resources of the unit, and then proceeds through the creation of a conceptual land use plan that culminates in the actual design and construction of park facilities. Input to the plan is provided by experts in environmental sciences, cultural resources, park operation and management. Additional input is received through public workshops, and through environmental and recreational-user groups. With this approach, the DRP objective is to provide quality development for resource-based recreation throughout the state with a high level of sensitivity to the natural and cultural resources at each park.

This component of the unit plan includes a brief inventory of the external conditions and the recreational potential of the unit. Existing uses, facilities, special conditions on use, and specific areas within the park that will be given special protection, are identified. The land use component then summarizes the current conceptual land use plan for the park, identifying the existing or proposed activities suited to the resource base of the park. Any new facilities needed to support the proposed activities are expressed in general terms.

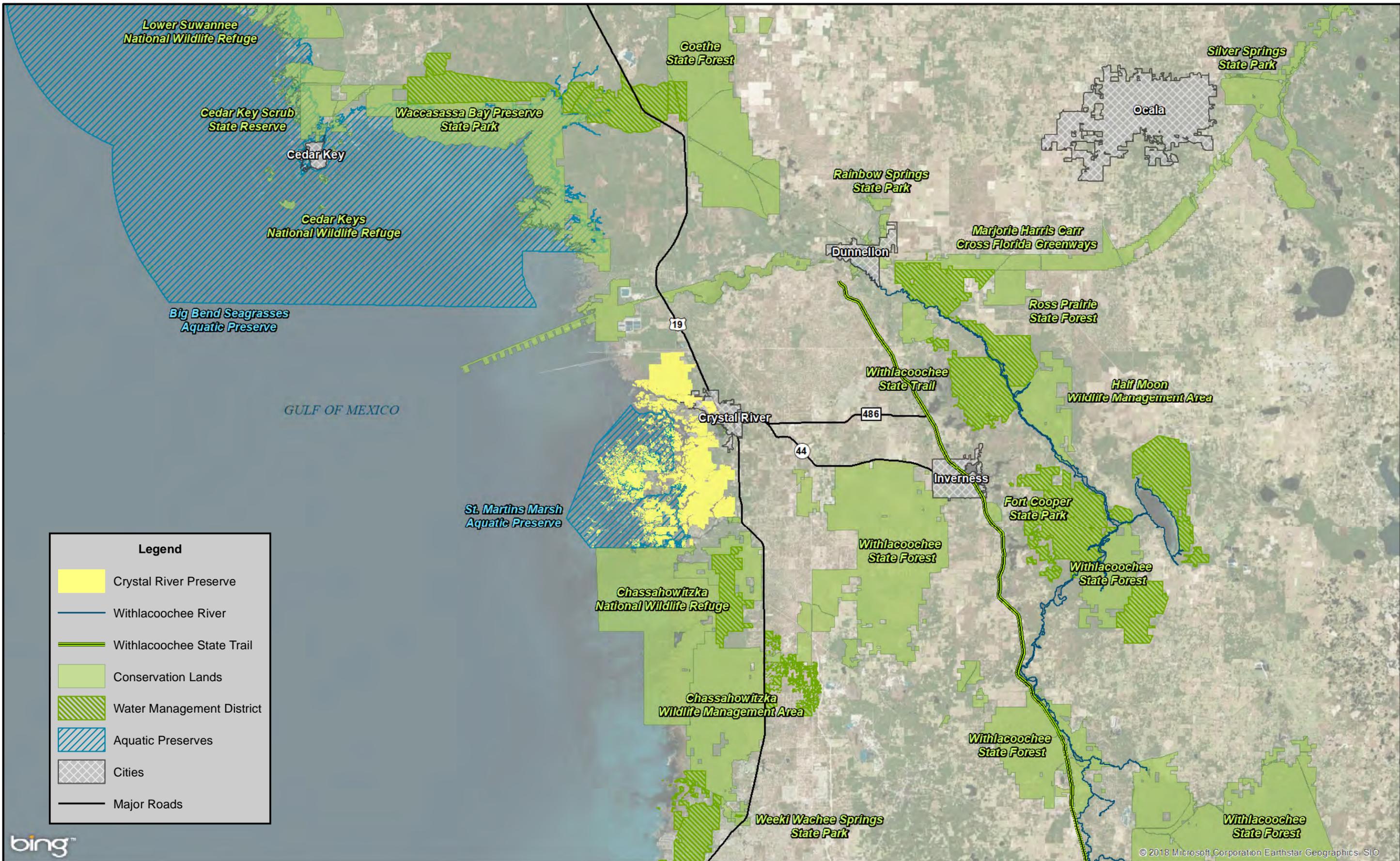
### **External Conditions**

An assessment of the conditions that exist beyond the boundaries of the unit can identify any special development problems or opportunities that exist because of the unit's unique setting or environment. This also provides an opportunity to deal systematically with various planning issues such as location, regional demographics, adjacent land uses and park interaction with other facilities.

Crystal River Preserve State Park is located within Citrus County, about 3 miles from the city center of Crystal River in the central part of the state. Approximately 491,500 people live within 30 miles of the park (U.S. Census 2010). According to U.S. Census data (2010), approximately 7% of residents in the county identify as black, Hispanic or Latino, or another minority group. More than half (54%) of the residents are considered to be of working age, which is defined as being between the age of 16 and 65 (U.S. Census 2010). Citrus County ranks 34<sup>th</sup> statewide in per capita personal income at \$36,200, below the state average of \$45,953 (U.S. Bureau of Economic Analysis 2017).

The table below identifies significant resource-based recreation opportunities within 15 miles of Crystal River Preserve State Park.

<b>Table 4. Resource-Based Recreational Opportunities Near Crystal River Preserve State Park</b>										
<b>Name</b>	<b>Biking</b>	<b>Hiking</b>	<b>Swimming/ Beach Access</b>	<b>Boating/ Paddling</b>	<b>Fishing</b>	<b>Nature Study</b>	<b>Picnicking</b>	<b>Camping</b>	<b>Hunting</b>	<b>Equestrian</b>
Florida Coastal Office (FCO)										
Big Bend Seagrasses Aquatic Preserve				✓						
St. Martins Marsh Aquatic Preserve				✓						
Florida Department of Environmental Protection (FDEP/DRP)										
Cedar Key Museum State Park		✓		✓		✓				
Cedar Key Scrub State Reserve	✓	✓		✓	✓	✓	✓			✓
Crystal River Archaeological State Park					✓	✓	✓			
Ellie Schiller Homosassa Springs Wildlife State Park		✓				✓	✓			
Fort Cooper State Park	✓	✓				✓	✓	✓		
Marjorie Harris Carr Cross Florida Greenways	✓	✓		✓	✓	✓	✓	✓		✓
Rainbow Springs State Park		✓	✓	✓		✓	✓	✓		
Silver Springs State Park	✓	✓		✓		✓	✓	✓		✓
Waccasassa Bay Preserve State Park				✓	✓	✓		✓		
Weeki Wachee Springs State Park			✓	✓			✓			
Withlacoochee State Trail	✓	✓				✓				✓
Yulee Sugar Mill Ruins Historic State Park						✓	✓			
Florida Forest Service (FFS)										
Goethe State Forest	✓	✓			✓		✓		✓	✓
Ross Prairie State Forest		✓					✓	✓	✓	✓



**Legend**

- Crystal River Preserve
- Withlacoochee River
- Withlacoochee State Trail
- Conservation Lands
- Water Management District
- Aquatic Preserves
- Cities
- Major Roads

bing™

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CRYSTAL RIVER PRESERVE STATE PARK

CONSERVATION AND RECREATION LANDS

N

0 2 4 8 Miles

Florida Department of Environmental Protection  
Division of Recreation and Parks  
Date of aerial, 2011



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<b>Name</b>	<b>Biking</b>	<b>Hiking</b>	<b>Swimming/ Beach Access</b>	<b>Boating/ Paddling</b>	<b>Fishing</b>	<b>Nature Study</b>	<b>Picnicking</b>	<b>Camping</b>	<b>Hunting</b>	<b>Equestrian</b>
Withlacoochee State Forest	✓	✓		✓	✓	✓	✓		✓	✓
<b>Florida Fish and Wildlife Conservation Commission (FWC)</b>										
Chassahowitzka Wildlife Management Area	✓	✓				✓			✓	✓
Half Moon Wildlife Management Area	✓	✓		✓	✓	✓			✓	✓
<b>Southwest Florida Water Management District (SWFWMD)</b>										
Annutteliga Hammock		✓								✓
Chassahowitzka River and Coastal Swamps	✓	✓		✓	✓	✓	✓	✓		
Flying Eagle Preserve	✓	✓			✓	✓		✓	✓	✓
Halpata Tastanaki Preserve	✓	✓			✓					✓
Lake Panasoffkee	✓	✓			✓	✓	✓	✓	✓	✓
Panasoffkee Outlet		✓		✓	✓	✓	✓			
Potts Preserve	✓	✓		✓	✓	✓		✓	✓	✓
Two Mile Prairie		✓			✓	✓		✓		✓
Weekiwachee Preserve	✓	✓		✓	✓	✓	✓		✓	
<b>United States Fish and Wildlife Service (USFWS)</b>										
Cedar Keys National Wildlife Refuge				✓	✓	✓				
Crystal River National Wildlife Refuge				✓	✓	✓				
Chassahowitzka National Wildlife Refuge					✓	✓			✓	
Lower Suwannee National Wildlife Refuge					✓	✓			✓	

The Florida Circumnavigational Saltwater Paddling Trail, or the CT, spans 1,515 miles along Florida's coast, from Big Lagoon State Park in Pensacola to Fort Clinch State Park in Jacksonville. Segment 7, known as the Nature Coast, is an 89-mile segment of the CT that links the Cross Florida Greenway and Anclote

Key State Park, flowing through the St. Martins Marsh Aquatic Preserve that borders CRPSP. The park offers paddlers a kayak launch to access the CT, as well as a primitive campsite that can be used for multi-day excursions.

The park is located in the Central West Vacation Region, which includes Citrus, Hernando, Pasco, Pinellas, and Hillsborough County (Visit Florida 2014). According to the 2014 Florida Visitor Survey, approximately 11% of domestic visitors to Florida visited this region. 88% of visitors to this region traveled to the Central West region for leisure purposes. The top activities for domestic visitors were going to the beach/waterfront and visiting friends/relatives. About a third of visitors came to the region during the winter and nearly half came during the spring and summer. Most visitors traveled by non-air (64%), reporting an average stay of 4 nights and spending an average of \$162 per person per day (Visit Florida 2014).

Florida's Statewide Comprehensive Outdoor Recreation Plan (SCORP) indicates that participation rates in this region for saltwater and freshwater beach activities, saltwater non-boat fishing, saltwater and freshwater boat ramps, unpaved biking, hiking, equestrian activities, nature study, picnicking, visiting archaeological sites, and hunting are higher than the statewide average with demand for additional facilities increasing through 2020 (FDEP 2013).

### **Existing Use of Adjacent Lands**

Crystal River Preserve State Park encompasses nearly 27,500 acres, which causes the park to interface with several different land uses along its boundary. The park is entirely within Citrus County and borders one incorporated city, Crystal River, along with three unincorporated areas that include Ozello, Homosassa Springs, and Homosassa. Along the northwestern boundary of the park, there are nearly 2,000 acres of buffer land between the coal-fired Crystal River Energy Complex and the park. This power plant is in the process of being converted to natural gas. Powerline Road and electricity transmission lines form the northern boundary. The US Highway 19 corridor runs parallel to the eastern boundary of the park and is the main road through the City of Crystal River. Commercial land uses dominate the properties adjacent to US Highway 19, while low to medium density residential housing occurs adjacent to CRPSP. The unincorporated areas that border the park are considered low intensity coastal areas with low density residential housing and mobile homes.

### **Planned Use of Adjacent Lands**

According to population projections calculated by the Bureau of Economic and Business Research (BEBR), Citrus County is expected to experience an approximately 21% increase in population by 2040, from an estimated 141,500 in 2015 to 171,700 by 2040 (BEBR 2015). While most of the population growth is expected in the central portions of the county (Hernando/Citrus County 2040 LRTP 2015), this growth could lead to an increase in park usage as Citrus County residents travel to CRPSP to enjoy the Gulf of Mexico. West of US

Highway 19 on the land immediately adjacent to the park boundary, the overwhelming majority of parcels have a low intensity coastal and lakes residential future land use designation. This designation allows for 1 dwelling unit per 20 acres, 1 dwelling unit per 5 acres with special planned development conditions, or 1 dwelling unit per acre with Florida Quality Developments. Along US Highway 19, future land use is classified as general commercial. Residential future land use designations east of US Highway 19 range from rural residential, low density residential, and medium density residential. These land uses allow for densities that range from 1 dwelling unit per acre to 8 dwelling units per acre (Citrus County Comprehensive Plan 2006).

In 2015, the Hernando/Citrus County Metropolitan Planning Organization (MPO) published the 2040 Long Range Transportation Plan (LRTP) in order to coordinate transportation infrastructure developments. As a part of these efforts, the plan calls for a widening of US Highway 19 between Fort Island Trail and Green Acres Street. The widening is scheduled to be completed by 2019. In addition to widening the roadway, the 2040 LRTP calls for the development of a trail network throughout Citrus County. Multi-use trails, trailheads, and trail connectors to fill in existing gaps are proposed in the City of Crystal River and along US Highway 19. The DRP should coordinate with Citrus County, where possible, to encourage the development of trails that create connectivity with CRPSP.

Along Powerline Road adjacent to the northeastern boundary of the park, a Liquefied Natural Gas (LNG) facility has been granted authority from the Federal Department of Energy (DOE) to produce and export LNG. As of the drafting of this plan, the development of the facility has not commenced, but the company seeking to establish this facility has submitted semi-annual reports to DOE on the progress of the project. The most recent report stated completion of the facility and commencement of commercial production of LNG is scheduled for the second quarter of 2019, although building permits have yet to be secured. DRP will continue to monitor the progress of this potential facility.

The future land use designations for the City of Crystal River differ slightly from those put in place by Citrus County. South of State Park Road on land adjacent to the Churchhouse Hammock parcel of CRPSP, future land use designations include medium density residential that allows for 8 dwelling units per acre and low density residential that allows 3 dwelling units per acre. The future land use designations surrounding park property at Miller Creek are also medium and low density residential. In addition, the eastern side of the Miller Creek parcel is adjacent to the City of Crystal River's Community Redevelopment Agency (CRA) boundary. The CRA boundary represents the area that the City of Crystal River will focus its redevelopment efforts. Potential redevelopment projects that could increase tourism and outdoor recreation in the area include the Hunter Springs Park redesign, the King's Bay Riverwalk and multi-use trail, and the Crystal River Aquarium project. These redevelopment projects represent areas in which there are opportunities to educate residents and visitors about CRPSP, as well as create connectivity with the park.

## **Property Analysis**

Effective planning requires a thorough understanding of the unit's natural and cultural resources. This section describes the resource characteristics and existing uses of the property. The unit's recreation resource elements are examined to identify the opportunities and constraints they present for recreational development. Past and present uses are assessed for their effects on the property, compatibility with the site, and relation to the unit's classification.

### **Recreational Resource Elements**

This section assesses the park's recreational resource elements, those physical qualities that, either singly or in certain combinations, can support various resource-based recreation activities. Breaking down the property into such elements provides a means for measuring the property's capability to support potential recreational activities. This process also analyzes the existing spatial factors that either favor or limit the provision of each activity.

### **Land Area**

Although CRPSP encompasses nearly 27,500 acres, a majority of the acreage at the park is ecologically-sensitive salt marsh and hydric hammock natural communities that limit potential recreational opportunities. However, the upland portions of the park have the ideal combination of elevation and seasonal dryness to allow for hiking, biking, and wildlife viewing recreational activities.

### **Water Area**

Access to the water is one of the most attractive aspects of CRPSP, and there are several waterways adjacent or nearby including Crystal River, Crystal Bay, Kings Bay, Salt River, and the Gulf of Mexico, as well as numerous other bays, keys, and creeks. The multitude of waterways in the area make the park an ideal launching point for a leisurely paddle, day-trip, or multi-day paddling excursion. A large portion of CRPSP's coastal marsh islands south of the Crystal River lay within the St. Martin's Marsh Aquatic Preserve boundary, which is managed by FDEP's Florida Coastal Office.

### **Shoreline**

The park shares a 20-mile border with the Gulf of Mexico, which mixes with several different spring-fed sources of freshwater to create the region's pristine estuary. This delicate combination of saltwater and freshwater creates an environment that is perfect for scalloping and fishing, as well as paddling and boating.

## **Natural Scenery**

CRPSP is uniquely situated in the transition area between temperate and sub-tropical zones, creating an environment that encompasses a wide range of natural communities. The transition from upland flatwoods to hydric hammock and salt marsh produces spectacular vistas that attract nature lovers and wildlife enthusiasts from around the world.

## **Significant Habitat**

Given the diversity of natural communities found at the park, CRPSP provides habitat for more than 50 imperiled species, with about half of those species being imperiled bird species. The park sustains important habitat for migratory and nesting birds, making CRPSP an exceptional location for birding and wildlife photography.

## **Natural Features**

The hydric hammock natural community is a rare coastal ecosystem that has rapidly declined in total acreage throughout its range, and CRPSP is one of the last remaining expanses of land that protects the dwindling natural community. Hydric hammock aids in keeping the adjacent navigable waters and estuary pristine for paddlers and birders, as well as providing shaded canopy for trails.

## **Archaeological and Historical Features**

The ecologically productive estuary attracted the earliest Native Americans to Crystal River, and the 110 recorded archaeological sites suggest that prehistoric peoples resided in the area as early as 12,000 years ago. One of the most impressive examples of this prehistoric history can be experienced by paddlers attempting to navigate The Narrows, where shell mounds extend skyward above the Salt River. The park is managed collectively with the nearby Crystal River Archaeological State Park, a pre-Columbian ceremonial burial mound complex and National Historic Landmark. The cultural resources of the two parks are closely connected given the proximity of the sites and time periods associated with archaeological findings.

## **Assessment of Use**

All legal boundaries, significant natural features, structures, facilities, roads and trails existing in the unit are delineated on the base map (see Base Map). Specific uses made of the unit are briefly described in the following sections.

### **Past Uses**

Many of the upland areas of the park were subject to logging activities at one time. Longleaf and loblolly pines were cut and utilized for construction materials. Several of the remaining large pines have "cat faces", which

indicated that turpentine production was also a traditional use of the property before state acquisition. In addition to timber and turpentine harvesting, the Hollins tract was used to raise cattle and for an exclusive hunting club. Limited limestone mining also occurred on some northern sections of the park. Wetlands were logged in some areas of the park, as evidenced by large stumps of cut cypress and black gum. In coastal hammocks, southern red cedar was harvested to support pencil factories in Crystal River and Cedar Key. As early as the late 19<sup>th</sup> and early 20<sup>th</sup> centuries, the Crystal River was home to a booming tourism industry based on hunting and fishing with several hunting leases located on areas that later became part of CRPSP.

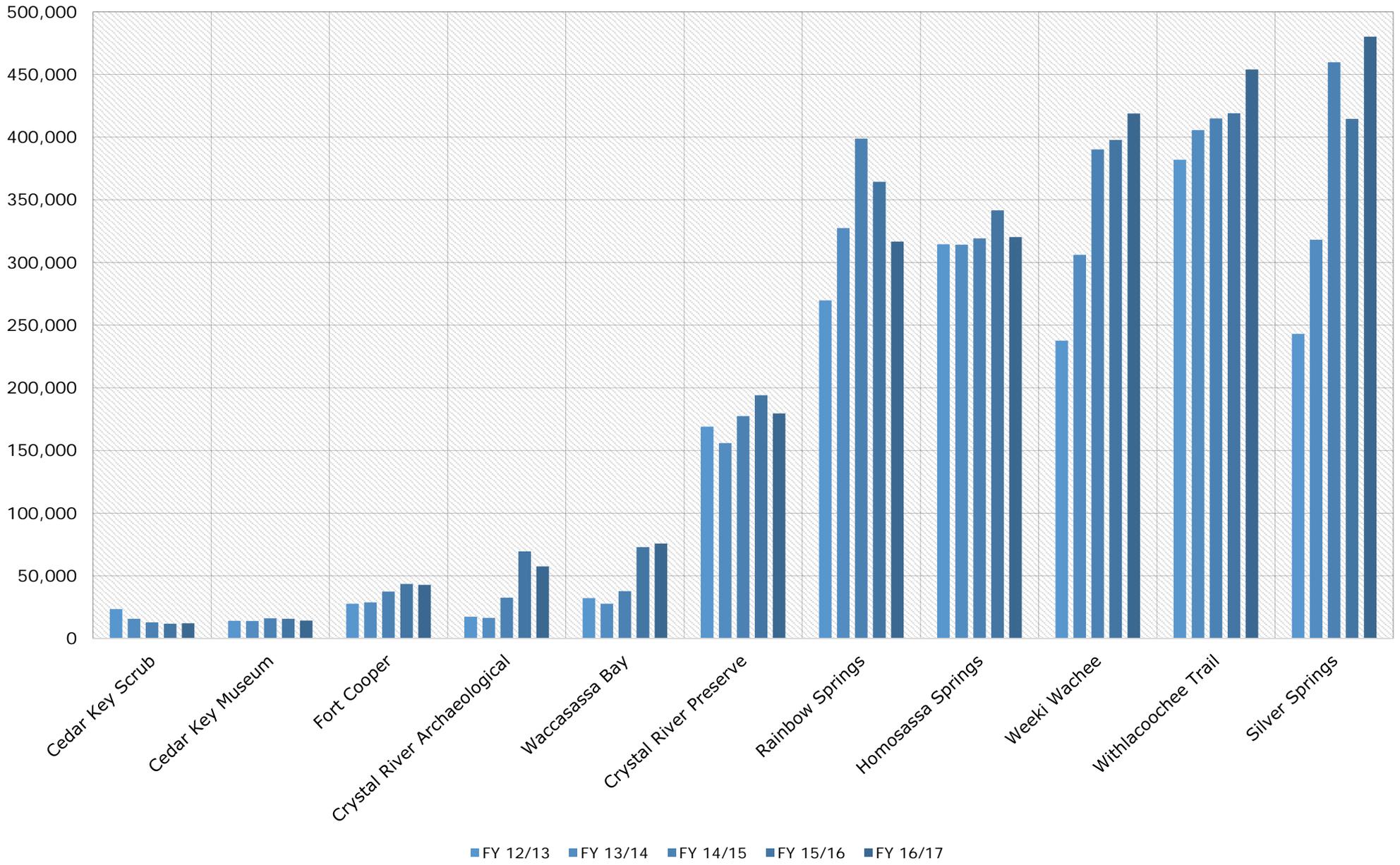
### **Future Land Use and Zoning**

The DRP works with local governments to establish designations that provide both consistency between comprehensive plans and zoning codes and permit typical state park uses and facilities necessary for the provision of resource-based recreation.

The Citrus County future land use map has CRPSP designated in the conservation district. This land use district allows for uses that are directed toward protection and conservation of natural resources, and the development of facilities in this district is limited to those that will further the purposes outlined in the agency's management plan (Citrus County Land Development Code 2012). Permitted uses include single family residential, educational facilities, outdoor recreational amenities, limited agricultural activities, public utilities, governmental offices, and neighborhood commercial uses such as museums and bait shops. Although the permitted residential uses are presumably in place to allow for the development of park staff residences, it may be necessary to coordinate with Citrus County to clarify or remove the residential category to avoid misinterpretation.

For the park property that falls within the City of Crystal River jurisdiction, there are two future land use classifications: conservation and public/semi-public. Similar to the Citrus County conservation designation, the City of Crystal River allows for limited residential with a density of 0.5 dwelling units per acre, along with accessory structures and essential public services (Crystal River Land Development Code 2012). It may be necessary to work with the City to clarify this language. The boat basin area at CRPSP has a future land use classification of public/semi-public, and this classification will allow for the continued use of the facility for launching purposes. The only boats that are permitted to launch at the boat ramp are official vessels responsible for law enforcement and emergency response. This area also has a canoe and kayak launch that can be used by the general public.

Nature Coast State Parks  
 Annual Attendance  
 Fiscal Year (FY) 2012-2017





## **Current Recreational Use and Visitor Programs**

There are numerous recreational opportunities at CRPSP. Land-based recreation includes hiking, biking, wildlife viewing, and nature study. The park office in the boat basin area also dedicates a small portion of the building to displays and interpretive exhibits, as well as large aquariums, intended to educate visitors about the habitats and wildlife that can be found throughout the park. From the park office, visitors can secure a seat on the Heritage-Eco Boat Tour or the Sunset Cruise. Two canoe and kayak launches are available for park visitors, one directly across from the park office in the boat basin area and another at the nearby Mullet Hole area, which is also a popular fishing location. Another popular fishing area known as the Redfish Hole is located off of Fort Island Trail.

Crystal River Preserve State Park recorded 179,605 visitors in FY 2016/2017. By DRP estimates, the FY 2016/2017 visitors contributed \$16,809,429 in direct economic impact, the equivalent of adding 269 jobs to the local economy (FDEP 2017). This direct economic impact accounts for nearly 7.5% of the regional economic activity generated by state parks in the region. During fiscal year 2016/2017, ten state parks and one state trail in this region had a total visitation of 2.4 million and an estimated economic impact of \$229 million.

## **Other Uses**

Volunteers with the US Coast Guard Auxiliary maintain a radio base station in a building located near the park office. The Coast Guard Auxiliary is the civilian volunteer arm of the US Coast Guard, and the Crystal River Flotilla members are in place to assist the US Coast Guard stationed at Yankeetown, if necessary, as well as volunteer their time to ensure boater safety on the Crystal River and in Crystal Bay.

Four full-time staff members of FDEP's Florida Coastal Office share administrative office space, boat storage, and maintain a lab at the park office. They are responsible for water quality monitoring, seagrass monitoring and restoration, education, and outreach for the St. Martin's Marsh Aquatic Preserve and Big Bend Seagrasses Aquatic Preserve.

The Florida Public Archaeological Network (FPAN) is state funded and administered by West Coast University in conjunction with the University of South Florida. The north Florida outreach coordinator and assistant share an office located at the park office. FPAN provides archaeological education and outreach for an area that covers 9 counties, and assists park staff with programs and events at CRPSP and Crystal River Archaeological State Park.

The FWC maintains two existing docks in the park's boat basin area for patrol boats and rapid recovery vessels. FWC uses the park's boat ramp on a daily basis for patrol and law enforcement on the Crystal River. The Citrus County Sheriff's Office also uses the boat ramp for launching patrol and emergency response vessels to the Crystal River.

Friends of the Crystal River State Parks, the park's citizen support organization, currently uses a portion of the boat basin area for special events and interpretive programming.

## **Protected Zones**

A protected zone is an area of high sensitivity or outstanding character from which most types of development are excluded as a protective measure. Generally, facilities requiring extensive land alteration or resulting in intensive resource use, such as parking lots, camping areas, shops or maintenance areas, are not permitted in protected zones. Facilities with minimal resource impacts, such as trails, interpretive signs and boardwalks are generally allowed. All decisions involving the use of protected zones are made on a case-by-case basis after careful site planning and analysis.

At Crystal River Preserve State Park all wetlands and floodplains as well as known imperiled species habitat have been designated as protected zones. The park's current protected zone is delineated on the Conceptual Land Use Plan.

## **Existing Facilities**

Most of the recreational facilities at CRPSP are located in the areas of the park north of the Crystal River. The boat basin area is one of the most frequented areas of the park. This use area includes small picnic pavilion, canoe and kayak launch, several support facilities, and a park office that doubles as a small interpretive exhibit. Another popular recreational use area is the fishing area known as Mullet Hole, located near the park entrance. Adjacent to the Mullet Hole, the Crystal Cove Trail meanders along the Indian River canal and leads to a marsh view of the Crystal River. North of the park entrance is the 7-mile loop trail, which is popular for hikers and off-road cyclists. Visitors can experience northern portions of the park at the Eco-Walk Trail located off of Tallahassee Road. The park support facilities north of the 7-mile loop trail can be accessed by park staff from Powerline Road.

On US Highway 19 across from the Crystal River Mall, the Churchhouse Hammock trailhead provides visitors with a parking area, picnic pavilion, and restroom, as well as access to hiking trails and boardwalk. Along County Road 44, the Redfish Hole and Dixie Shores trailheads offer hiking trails and fishing (see Base Map).

## **Recreation Facilities**

### Boat Basin Area

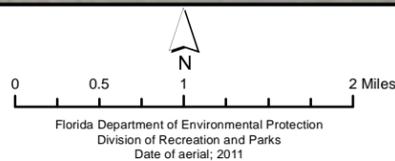
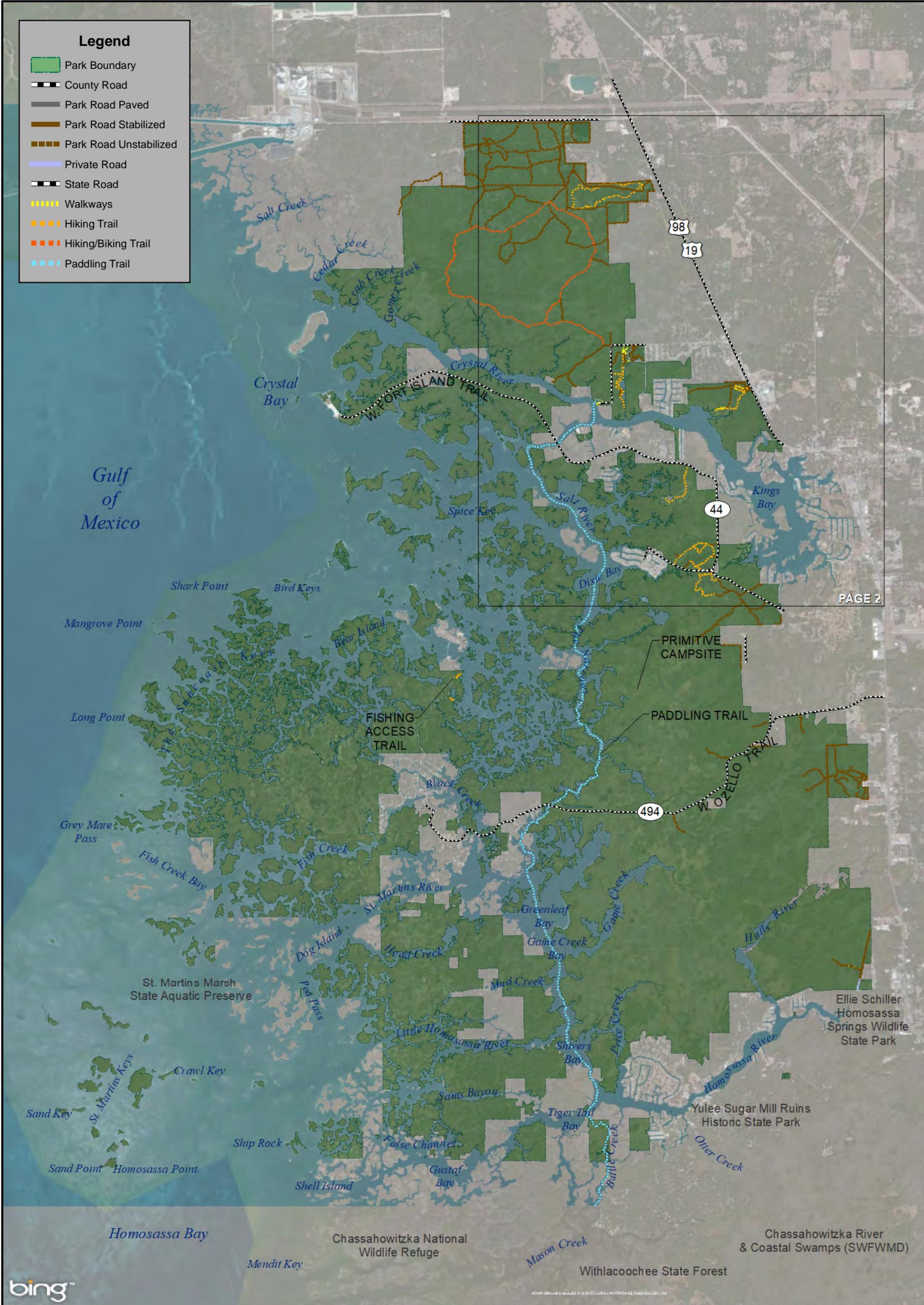
Interpretive Exhibit (Small)  
Canoe/Kayak Launch  
Picnic Pavilion (Small)

### Trails

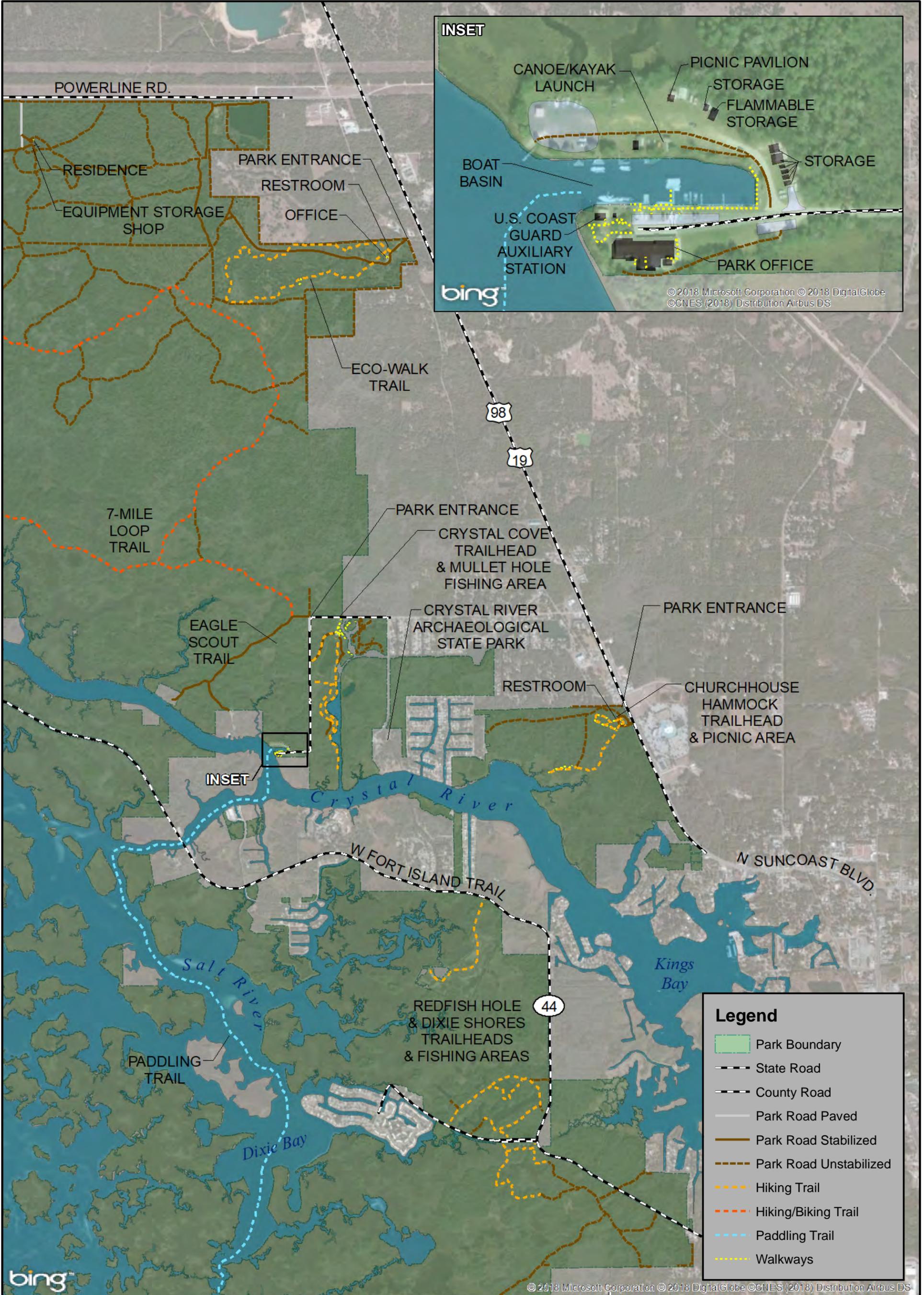
Shared Use (8 miles)  
Hiking (6.5 miles)  
Paddling (13 miles)

**Legend**

-  Park Boundary
-  County Road
-  Park Road Paved
-  Park Road Stabilized
-  Park Road Unstabilized
-  Private Road
-  State Road
-  Walkways
-  Hiking Trail
-  Hiking/Biking Trail
-  Paddling Trail









Mullet Hole Area  
Shoreline Fishing  
Restroom

Churchhouse Hammock Area  
Picnic Pavilion (Medium)  
Composting Restroom

Camping Area  
Primitive Boat-in Campsite

### **Support Facilities**

Boat Basin Area  
Administrative Office  
Storage (7)  
Flammable Storage

Shop Area  
Residence (Bunkhouse)  
Storage  
Flammable Storage

### **Conceptual Land Use Plan**

The following narrative represents the current conceptual land use proposal for this park. The conceptual land use plan is the long-term, optimal development plan for the park, based on current conditions and knowledge of the park's resources, landscape and social setting (see Conceptual Land Use Plan). The conceptual land use plan is modified or amended, as new information becomes available regarding the park's natural and cultural resources or trends in recreational uses, in order to adapt to changing conditions. Additionally, the acquisition of new parkland may provide opportunities for alternative or expanded land uses. The DRP develops a detailed development plan for the park and a site plan for specific facilities based on this conceptual land use plan, as funding becomes available.

During the development of the conceptual land use plan, the DRP assessed the potential impact of proposed uses or development on the park resources and applied that analysis to determine the future physical plan of the park as well as the scale and character of proposed development. Potential resource impacts are also identified and assessed as part of the site planning process once funding is available for facility development. At that stage, design elements (such as existing topography and vegetation, sewage disposal and stormwater management) and design constraints (such as imperiled species or cultural site locations) are investigated in greater detail. Municipal sewer connections, advanced wastewater treatment or best available technology systems are applied for on-site sewage disposal.

Creation of impervious surfaces is minimized to the greatest extent feasible in order to limit the need for stormwater management systems, and all facilities are designed and constructed using best management practices to limit and avoid resource impacts. Federal, state and local permit and regulatory requirements are addressed during facility development. This includes the design of all new park facilities consistent with the universal access requirements of the Americans with Disabilities Act (ADA). After new facilities

are constructed, park staff monitors conditions to ensure that impacts remain within acceptable levels.

## **Potential Uses**

### **Public Access and Recreational Opportunities**

**Goal: Provide public access and recreational opportunities in the park.**

The existing recreational activities and programs of this state park are appropriate to the natural and cultural resources contained in the park and should be continued. New and improved activities and programs are also recommended and discussed below.

***Objective: Maintain the park's current recreational carrying capacity of 920 users per day.***

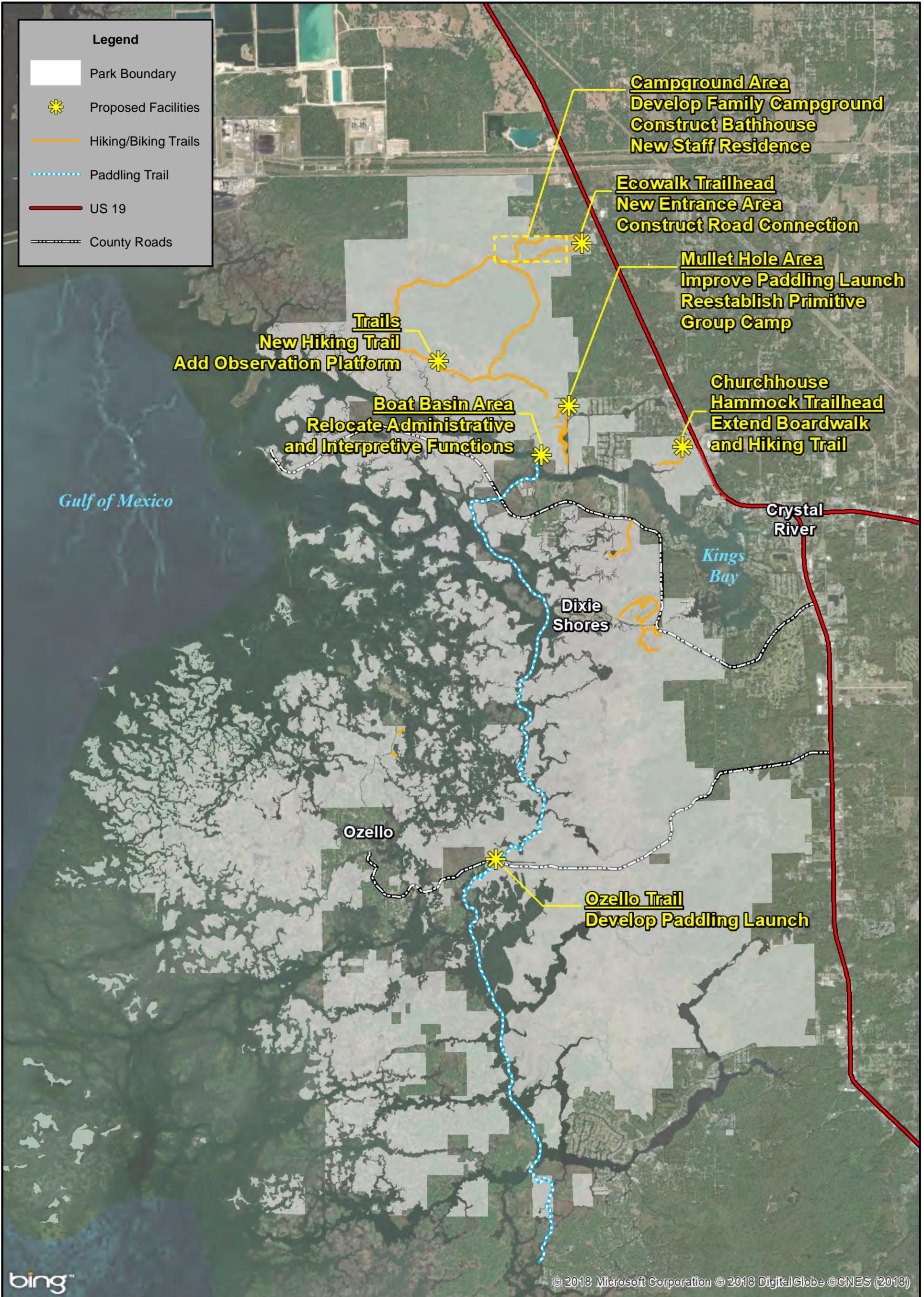
Given its pristine estuary and ideal location on the Gulf of Mexico, CRPSP will continue to be presented as a nature enthusiast's paradise. The existing recreational facilities that encourage hiking, biking, padding, and fishing will be maintained as key assets for the park. In addition, interpretation of the park's natural and cultural resources will remain an emphasis.

***Objective: Expand the park's recreational carrying capacity by 648 users per day.***

Currently, the park can be considered underutilized from a recreational perspective. In order to expand recreational activities at the park, a developed campground should be established to attract overnight visitors. Following the implementation of the RV campground, it can be expected that the demand for other recreational activities will also increase. Hiking, biking, and paddling opportunities should be expanded to capture this increased demand. In order to accommodate an increase capacity, an entrance station will need to be constructed to control access to the park.

***Objective: Continue to provide the current repertoire of 6 interpretive, educational and recreational programs on a regular basis.***

This plan recommends the park office, which also houses a small interpretive exhibit, should be offered to a concessionaire. As such, the administrative functions and interpretive exhibit would need to be relocated. The interpretive material displayed at the park office should be absorbed into the museum at Crystal River Archaeological State Park in order to continue to educate visitors about the natural communities and wildlife found at the park. Interpretive signage that illustrates resource management efforts, restoration techniques, and recreational activities will continue to inform and guide visitors' exploration of the park. Ranger and park staff-led interpretive tours and workshops will also continue to be offered.





***Objective: Develop 2 new interpretive, educational and recreational programs.***

CRPSP should be presented as a premier paddling destination, and as such, new interpretive signage is needed to enable paddlers to easily navigate the waters surrounding the park. The development of waterproof maps and wayfinding signage along the paddling trail should be explored. In addition, hundreds of archaeological sites can be found throughout the park. The cultural resources should be interpreted to educate visitors on the significance of the area to prehistoric cultures, and an interpretive boat tour service could be one way to interpret the history associated with the park and surrounding lands.

## **Proposed Facilities**

### **Capital Facilities and Infrastructure**

**Goal: Develop and maintain the capital facilities and infrastructure necessary to implement the recommendations of the management plan.**

The development concept for CRPSP envisions the park as an emergent destination for paddling, boating, and camping. The process of achieving this vision should be implemented through a phased approach in which each development enables the next to take place. The first step involves creating a unified entrance area for both CRPSP and Crystal River Archaeological State Park. This step requires the acquisition of parcels north of State Park Street that have been identified on the optimum boundary, along with securing the rights-of-way for State Park Street and Museum Pointe. The unified entrance area will allow for the construction of a ranger station, which will become the new administrative office for the park. From there, the establishment of a developed campground will create a demand for additional facilities that provide outdoor recreation opportunities for overnight visitors. These recreational facilities should be relatively concentrated around the existing facilities north of the Crystal River to enable the park staff to effectively manage and maintain new developments.

The existing facilities of this state park are appropriate to the natural and cultural resources contained in the park and should be maintained. New construction, as discussed further below, is recommended to improve the quality and safety of the recreational opportunities, to improve the protection of park resources, and to streamline the efficiency of park operations. The following is a summary of improved and new facilities needed to implement the conceptual land use plan for Crystal River Preserve State Park:

***Objective: Maintain all public and support facilities in the park.***

All capital facilities, trails and roads within the park will be kept in proper condition through the daily or regular work of park staff and/or contracted help.

***Objective: Improve/repair 3 existing facilities, 7 miles of trail, and 500 feet of boardwalk.***

Major repair projects for park facilities may be accomplished within the ten-year term of this management plan, if funding is made available. These include the modification of existing park facilities to bring them into compliance with the Americans with Disabilities Act (a top priority for all facilities maintained by DRP). The following discussion of other recommended improvements and repairs are organized by use area within the park.

Boat Basin Area

Following the development of a unified entrance area and ranger station, the administrative office functions should be moved to the new ranger station and the interpretive exhibit should be absorbed into the Crystal River Archaeological State Park museum. This relocation will streamline park operations for the two parks, which are the responsibility of the same park manager and staff. In addition, the storage and shop facilities should be removed from this use area and relocated to existing support facility areas at CRPSP and Crystal River Archaeological State Park. Additional considerations to accommodate the relocated support facilities will be proposed below.

Once these facilities have been relocated, the structure that previously housed the administrative office and interpretive exhibit could be offered to a concessionaire. An alternative in which modifications to the existing structure are made to accommodate both an administrative office and small concession will also be considered. Possible concession opportunities include rentals for paddling, interpretive boat tours, and outfitting. As previously stated, there are several other agencies and organizations that currently share the administrative office space with park staff at CRPSP. Coordination with the relevant stakeholders will take place prior to starting the request for proposals process in order to ensure an orderly withdrawal of support facilities from the boat basin area. In addition, results from a marketing and visitor analysis survey should be used to determine the scope of concession needs.

Churchhouse Hammock Area

Improvements to the Churchhouse Hammock trails should be implemented. One of these improvements includes the addition of an outer hiking loop that connects the northern boardwalk loop near the trailhead with the marsh boardwalk. The area near the start of the marsh boardwalk is particularly wet, and the new outer loop and existing primitive hiking trail should be raised in this area. Additionally, the marsh boardwalk should be extended to traverse to Bagley Cove and provide a scenic viewing area of the marsh landscape. The composting restrooms in this area of the park will be removed.

## Trails

In the southwestern area of the 7-mile loop trail, an observation platform should be constructed in a location that is deemed to have no or minimal impact to the surrounding environment. This observation platform will showcase the scenic vistas of the salt marsh. An additional 3-mile loop should be developed to offer park visitors a shorter hiking option. The 3-mile loop will branch off of the existing 7-mile loop trail and could be routed to travel through land identified on the optimum boundary. In addition to these terrestrial trails, the park should also add up to 3 miles of paddling trails. The DRP should coordinate with county and city officials to develop a bike trail that leads to the park entrance and explore the potential of developing a network of paddling trails that enable paddlers to utilize both state and local launching facilities.

***Objective: Construct 4 new facilities and 1 mile of road.***

## Entrance Area

The creation of a unified entrance station that allows visitors to access both CRPSP and Crystal River Archaeological State Park through the same gate is the first step in achieving the park's development vision. Currently, there is not an entrance station at CRPSP, and in order to develop a family campground area, a ranger/entrance station will need to be constructed. A new entrance station will be explored at the Ecowalk Trailhead. A road connecting the entrance area to State Park Street and Museum Pointe will be needed, and an engineering study should be conducted to identify an appropriate route. It will be necessary to annex portions of State Park Street and Museum Pointe from Citrus County for the construction of the entrance station to take place and may also require acquisition of parcels identified in the optimum boundary north of State Park Street.

New support facilities should be developed in this area as a means to remove support facilities from the boat basin area. Once the entrance station is established, it will be possible to move the administrative office from the boat basin area to the entrance station, and the park office's interpretive exhibit can be absorbed into the museum at Crystal River Archaeological State Park. With the park office and interpretive exhibit relocated, the structure at the boat basin area will be available to offer to a concessionaire.

## Campground Area

The City of Crystal River is an increasingly popular eco-tourism destination, particularly during the winter months when manatees are attracted to the waters of Kings Bay. As a means to capture this tourist activity and increase park visitation, a developed campground should be established at CRPSP. The campground configuration will include up to two loops with central bathhouse facilities and an additional tent camping-only loop. Following preliminary investigation and public feedback on possible sites, the area between the

Ecowalk Trailhead and the existing northern support area will be explored for potential campground locations. This area contains previously disturbed land and could be developed with minimal-to-no disturbance of intact natural communities. Local sewage connections should be pursued, if possible. A new staff residence will need to be constructed to monitor the campground and be available to respond to emergencies. Volunteer camp sites could also supplement staff responsibilities and facilitate the visitor experience.

### Ozello Trail

Along the West Ozello Trail (County Road 494) on the paddling trail, an informal canoe and kayak launch has been created. This area should be stabilized and developed into an official launching point. An entrance and exit for paddlers at this location would create a shorter paddling trail option for visitors who do not wish to complete the entire 13 miles of the existing paddling trail. In the event of a concession operation at the boat basin area, this area could be a pick-up point for guided kayak tours of the Salt River.

### Mullet Hole Area

The Mullet Hole area is a popular fishing location that includes a small parking area, restroom, and an informal paddling launch. The paddling launch should be improved to facilitate paddling opportunities at the park. This area of the park has been historically used for primitive group camps to accommodate youth groups, although primitive group camping has not been offered in recent years. The primitive group camp should be reestablished, and the existing waterline should be repaired/extended to provide tent-only group camping opportunities.

## **Facilities Development**

Preliminary cost estimates for these recommended facilities and improvements are provided in the Ten-Year Implementation Schedule and Cost Estimates (Table 6) located in the Implementation Component of this plan. These cost estimates are based on the most cost-effective construction standards available at this time. The preliminary estimates are provided to assist DRP in budgeting future park improvements, and may be revised as more information is collected through the planning and design processes. New facilities and improvements to existing facilities recommended by the plan include:

### **Recreation Facilities**

#### Boat Basin Area

Relocate Interpretive Exhibit

#### Ozello Trail

Develop Paddling Launch

#### Trails

New Hiking Trail (Up to 3 miles)  
New Paddling Trail (Up to 3 miles)  
Construct Observation Platform

#### Churchhouse Hammock Area

Extend Boardwalk (Up to 500 feet)  
New Hiking Trail (Up to 1 mile)  
Remove Composting Restrooms

Campground Area

Develop Family Campground  
Construct Bathhouse  
New Staff Residence/Volunteer Sites

Mullet Hole Area

Improve Paddling Launch  
Reestablish Primitive Group Camp

**Support Facilities**

Entrance Area

Redesign Entrance Road  
Construct Ranger Station  
Add Storage Facilities

Boat Basin Area

Relocate Administrative Office  
Relocate Storage/Shop

**Recreational Carrying Capacity**

Carrying capacity is an estimate of the number of users a recreation resource or facility can accommodate and still provide a high quality recreational experience and preserve the natural values of the site. The carrying capacity of a unit is determined by identifying the land and water requirements for each recreation activity at the unit, and then applying these requirements to the unit's land and water base. Next, guidelines are applied which estimate the physical capacity of the unit's natural communities to withstand recreational uses without significant degradation. This analysis identifies a range within which the carrying capacity most appropriate to the specific activity, the activity site and the unit's classification is selected (see Table 5). The DRP's Recreational Carrying Capacity Guidelines are outlined in Addendum 10.

**Table 5. Recreational Carrying Capacity**

<b>Activity/Facility</b>	<b>Existing Capacity*</b>		<b>Proposed Additional Capacity</b>		<b>Estimated Recreational Capacity</b>	
	<b>One Time</b>	<b>Daily</b>	<b>One Time</b>	<b>Daily</b>	<b>One Time</b>	<b>Daily</b>
<b>Trails</b>						
Shared Use	80	320			80	320
Hiking	65	260	30	120	95	380
Paddling	104	208	24	48	128	256
<b>Picnicking</b>	24	48			24	48
<b>Camping</b>						
Developed			480	480	480	480
<b>Fishing</b>	40	80			40	80
<b>TOTAL</b>	<b>313</b>	<b>916</b>	<b>534</b>	<b>648</b>	<b>847</b>	<b>1,564</b>

\*Existing capacity revised from approved plan according to DRP guidelines.

## **Optimum Boundary**

The optimum boundary map reflects lands considered desirable for direct management by the DRP as part of the state park. These parcels may include public or privately owned land that would improve the continuity of existing parklands, provide the most efficient boundary configuration, improve access to the park, provide additional natural and cultural resource protection or allow for future expansion of recreational activities. Parklands that are potentially surplus to the management needs of DRP are also identified. As additional needs are identified through park use, development, and research, and as land use changes on adjacent property, modification of the park's optimum boundary may be necessary.

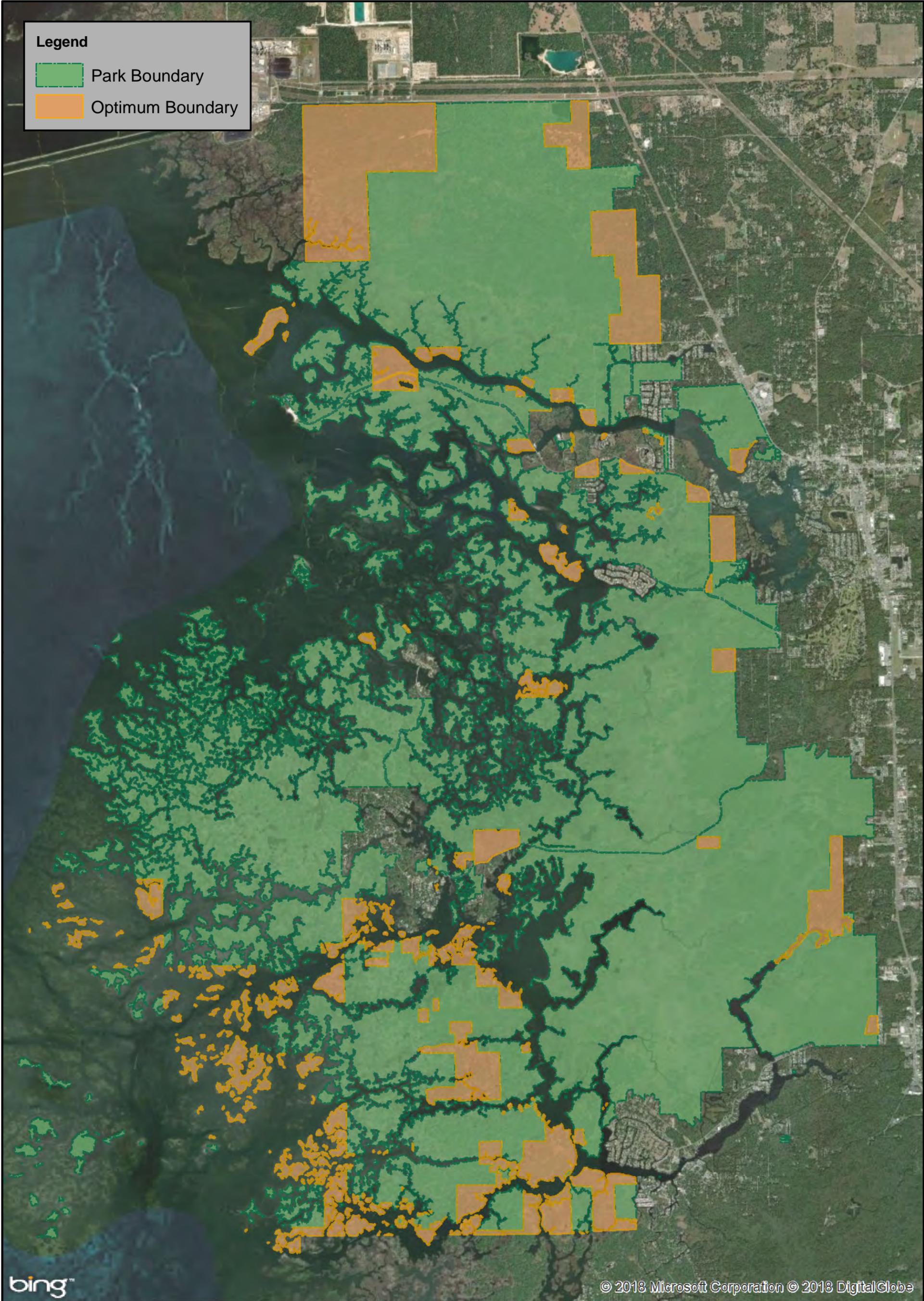
Identification of parcels on the optimum boundary map is intended solely for planning purposes. It is not to be used in connection with any regulatory purposes. Any party or governmental entity should not use a property's identification on the optimum boundary map to reduce or restrict the lawful rights of private landowners. Identification on the map does not empower or suggest that any government entity should impose additional or more restrictive environmental land use or zoning regulations. Identification should not be used as the basis for permit denial or the imposition of permit conditions.

Several parcels, approximately 5,000 acres in total, have been identified for the optimum boundary of CRPSP. Many of these parcels are included on the optimum boundary as a means to improve habitat connectivity in the marsh lands bordering the Gulf of Mexico and ensure the protection of some of the last remaining patches of the hydric hammock natural community in the state. Other parcels have been included for resource management and operational purposes. In particular, parcels north of State Park Street on the eastern boundary of the park may be required in order to achieve the conceptual development concept described above. These parcels will allow the park to construct an entrance station, which is needed to allow the park office relocation and campground development to take place.

No lands currently within the park boundary have been identified as surplus to the management needs of the park.

**Legend**

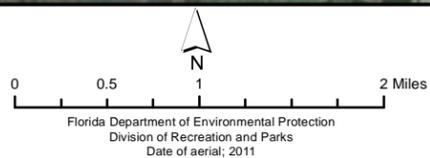
-  Park Boundary
-  Optimum Boundary



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CRYSTAL RIVER PRESERVE  
STATE PARK



OPTIMUM BOUNDARY MAP



## **IMPLEMENTATION COMPONENT**

The resource management and land use components of this management plan provide a thorough inventory of the park's natural, cultural and recreational resources. They outline the park's management needs and problems, and recommend both short and long-term objectives and actions to meet those needs. The implementation component addresses the administrative goal for the park and reports on the Division of Recreation and Parks (DRP) progress toward achieving resource management, operational and capital improvement goals and objectives since approval of the previous management plan for this park. This component also compiles the management goals, objectives and actions expressed in the separate parts of this management plan for easy review. Estimated costs for the ten-year period of this plan are provided for each action and objective, and the costs are summarized under standard categories of land management activities.

### **Management Progress**

Since the approval of the last management plan for Crystal River Preserve State Park in 2004, significant work has been accomplished and progress made towards meeting the DRP's management objectives for the park. These accomplishments fall within three of the five general categories that encompass the mission of the park and the DRP.

#### **Acquisition**

- 2,766 acres in Levy County transferred to Cross Florida Greenway (District 3) to simplify management.
- 22 parcel errors resolved by working with County and OPP personnel to clarify ownership and boundary location.
- Acquired 116.7 contiguous acres on the Crystal River where County records showed no ownership.
- Acquired a mitigation parcel of 24.35 acres through mitigation, added to Management Unit C3J.

#### **Park Administration and Operations**

- Installed 2,300 feet of new boundary fence and upgraded 10 gates to protect resources.
- Upgraded park telephone system to Cisco voice over internet protocol.
- Purchased and installed traffic counters at three park entrances.
- During the last ten years, park volunteers contributed over 125,000 hours of volunteer service.
- The park's Citizen Support Organization (CSO), Friends of Crystal River Parks, Inc., has provided the park with:
  - Specialized equipment for park operations and resource management activities.
  - Funding for building improvements and additional storage.
  - Funding for education, resource management and staff training.

- The CSO sponsors special events and operates the Eco Heritage boat tours expanding the public's interest in the natural and cultural resources the park represents.

## **Resource Management**

### **Natural Resources**

- Type 6 brush truck, forestry disc, and other implements acquired for fire operations.
- Prescribed fire conducted on 4,190 acres.
- Prescribed fire program expanded into the growing season; fire introduced to 1,295 burn-type acres with no previous management history.
- 3,273 acres treated for exotic plants, resulting in a 29% decrease in infestation levels.
- Additional personnel and equipment including an OSHA compliant herbicide storage building, ATV and sprayer acquired to improve herbicide application capability.
- 643 feral hogs removed from park to reduce groundcover disturbance and protect natural communities.
- Five new culverts placed on Sailboat Avenue and Seven-mile Loop Trail. Repaired two culverts. Installed 330-foot low water crossing to restore sheet flow and allow for fire operations. Five additional low water crossings designed and permitted.
- Conducted timber thinning in 2007 and 2011 for restoration of flatwoods natural communities. 398 acres of plantation pine and 40 acres of overgrown natural forest were thinned.
- 83,000 longleaf pine seedlings planted over 455 acres
- 4.1 miles of unnecessary trails and firebreaks were closed. Combination of these units allowed more efficient resource management and reduced habitat fragmentation.
- Mechanical treatment (roller chopping or mowing) conducted on 120.7 acres for habitat improvement and facilitating prescribed fire.
- Cabbage palms thinned on 59.5 acres to improve groundcover and restore flatwoods to historic condition.
- Park staff or volunteers have monitored or conducted baseline surveys on freshwater fish, butterflies, bobwhite quail, feral hogs, small mammals, mesopredators, gopher tortoise and other herpetofauna.
- 109 plant, animal and fish species have been documented and added to the Preserve inventory from 2004-2014.
- AmeriCorps host park from 2008-2018, total of 14 AmeriCorps staff who participated in exotic plant control, outreach, volunteer recruitment, and trail maintenance. Allowed us to nearly double annual treatment goals.
- Applied for and received 6 FWC exotic plant treatment contracts totaling 964.4 acres.

## **Cultural Resources**

- The Florida Public Archaeology Network (FPAN) Central Florida Office co-located in the park, assisting the park and surrounding counties with outreach concerning prehistoric and historic cultural resources in the area.
- Continued partnership with Gulf Archaeological Research Institute to provide education and research regarding the cultural resources in the park. This has led to:
  - 10 Action Reports on weather related impacts to coastal sites with recommendations for remediation or treatment
  - Coordination and field action on Park projects requiring Cultural Resource Management treatments
  - Site condition (natural-cultural) monitoring of cultural resources
  - Coordination with the Park Biologist on the location of new sites and GIS mapping. Eight new sites identified during routine monitoring of park areas on Fort Island Trail and South of Dixie Shores.
  - 6 technical reports submitted on cultural resources
- Completed Archaeological Resource Sensitivity Modeling for park.

## **Recreation and Visitor Service**

- Loop trail was shortened and rerouted to simplify navigation for recreational user groups.
- Native plant garden with over 35 local species opened to the public as an example and teaching tool.
- Citrus Audubon and Citrus Native Plant Society provide guided walks 3-4 times per year on the Preserve.
- Two canoe/ kayak launches installed.
- Hosted weeklong children's day camp called Estuary Exploration each summer 2008-current.
- The Preserve staff have been involved in the Annual Save Our Waters Week and Coastal Cleanup since 2007. Staff serve as group cleanup leaders, provide interpretive programs, boat, and kayak tours.
- The park consistently hosts alternative spring break and scout groups to complete resource management or facility improvement projects.
- Four trail locations are listed as destinations on the Great Florida Birding Trail.

## **Park Facilities**

- Converted old shop office to living space for AmeriCorps, burn teams, and other temporary staff.
- New herbicide storage building erected at shop area.
- 60' High band radio tower installed at Office for repeater.
- Conference room completely refurbished including AV system.
- Built event stage for small concerts and events.
- Replaced roof on Park Office/Visitor Center.

- Multistage water filter installed at shop and Ecowalk buildings to fix poor well water conditions and provide potable water.
- New office HVAC unit- moved out of attic to reduce moisture buildup and improve maintenance.
- New metal carport erected at office for protection of state watercraft.
- New metal carport erected at shop to protect tractors and other equipment
- Resident volunteer RV site added to shop area.

### **Management Plan Implementation**

This management plan is written for a timeframe of ten years, as required by Section 253.034 Florida Statutes. The Ten-Year Implementation Schedule and Cost Estimates (Table 6) summarizes the management goals, objectives and actions that are recommended for implementation over this period, and beyond. Measures are identified for assessing progress toward completing each objective and action. A time frame for completing each objective and action is provided. Preliminary cost estimates for each action are provided and the estimated total costs to complete each objective are computed. Finally, all costs are consolidated under the following five standard land management categories: Resource Management, Administration and Support, Capital Improvements, Recreation Visitor Services and Law Enforcement.

Many of the actions identified in the plan can be implemented using existing staff and funding. However, a number of continuing activities and new activities with measurable quantity targets and projected completion dates are identified that cannot be completed during the life of this plan unless additional resources for these purposes are provided. The plan's recommended actions, time frames and cost estimates will guide the DRP's planning and budgeting activities over the period of this plan. It must be noted that these recommendations are based on the information that exists at the time the plan was prepared. A high degree of adaptability and flexibility must be built into this process to ensure that the DRP can adjust to changes in the availability of funds, improved understanding of the park's natural and cultural resources, and changes in statewide land management issues, priorities and policies.

Statewide priorities for all aspects of land management are evaluated each year as part of the process for developing the DRP's annual legislative budget requests. When preparing these annual requests, the DRP considers the needs and priorities of the entire state park system and the projected availability of funding from all sources during the upcoming fiscal year. In addition to annual legislative appropriations, the DRP pursues supplemental sources of funds and staff resources wherever possible, including grants, volunteers and partnerships with other entities. The DRP's ability to accomplish the specific actions identified in the plan will be determined largely by the availability of funds and staff for these purposes, which may vary from year to year. Consequently, the target schedules and estimated costs identified in Table 6 may need to be adjusted during the ten-year management planning cycle.

Table 6  
 Crystal River Preserve State Park  
 Ten-Year Implementation Schedule and Cost Estimates  
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**NOTE: THE DIVISION'S ABILITY TO COMPLETE THE OBJECTIVES OUTLINED BY THE MANAGEMENT PLAN IS CONTINGENT ON THE AVAILABILITY OF FUNDING AND OTHER RESOURCES FOR THESE PURPOSES.**

Goal I: Provide administrative support for all park functions.		Measure	Planning Period	Estimated Manpower and Expense Cost* (10-years)
Objective A	Continue day-to-day administrative support at current levels.	Administrative support ongoing	C	\$579,500
Objective B	Expand administrative support as new lands are acquired, new facilities are developed, or as other needs arise.	Administrative support expanded	C	\$408,500
Goal II: Protect water quality and quantity in the park, restore hydrology to the extent feasible, and maintain the restored condition.		Measure	Planning Period	Estimated Manpower and Expense Cost* (10-years)
Objective A	Conduct/obtain an assessment of the park's hydrological needs.	Assessment conducted	ST or LT	\$41,760
Objective B	Restore natural hydrological conditions and function to approximately 648 acres of salt marsh, 139 acres of freshwater tidal marsh, 213 acres of hydric hammock and floodplain swamp, and 44 acres of wet flatwoods natural communities.	# Acres restored or with restoration underway	UFN	\$1,269,160
Goal III: Restore and maintain the natural communities/habitats of the park.		Measure	Planning Period	Estimated Manpower and Expense Cost* (10-years)
Objective A	Within 10 years have 2,235 acres of the park maintained within optimal fire return interval.	# Acres within fire return interval target	LT	\$1,187,340
Objective B	Conduct habitat/natural community restoration activities on 18.4 acres of restoration natural community.	# Acres restored or with restoration underway	ST or LT	\$30,500
Objective C	Conduct habitat/natural community restoration activities on 31 acres of successional hardwood forest.	# Acres restored or with restoration underway	ST or LT	\$48,000
Objective D	Conduct habitat restoration on pasture areas.	# Acres improved or with improvements underway	ST or LT	\$213,500
Objective E	Conduct habitat/natural community restoration activities on 48 acres of exotic invasive monoculture.	# Acres improved or with improvements underway	ST or LT	\$107,000
Objective F	Conduct habitat/natural community improvement activities on 153 acres of mesic flatwoods natural community.	# Acres improved or with improvements underway	ST or LT	\$89,400

\* 2018 Dollars  
 ST = actions within 2 years  
 LT = actions within 10 years  
 C = long term or short term actions that are continuous or cyclical  
 UFN = currently unfunded need



Table 6  
Crystal River Preserve State Park  
Ten-Year Implementation Schedule and Cost Estimates  
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**NOTE: THE DIVISION'S ABILITY TO COMPLETE THE OBJECTIVES OUTLINED BY THE MANAGEMENT PLAN IS CONTINGENT ON THE AVAILABILITY OF FUNDING AND OTHER RESOURCES FOR THESE PURPOSES.**

Goal IV: Maintain, improve or restore imperiled species populations and habitats in the park.		Measure	Planning Period	Estimated Manpower and Expense Cost* (10-years)
Objective A	Update baseline imperiled species occurrence inventory lists for plants and animals, as needed.	List updated	C	\$2,000
Objective B	Monitor and document 4 selected imperiled animal species in the park.	# Species monitored	C	\$15,900
Objective C	Monitor and document 3 selected imperiled plant species in the park.	# Species monitored	C	\$6,200
Goal V: Remove exotic and invasive plants and animals from the park and conduct needed maintenance-control.		Measure	Planning Period	Estimated Manpower and Expense Cost* (10-years)
Objective A	Annually treat 60 acres of exotic plant species in the park.	# Acres treated	C	\$1,275,500
Objective B	Implement control measures to remove a minimum of 150 exotic feral hogs in the park annually.	# Species for which control measures implemented	C	\$8,500
Goal VI: Protect, preserve and maintain the cultural resources of the park.		Measure	Planning Period	Estimated Manpower and Expense Cost* (10-years)
Objective A	Assess and evaluate 114 of 114 recorded cultural resources in the park.	Documentation complete	LT	\$103,500
Objective B	Compile reliable documentation for all recorded historic and archaeological sites.	Documentation complete	LT	\$98,500
Objective C	Bring 3 of 114 recorded cultural resources into good condition.	# Sites in good condition	LT	\$20,000
Goal VII: Provide public access and recreational opportunities in the park.		Measure	Planning Period	Estimated Manpower and Expense Cost* (10-years)
Objective A	Maintain the park's current recreational carrying capacity of 920 users per day.	# Recreation/visitor	C	\$579,500
Objective B	Expand the park's recreational carrying capacity by 648 users per day.	# Recreation/visitor	ST or LT	\$408,500
Objective C	Continue to provide the current repertoire of 6 interpretive, educational and recreational programs on a regular basis.	# Interpretive/education programs	C	\$30,000
Objective D	Develop 2 new interpretive, educational and recreational programs.	# Interpretive/education programs	ST or LT	\$10,000

\* 2018 Dollars  
ST = actions within 2 years  
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Table 6  
 Crystal River Preserve State Park  
 Ten-Year Implementation Schedule and Cost Estimates  
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**NOTE: THE DIVISION'S ABILITY TO COMPLETE THE OBJECTIVES OUTLINED BY THE MANAGEMENT PLAN IS CONTINGENT ON THE AVAILABILITY OF FUNDING AND OTHER RESOURCES FOR THESE PURPOSES.**

Goal VIII: Develop and maintain the capital facilities and infrastructure necessary to meet the goals and objectives of this management plan.		Measure	Planning Period	Estimated Manpower and Expense Cost* (10-years)
Objective A	Maintain all public and support facilities in the park.	Facilities maintained	C	\$649,000
Objective B	Continue to implement the park's transition plan to ensure facilities are accessible in accordance with the American with Disabilities Act of 1990.	Plan implemented	ST or LT	\$50,000
Objective C	Improve/repair 3 existing facilities, 7 miles of trail, and 500 feet of boardwalk as identified in the Land Use Component.	# Facilities/Miles of Trail/Miles of Road	LT	\$895,000
Objective D	Construct 3 new facilities and 1 mile of road as identified in the Land Use Component.	# Facilities/Miles of Trail/Miles of Road	LT	\$1,720,800
Objective E	Expand maintenance activities as existing facilities are improved and new facilities are developed.	Facilities maintained	C	\$457,200
<b>Summary of Estimated Costs</b>				
<b>Management Categories</b>				<b>Total Estimated Manpower and Expense Cost* (10-years)</b>
Resource Management				\$4,516,760
Administration and Support				\$988,000
Capital Improvements				\$3,772,000
Recreation Visitor Services				\$1,028,000
Law Enforcement Activities			Note: Law enforcement activities in Florida State Parks are conducted by the FWC Division of Law Enforcement and by local law enforcement agencies.	

\* 2018 Dollars  
 ST = actions within 2 years  
 LT = actions within 10 years  
 C = long term or short term actions that are continuous or cyclical  
 UFN = currently unfunded need



## **Addendum 1—Acquisition History**



## Crystal River Preserve State Park Acquisition History

LAND ACQUISITION HISTORY REPORT					
<b>Park Name</b>	Crystal River Preserve State Park				
<b>Date Updated</b>	10/13/2016				
<b>County</b>	Citrus County, Florida				
<b>Trustees Lease Number</b>	Lease No. 4084				
<b>Current Park Size</b>	27,417.30 acres				
<b>Purpose of Acquisition</b>	The State of Florida initially acquired Crystal River Preserve State park to protect the water quality of a significant bay and river system as well as the habitat of endangered species.				
Acquisition History					
Parcel Name or Parcel DM-ID	Date Acquired	Initial Seller	Initial Purchaser	Size in acres	Instrument Type
218 Parcels and Deeds	Different	Different individuals and companies	State of Florida	12,671.79	Different Legal Instruments
MDID 11179	112/29/1994	Hollins Corporation	The Board of Trustees of the Internal Improvement Trust Fund of the State of Florida (Trustees)	3,843.59	Warranty Deed
MDID 7017	4/8/1988	Eva Mae Lane John G. Stoney and his wife Lottie M. Stoney	Trustees	1,627.13	Warranty Deed
MDID 964	4/21/1992	Harlow H. Land	Trustees	1,226.66	Warranty Deed

**Crystal River Preserve State Park Acquisition History**

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MDID 105	10/16/1984	Crystal Lakes, LTD	Trustees	1,038.30	Warranty Deed
MDID 969	12/9/1991	Crystal River Real Estate Company Limited	Trustees	942.16	Warranty Deed
MDID 8165	12/4/1995	Hugh Corrigan, III and J. Pat Corrigan	Trustees	746.58	Warranty Deed
MDID 362684	12/29/1994	Hollins Corporation	Trustees	713.97	Quit Claim Deed
MDID 917	8/16/1993	R. C. Garby, Donald E. MacClanathan, Shirley Bergquist, Terry F. Tanner, Kenneth A. Baker, Jeffrey P. MacClanathan, Nations Bank of Florida, and Doris Claire Butter	Trustees	699.23	Warranty Deed
MDID 12048	3/3/1995	Hugh Corrigan, III and J. Pat Corrigan	Trustees	665.74	Warranty Deed
MDID 4115	10/27/1988	Suncoast Shores, Inc.	Trustees	636.42	Warranty Deed
MDID 946	5/14/1992	Mary B. Schoenrock	Trustees	622.79	Quit Claim Deed
MDID 934	9/23/1992	W. J. Houle, Sr. and W. J. Houle, Jr.	Trustees	610.67	Warranty Deed
MDID 967	3/27/1992	Mary V. Schoenrock	Trustees	534.43	Warranty Deed

**Crystal River Preserve State Park Acquisition History**

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MDID 12039	3/3/1995	Anne McVeigh Bywater	Trustees	519.68	Warranty Deed
MDID 970	12/31/1991	SRC of Florida, Inc	Trustees	505.50	Warranty Deed
MDID 920	8/1/1993	Nations Bank of Florida and Doris Claire Butter as co- Trustees of the Butter Family Trust dated January 15, 1969, as to undivided 6/48 interest	Trustees	494.03	Warranty Deed
MDID 922	7/15/1993	Berkowitz David Berkowitz	Trustees	406.09	Warranty Deed
MDID 450	3/1/1967	Miguel Rodriguez and his wife Bertha Rodriguez, Luciano Rodriguez and his wife Sandra Rodriguez	The Canal Authority of the State of Florida	314.63	Deed

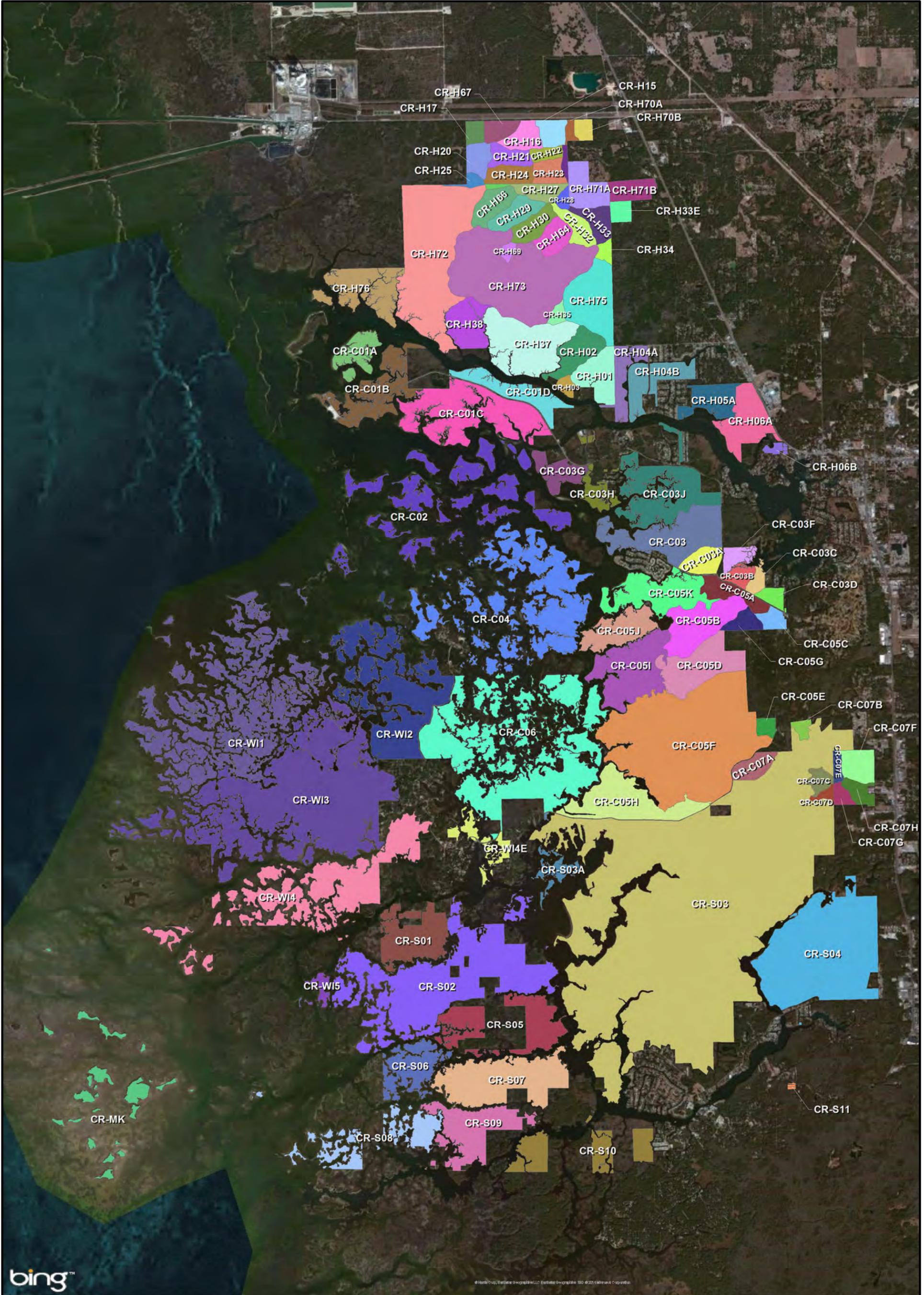
**Crystal River Preserve State Park Acquisition History**

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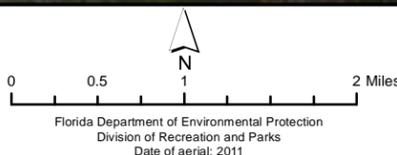
<b>Management Lease</b>					
<b>Parcel Name or Lease Number</b>	<b>Date Leased</b>	<b>Initial Lessor</b>	<b>Initial Lessee</b>	<b>Current Term</b>	<b>Expiration Date</b>
Lease No. 4084	3/7/1996	The Board of Trustees of the Internal Improvement Trust Fund of the State of Florida	State of Florida Department of Environmental Protection, Division of Marine Resources	50 years	3/6/2046
<b>Outstanding Issue</b>	<b>Type of Instrument</b>	<b>Brief Description of the Outstanding Issue</b>		<b>Term of the Outstanding Issue</b>	
Keep in natural condition	Special Warranty Deed	<i>The conveyance of this parcel is subject to express condition that the conveyed parcel shall forever be held as a nature preserve, for scientific, educational and aesthetic purpose and shall be kept in its natural state, without any disturbance of habitat or plant or animal populations</i>		Forever (in perpetuity)	

## **Addendum 2—Management Zones**





CRYSTAL RIVER PRESERVE  
STATE PARK



MANAGEMENT ZONES MAP



**Crystal River Preserve State Park Management Zones**

<b>Table 7. Management Zones</b>			
<b>Management Zones</b>	<b>Acreage</b>	<b>Managed with Prescribed Fire</b>	<b>Contains Cultural Resources</b>
CR-C1a	113.56	No	Yes
CR-C1b	252.71	No	Yes
CR-C1c	496.85	No	No
CR-C1d	165.92	No	No
CR-C2	488.05	No	Yes
CR-C3	367.07	Yes	No
CR-C3a	81.79	Yes	No
CR-C3b	47.72	Yes	No
CR-C3c	34.69	Yes	No
CR-C3d	39.47	Yes	No
CR-C3f	51.41	No	No
CR-C3g	102.35	No	No
CR-C3h	77.96	No	Yes
CR-C3j	391.91	Yes	No
CR-C4	777.38	No	Yes
CR-C5a	95.67	Yes	No
CR-C5b	253.63	Yes	No
CR-C5c	44.65	Yes	No
CR-C5d	276.41	Yes	No
CR-C5e	31.68	Yes	Unknown
CR-C5f	1,338.84	Yes	Unknown
CR-C5g	53.15	Yes	No
CR-C5h	333.21	No	No
CR-C5i	360.88	No	No
CR-C5j	180.51	No	Yes
CR-C5k	280.27	Yes	No
CR-C6	1,095.71	No	Yes
CR-C7	484.48	Yes	No
CR-C7a	77.71	Yes	No
CR-C7b	25.95	Yes	No
CR-C7c	46.08	Yes	No
CR-C7d	19.92	Yes	No
CR-C7e	25.58	Yes	No
CR-C7f	95.41	Yes	No
CR-C7h	53.22	Yes	No
CR-H1	151.80	Yes	Yes
CR-H2	137.47	Yes	Yes
CR-H3	26.87	No	No
CR-H4a	114.89	Yes	Yes
CR-H4b	171.97	No	Yes
CR-H5a	134.49	Yes	Yes
CR-H6a	217.63	Yes	Yes

## Crystal River Preserve State Park Management Zones

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CR-H6b	18.60	No	No
CR-H15	65.81	Yes	No
CR-H16	81.30	Yes	No
CR-H17	38.22	Yes	No
CR-H19	16.86	Yes	No
CR-H20	69.97	Yes	No
CR-H21	70.21	Yes	No
CR-H22	37.89	Yes	No
CR-H23	66.28	Yes	No
CR-H24	78.25	Yes	No
CR-H25	23.10	Yes	No
CR-H26	8.94	Yes	No
CR-H27	70.05	Yes	No
CR-H28	22.35	Yes	No
CR-H29	98.24	Yes	No
CR-H30	86.25	Yes	Yes
CR-H32	76.64	Yes	No
CR-H33	81.07	Yes	No
CR-H33e	41.00	Yes	Unknown
CR-H34	26.93	Yes	No
CR-H35	25.97	Yes	No
CR-H37	376.29	Yes	Yes
CR-H38	156.94	Yes	Unknown
CR-H64	90.07	Yes	No
CR-H66	102.95	Yes	No
CR-H67	57.41	Yes	No
CR-H69	21.13	No	No
CR-H70a	18.59	Yes	No
CR-H70b	34.57	No	No
CR-H71a	136.75	Yes	Unknown
CR-H71b	86.52	Yes	No
CR-H72	818.66	Yes	Yes
CR-H73	827.84	Yes	No
CR-H74*	163.14	Yes	No
CR-H75	277.23	Yes	No
CR-H76	256.77	No	Yes
CR-MK	146.95	No	No
CR-S1	282.09	No	Yes
CR-S2	1,095.83	No	Yes
CR-S3	4,367.11	No	Yes
CR-S3a	213.70	No	No
CR-S4	1,025.71	Yes	No
CR-S5	313.00	No	Yes
CR-S6	197.21	No	Yes
CR-S7	468.62	No	Yes
CR-S8	222.16	No	Yes

## Crystal River Preserve State Park Management Zones

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CR-S9	308.13	No	Yes
CR-S10	238.11	No	Yes
CR-WI1	1175.5	No	Yes
CR-WI2	708.00	No	Yes
CR-WI3	1,764.37	No	Unknown
CR-WI4	731.60	No	No
CR-WI4e	84.98	No	No

\*currently in the process of acquisition



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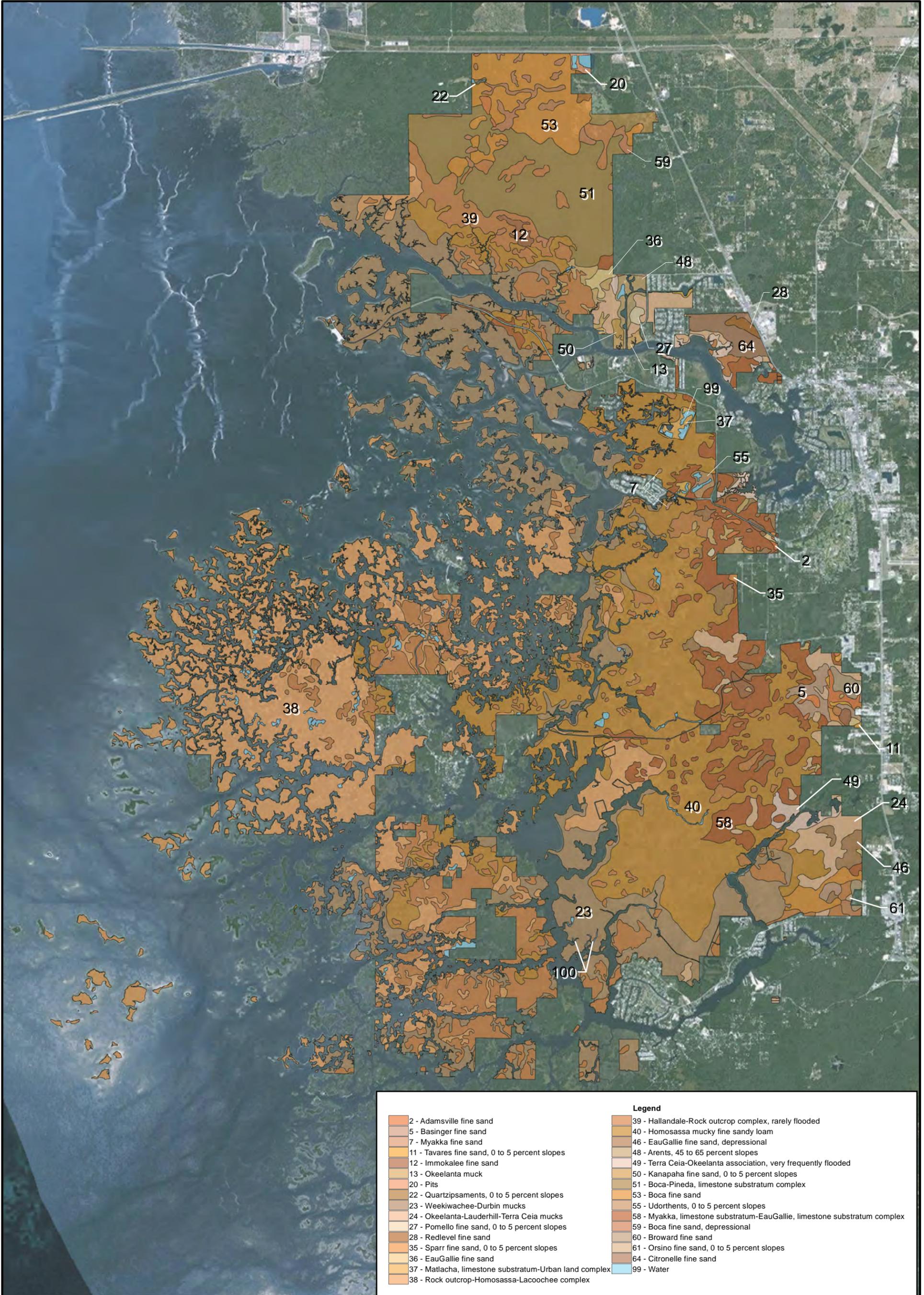
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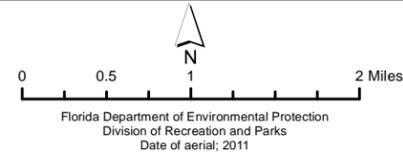
## **Addendum 4–Soil Descriptions**





Legend	
2 - Adamsville fine sand	39 - Hallandale-Rock outcrop complex, rarely flooded
5 - Basinger fine sand	40 - Homosassa mucky fine sandy loam
7 - Myakka fine sand	46 - EauGallie fine sand, depressional
11 - Tavares fine sand, 0 to 5 percent slopes	48 - Arents, 45 to 65 percent slopes
12 - Immokalee fine sand	49 - Terra Ceia-Okeelanta association, very frequently flooded
13 - Okeelanta muck	50 - Kanapaha fine sand, 0 to 5 percent slopes
20 - Pits	51 - Boca-Pineda, limestone substratum complex
22 - Quartzsaments, 0 to 5 percent slopes	53 - Boca fine sand
23 - Weekiwachee-Durbin mucks	55 - Udorthents, 0 to 5 percent slopes
24 - Okeelanta-Lauderhill-Terra Ceia mucks	58 - Myakka, limestone substratum-EauGallie, limestone substratum complex
27 - Pomello fine sand, 0 to 5 percent slopes	59 - Boca fine sand, depressional
28 - Redlevel fine sand	60 - Broward fine sand
35 - Sparr fine sand, 0 to 5 percent slopes	61 - Orsino fine sand, 0 to 5 percent slopes
36 - EauGallie fine sand	64 - Citronelle fine sand
37 - Matlacha, limestone substratum-Urban land complex	99 - Water
38 - Rock outcrop-Homosassa-Lacoochee complex	

CRYSTAL RIVER PRESERVE  
STATE PARK



SOILS MAP



## Crystal River Preserve State Park Soil Descriptions

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**(2) Adamsville fine sand** – This soil is nearly level and somewhat poorly drained. It is on low ridges in the coastal swamps and on the flatwoods and is at the base of the lower slopes on the uplands. With slopes of 2 percent or less, this soil is in a transitional position in the drainage pattern. It gradually releases water to more poorly drained soil in natural drainageways, swamps, ponds, and marshes.

Typically, the surface layer is dark grayish brown fine sand about 7 inches thick. The underlying material to a depth of 80 inches is light yellowish brown and very pale brown fine sand.

Included with this soil (less than 20 percent of the map unit) are areas of Basinger, Myakka, Pompano, and Tavares soils. Also included are small areas of soils that are similar to Adamsville soil and have limestone boulders or bedrock in the profile.

The water table is between depths of 20 and 40 inches for 2 to 6 months. It may rise to a depth of less than 20 inches for 2 weeks during very wet weather. During dry seasons, the water table generally recedes to a depth of more than 40 inches. Internal drainage is slow. Permeability is rapid. The available water capacity is very low. Natural fertility is low.

**(5) Basinger fine sand** – Nearly level and poorly drained, this soil is in poorly defined drainageways and sloughs throughout the county. The mapped areas are irregular in shape, following the local drainage patterns. The slopes are less than 2 percent.

Typically, the surface layer is black fine sand 3 inches thick. The subsurface layer, to a depth of 8 inches, is light gray fine sand. The next layer, to a depth of 24 inches, is a mixture of light brownish gray subsurface material and dark reddish brown and dark brown subsoil material. The substratum to a depth of 80 inches or more is light gray and white fine sand.

Included with this soil (about 25 percent of the map unit) are small areas of EauGallie, Immokalee, Myakka, and Pompano soils. Also included are small areas of soils that are similar to Basinger soil but have limestone bedrock at a depth of 65 inches or more. These similar soils mainly are in the coastal and extreme eastern parts of the county.

The water table is at a depth of less than 10 inches for two to six months. During dry seasons, it recedes to a depth of 30 inches or more. Internal drainage is slow. Permeability is rapid. The available water capacity and natural fertility are both low.

**(7) Myakka fine sand** - Nearly level and poorly drained, this soil is in broad, flatwoods areas. It also occurs as a narrow band around some slightly depressional, poorly drained soils. The slopes are smooth and less than 2 percent.

Typically, the surface layer is black fine sand 4 inches thick. The subsurface

## Crystal River Preserve State Park Soil Descriptions

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layer, to a depth of 27 inches, is dark gray and gray fine sand. The subsoil extends to a depth of 80 inches. It is black and dark reddish brown fine sand in the upper part and dark brown fine sand in the lower part.

Included with this soil (about 20 percent of the map unit) are small areas of Basinger, EauGallie, and Pompano soils. Also included are a few areas of soils that are similar to Myakka soil in the western part of the county that have limestone bedrock within 60 inches of the surface.

The water table is at a depth of less than 10 inches for 1 month to 4 months. It gradually recedes to a depth of 40 inches or more. Internal drainage is slow. Permeability is moderate or moderately rapid in the subsoil and low or very low in the other layers. Natural fertility is low.

**(11) Tavares fine sand, 0 to 5 percent slopes** – This soil is nearly level to gently sloping and moderately well drained. It is on knolls and ridges throughout the county and on lower ridges on the uplands. The slopes are 5 percent or less.

Typically, this soil is fine sand throughout. The surface layer is dark grayish brown about 3 inches thick. The upper part of underlying material, to a depth of 63 inches, is very pale brown. The lower part to a depth of 80 inches is white.

Included with this soil (about 20 percent of the map unit) are small areas of Adamsville, Candler, and Lake soils. Also included are small areas of soils that are similar to Tavares soil but have a few limestone boulders at a depth of about 60 inches or more.

The water table is between depths of 40 and 72 inches for up to 6 months. Permeability is rapid or very rapid. The available water capacity is very low. The soil becomes droughty during periods of low rainfall. Natural fertility is low.

**(12) Immokalee fine sand** – This soil is nearly level and poorly drained. It is in broad flatwood areas and also occurs as scattered, transitional areas between the elevated, better drained soils and the more poorly drained, ponded soils throughout the county. The slopes are 2 percent or less.

Typically, the surface layer is black fine sand about 6 inches thick. The subsurface layer, to a depth of 33 inches, is light brownish gray fine sand. The subsoil extends to a depth of 52 inches. It is very dark grayish brown and dark reddish brown fine sand. The sand grains in the subsoil are coated with finely divided organic material. The substratum to a depth of 80 inches is light brownish gray and light gray fine sand.

Included with this soil (about 20 percent of the map unit) are small areas of Basinger, EauGallie, Myakka, and Pompano soils. Also included are small areas of soils that are similar to Immokalee soil but have limestone bedrock at a depth of more than 60 inches.

## Crystal River Preserve State Park Soil Descriptions

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The water table is at a depth of less than 10 inches for 2 months. It recedes between depths of 10 and 40 inches for 8 months or more and is at a depth of more than 40 inches during dry periods. Internal drainage is slow. Permeability is moderate in the subsoil and rapid in the other layers. The available water capacity is moderate in the subsoil and low or very low in the other layers. Natural fertility is low.

**(13) Okeelanta muck** - This soil, which is nearly level and very poorly drained, is in depressions and freshwater coastal swamps. It receives drainage from other soils and retains the water for long periods. The slopes are less than 2 percent.

Typically, the surface layer is well decomposed, black muck about 8 inches thick. Below that layer, very dark gray muck extends to a depth of 35 inches, and very dark grayish muck extends to a depth of 38 inches. The underlying material to a depth of 80 inches or more is light grayish brown and light gray fine sand.

Included with this soil (about 25 percent of the map unit) are small areas of depressional phases of Basinger, EauGallie, and Pompano soils and some small areas of Lauderhill and Terra Ceia soils.

This soil is ponded for 6 to 12 months. The water table recedes to a depth of less than 10 inches during dry periods. Internal drainage is slow, and permeability is rapid. The organic material is highly absorbent and has a very high available water capacity, while underlying sands have a low or very low available water capacity. Natural fertility is moderate.

**(20) Pits** – This map unit consists of irregularly-shaped, open pits from which the soil and other materials have been mined or excavated. The mined material was mainly limestone and phosphate, but in some areas, sand and other soil material were removed. These excavations are 5 to 50 feet below the surrounding natural ground level. The walls are strongly sloping to nearly vertical and consist of exposed layers of sand and other soil material and, frequently, bedrock.

In most areas, the bottoms of the pits consist of a highly variable mixture of smooth to strongly sloping sand and geologic materials. These materials may contain scattered limestone boulders or limestone bedrock, or both. In areas where the pits have been excavated to near ground water level, they retain water for variable periods and have a seasonal high water table. Some pits are permanent bodies of water and, if large enough, are shown on the soil maps as water. In these areas, fish and other wildlife have become established. Other pits have exposed bedrock.

**(22) Quartzipsamments, 0 to 5 percent slopes** - Quartzipsamments soil is nearly level to gently sloping. It has been reworked and shaped by earthmoving equipment. This map unit commonly is adjacent to urban lands but can occur throughout the country. Many areas of this soil were formerly sloughs, marshes, shallow ponds, or other areas of standing water. These

## Crystal River Preserve State Park Soil Descriptions

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areas have been filled with sandy soil material to the level of the surrounding landscape, or higher. In a few areas, this soil originally was on the high ridges that were excavated to below natural ground level. Smoothing and shaping have made the soil better suited to use as sites for buildings, roads and streets, recreation areas, and other related uses.

The color and thickness of the various layers of this soil are variable. One of the more common profiles has a surface layer of mottled, brownish-yellow and pale brown, fine sand 54 inches thick. The upper part of the underlying material, to a depth of 59 inches, is dark gray, fine sand. The lower part to a depth of 80 inches is brownish-yellow, fine sand.

Included with this soil (less than 20 percent of the map unit) are small areas of Basinger and Immokalee soils that have not been disturbed. Also included are small areas that have less than 20 inches of fill material on the surface, and areas where small amounts of soil material, such as sandy loam, sandy clay loam, and sandy clay, are mixed with the sand. Scattered fragments of hard limestone are in some places.

The depth of the water table is variable, but ranges from about 20 inches to more than 72 inches depending on the thickness of the fill material and drainage of the underlying soil. In most excavated areas, the water table is at a depth of more than 72 inches. Permeability is variable, but generally is very rapid. The available water capacity is also variable, but generally is very low. Natural fertility is very low.

**(23) Weekiwachee-Durbin mucks** - This complex consists of very poorly drained, well decomposed soils that contain sulfur. These soils occur along the coast at about sea level in broad, flat tidal marshes. The soil area is a transition zone between freshwater and marine water. Weekiwachee soil occurs in parts that are adjacent to mineral soils or rock outcrop. Durbin soil is mainly exposed to open water and along tidal flood channels and streams.

Weekiwachee soil typically has a surface layer of black muck that extends to a depth of 34 inches. The underlying material is gray fine sand that extends to a depth of 38 inches. The next underlying layer is white, soft limestone bedrock underlain by hard limestone bedrock.

Durbin soil typically has a 7-inch surface layer of very dark gray muck. The underlying layer is black muck that extends to a depth of 80 inches. Lauderhill, Okeelanta, and Terra Ceia soils, and rock outcrop are also included in small areas of this complex.

Included with these soils in mapping are small areas of Lauderhill, Okeelanta, and Terra Ceia soils. Also included are some small areas of rock outcrop and a soil near the inland areas that is similar to Weekiwachee soil. This soil has a sandy substratum up to 30 inches thick between the organic layers and the bedrock.

Most of the soils in this complex are flooded daily at normal high tide and all

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are flooded during storm tides. The organic soils remain nearly saturated between high tides. The available water capacity is very high.

**(24) Okeelanta-Lauderhill-Terra Ceia mucks** - These mucks are comprised of nearly level, very poorly-drained, well-decomposed organic soils. These soils are in broad freshwater swamps that parallel the coast. Most of the area is less than 5 feet above sea level, and limestone bedrock is frequently within 80 inches of the surface layer.

Typically, Okeelanta soil has a surface layer that is black muck about 8 inches thick. Below the surface layer, dark reddish brown muck extends to a depth of 32 inches. The underlying material to a depth of 80 inches is dark gray fine sand. Lauderdale soil typically has a surface layer that is black muck about 9 inches thick. Below the surface layer, dark brown muck extends to a depth of 26 inches and is underlain by hard, white limestone bedrock. Terra Ceia soil typically has a surface layer that is black muck about 8 inches thick. Below the surface layer, very dark brown muck extends to a depth of 80 inches.

The soils in this complex are ponded for 6 to 12 months. The water recedes to a depth of less than 10 inches during extended periods of drought. Internal drainage is slow, and surface outlets are limited. Permeability is rapid in the organic layers and is very rapidly permeable in pedons that have sandy mineral layers. The available water capacity is very high in the organic layers and is low in the mineral layers. Natural fertility is high.

**(27) Pomello fine sand, 0 to 5 percent slopes** - This soil is nearly level to gently sloping and moderately well drained. It is on low ridges and knolls on the flatwoods and also occurs in areas adjacent to some streams and water areas.

Typically, the surface layer is dark gray and light brownish gray fine sand 5 inches thick. The subsurface layer, to a depth of 31 inches, is white fine sand. The upper part of the subsoil, to a depth of 52 inches, is black and dark brown fine sand. The lower part to a depth of 80 inches is brown fine sand.

Included with this soil (less than 20 percent of the map unit) are small areas of Basinger, EauGallie Immokalee, Myakka Orsino, and Paola soils. Also included are small areas of soils that have limestone cobbles and boulders at a depth of more than 60 inches. These buried rocks and boulders are mainly in areas adjacent to soils that are underlain by bedrock within 80 inches of the surface layer or adjacent to rock outcrop areas.

The water table is at a depth of 2 to 3.5 feet for 1 month to 4 months and between depths of 3.5 and 5 feet for 8 months. Permeability is very rapid in the surface and subsurface layers. It is moderate in the upper part of the subsoil and moderately rapid in the lower part. The available water capacity is moderate in the subsoil and very low in the other layers. Natural fertility is very low.

**(28) Redlevel fine sand** – This soil is nearly level and somewhat poorly

## Crystal River Preserve State Park Soil Descriptions

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drained. It is on the flatwoods in the western part of the county between the coastal marshes and the upland ridges. Depth to limestone bedrock typically ranges from 40 to 60 inches. Stones and boulders are scattered on the surface and throughout the subsoil in some horizons.

Typically, the surface layer is dark brown and dark grayish brown fine sand 7 inches thick. The subsoil to a depth of 55 inches is yellowish brown and strong brown fine sand underlain by limestone bedrock.

Included with this soil (less than 20 percent of the map unit) are small areas of Adamsville, Boca, Broward, Hallandale, and Pompano soils. Also included are areas of rock outcrop.

The water is at a depth of 20 to 40 inches for 2 to 4 months. It may rise above 20 inches during very wet periods in some years. Permeability is rapid. Both the available water capacity and natural fertility are low.

**(35) Sparr fine sand, 0 to 5 percent slopes** – This soil is nearly level to gently sloping and somewhat poorly drained. It is in seasonally wet areas on the upland ridges, at the base of some sloping areas, and near some poorly drained areas. The slopes are smooth and slightly concave.

Typically, the surface layer is grayish brown fine sand 8 inches thick. The subsurface layer, to a depth of 50 inches, is brown, pale brown, and very pale brown fine sand. The upper part of the subsoil, to a depth of 59 inches, is light yellowish brown fine sandy loam. The middle part, to a depth of 70 inches, is light yellowish brown sandy clay loam. The lower part to a depth of 80 inches is light brownish gray sandy clay loam. Mottles of brown, red, yellow, and gray occur from a depth of about 20 to 80 inches.

Included with this soil (less than 25 percent of the map unit) are small areas of Arredondo, Kendrick, and Lochloosa soils. Also included are small areas of Sparr soils that have slopes of more than 5 percent and a few small areas of soils that are similar to Sparr soils but have limestone boulders in the subsoil. These areas are mainly adjacent to soils that contain bedrock or boulders in their profiles.

The water table is at a depth of 2.5 to 3.5 feet for periods of 1 to 4 months. Permeability is rapid in the sandy surface and subsurface layers and slow in the subsoil. Runoff is slow. The available water capacity is low to moderate. Natural fertility is low.

**(36) EauGallie fine sand** - This is nearly level, poorly drained soil that is on the flatwoods. The slopes are gradual and less than 2 percent.

Typically, the surface layer is very dark and dark gray fine sand 10 inches thick. The subsurface layer, to a depth of 22 inches, is light brownish gray fine sand. The subsoil extends to a depth of 80 inches. The upper part is dark brown fine sand. The middle part is dark reddish brown fine sand. The lower part is pale olive and light gray fine sandy loam.

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Included with this soil (less than 20 percent of the map unit) are small areas of Basinger, Immokalee, and Myakka soils. Also included are small areas of soils that are similar to EauGallie soil but have scattered limestone boulders in the subsoil.

The water table is within 10 inches of the surface for 1 month to 4 months. It recedes during dry periods but is generally within 40 inches of the surface layer for 6 months. Runoff is slow. The available water capacity is low to very low in the surface and subsurface layers and is moderate to high in the subsoil. Natural fertility is very low.

**(37) Matlacha, limestone substratum-Urban land complex** - This complex consists of nearly level, somewhat poorly-drained Matlacha soil and areas of urban land. Matlacha soil was formed by fill material from early earth-moving operations.

Typically, Matlacha soil has a surface layer that is very dark, grayish-brown, gravelly, fine sand about 6 inches thick. The lower part, to a depth of about 23 inches, is mottled white, brown and yellow, fine sand mixed with 25 percent limestone fragments and scattered pockets of fine-textured clay material. Below the layers of fill material is original buried soil. The upper part of the buried soil, to a depth of about 44 inches, is a very dark grayish-brown and light gray sand. The next layer, to a depth of 48 inches, is light brownish-gray, fine, sandy loam. Below the fine sandy loam is a thin layer of soft limestone bedrock underlain by hard, white, fractured limestone bedrock.

Included with these soils in mapping are small areas of Basinger, EauGallie, Hallandale, Homosassa, Lauderhill, Lacoochee, Myakka, Okeelanta, Pompano, and Weekiwachee soils. These soils have not been covered by fill material.

Matlacha soil has a water table between depths of 2 and 3 feet for 1 month to 3 months annually. In many areas, the high water table and depth to bedrock significantly limit the use of these soils for most sanitary facilities and for building site development.

**(38) Rock outcrop-Homosassa-Lacoochee complex** – This complex consists of limestone rock outcrop and Homosassa and Lacoochee soils that are in tidal saltwater marshes and on some offshore islands along the Gulf Coast.

Rock outcrop makes up about 40 percent of the map unit but ranges from about 10 to 90 percent in individual delineations. Homosassa soil makes up about 35 percent, while Lacoochee soil comprises about 15 percent.

In some areas, rock outcrop is exposed large, flat surfaces pitted with solution holes. In other areas, such as sites near Ozello, it is highly fractured and pitted and is partly dissolved along fractures.

Typically, Homosassa soil has a surface layer that is black mucky fine sandy loam about 8 inches thick. Below that, dark grayish brown fine sand

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extends to a depth of 21 inches and is underlain by hard limestone bedrock. Lacochee soil typically has a surface layer that is light gray fine sandy loam about 5 inches thick. The subsurface layer, to a depth of 8 inches, is grayish brown loamy fine sand. The subsoil, to a depth of 13 inches, is yellowish brown loamy fine sand. Below that, white soft limestone bedrock extends to a depth of 21 inches and is underlain by hard, white limestone bedrock.

Included with these soils (about 10 percent of the map unit) are small areas of Weekiwachee soils. Also included are some areas of soils that are similar to Homosassa and Lacochee soils but are less than 10 inches to bedrock.

The soils in this map unit are flooded daily by high tides. Some of the included soils on the elevated parts of this map unit are periodically flooded by exceptional high tides and storm tides. The available water capacity of Homosassa and Lacochee soils is very high in the surface layer and moderate in the deeper layers.

**(39) Hallandale-Rock outcrop complex, rarely flooded** - This complex consists of nearly level, poorly drained, mineral soil and rock outcrop. It is underlain by bedrock at a depth of 20 inches or less.

Typically, Hallandale soil has a surface layer that is black fine sand about 2 inches thick. The subsurface layer, to a depth of 6 inches, is grayish brown fine sand. The subsoil, to a depth of 10 inches, is yellowish brown fine sand. Below the subsoil is hard limestone bedrock. Rock outcrop is randomly scattered, and individual exposures are mostly less than 2 square feet.

Hallandale soil makes up about 55 percent of the map unit, while rock outcrop comprises about 25 percent. The included soils (Basinger, Citronelle, Lauderhill, and Redlevel) make up about 20 percent.

In most years, this soil complex has a high water table within 10 inches of the surface for up to 6 months. In some areas, the surface may be covered by shallow water for up to a month after very heavy rains. Permeability is moderate to moderately slow. Runoff is slow, and natural fertility is low.

**(40) Homosassa mucky fine sandy loam** – Nearly level and very poorly drained, this soil is in coastal tidal marshes--primarily at elevations that are less than 3 feet above sea level. The slopes are less than 1 percent.

Typically, the surface layer is very dark gray mucky fine sandy loam about 10 inches thick. The next layer, to a depth of 18 inches, is very dark grayish brown loamy fine sand. The upper part of underlying layer, to a depth of 31 inches, is grayish brown loamy fine sand. The lower part to a depth of 35 inches is soft limestone bedrock underlain by hard limestone bedrock.

Included with this soil (about 20 percent of the map unit) are areas of soils that have a fine sandy loam or mucky sandy clay loam surface texture. Also included are areas of soils that have bedrock at a depth of 40 inches or more.

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This soil is flooded daily by tides. The available water capacity is very high in the surface layer and is medium in the other layers.

**(46) EauGallie fine sand, depressional** – This soil is nearly level and very poorly drained. It is in depressions and is adjacent to drainageways on the flatwoods, as well as along the outer edges of some swamps and marshes. The slopes are smooth to concave and less than 2 percent.

Typically, the surface layer is black fine sand about 3 inches thick. The subsurface layer, to a depth of 26 inches, is light brownish gray and gray fine sand. The upper part of the subsoil, to a depth of 46 inches, is dark brown, pale brown, and grayish brown fine sand. The middle part, to a depth of 54 inches, is grayish brown fine sandy loam. The lower part to a depth of 80 inches is gray sandy clay.

Included with this soil (about 20 percent of the map unit) are small areas of Basinger, Immokalee, Myakka, and Pompano soils. Also included are small areas of soils that are similar to EauGallie soil but have scattered boulders and cobbles in the subsoil and soils that have up to 10 inches of litter and organic matter on the surface.

In most years, this soil is ponded for 3 to 9 months. In slightly elevated positions around the margins of the ponded areas, the water table is within 10 inches of the surface, and these areas are ponded during periods of heavy rains. During dry periods, the water table recedes to a depth of 10 inches or more. Permeability is rapid in the surface and subsurface layers and is moderate in the subsoil. The available water capacity is low or very low in the surface and subsurface layers and is moderate in the subsoil. Natural fertility is low.

**(48) Arents, 45 to 65 percent slopes** – This soil, which consists of soil material and limestone dug from canals, is piled along the side of the canals or used to form embankments for highway overpasses. Most of this map unit is along the excavations that were dug as part of the Cross Florida Barge Canal.

This soil is comprised of sandy mineral material mixed with varying amounts of loamy and finer textured material from the former subsoil and substratum and with limestone fragments ranging from sand-size to large boulders. In some locations, parts of former organic soil horizons are also intermixed. This soil does not have an orderly sequence of soil layers but is a highly variable mixture of lenses, streaks, and pockets of soil material and limestone fragments. The thickness of the Arents ranges from about 2 feet to 30 feet or more.

Included with this soil (less than 10 percent of the map unit) are other areas of Arents that have slopes ranging from 12 to 45 percent. Also included are small areas of natural soils and Arents that have slopes of 5 percent or less.

The water table is more than 6 feet below the surface throughout the year. Permeability is variable, but it is rapid in most areas. Rain runs off rapidly with

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minimal absorption except where the surface is protected by vegetation. The available water capacity varies, but is mostly low to very low.

**(49) Terra Ceia-Okeelanta association, frequently flooded** - This association consists of nearly level, very poorly drained, organic soils along the edges of freshwater rivers and lakes. Terra Ceia soil is adjacent to the open water and is bounded on the inland side by Okeelanta soil, which is adjacent to the upland areas.

Typically, Terra Ceia soil has a surface layer of black muck about 10 inches thick. Below that layer, black and dark reddish brown muck extends to a depth of 80 inches or more. Okeelanta soil typically has a surface layer of black muck about 10 inches thick. Below that layer, dark brown muck extends to a depth of about 27 inches. The underlying material to a depth of 65 inches is light gray fine sand.

Included with these soils in mapping are small areas of Basinger and Lauderhill soils. Also included are small areas of rock outcrop.

During low tide, the soils in this association are covered by shallow water from the adjacent streams and rivers. At high tide, flood waters are generally 2 to 3 feet above the surface.

**(50) Kanapaha fine sand, 0 to 5 percent slopes** – This soil is nearly level to gently sloping and poorly drained. It is in low positions on the upland ridges.

Typically, the surface layer is very dark gray fine sand 6 inches thick. The subsurface layer, to a depth of 45 inches, is light brownish gray and light gray fine sand. The subsoil to a depth of 80 inches is light brownish gray fine sandy loam.

Included with this soil, and comprising less than 20 percent of the map unit, are small areas of Adamsville, Arredondo, Basinger, and Sparr soils.

The water table is at a depth of less than 10 inches for 1 to 3 months each year and is at a depth of 10 to 30 inches for about 4 months in most years. The available water capacity is very low in the sandy surface layer and is moderate in the subsoil. Natural fertility is low.

**(51) Boca-Pineda, limestone substratum complex** – This complex consists of nearly level, poorly drained soils that are underlain by limestone bedrock. With slopes that range from 0 to 2 percent, these soils are adjacent to freshwater swamp areas that parallel the coast.

Boca soil, which comprises about 55 percent of the map unit, typically has a surface layer that is very dark brown fine sand 3 inches thick. The upper part of the subsurface layer, to a depth of 8 inches, is very pale brown fine sand. The lower part, to a depth of 22 inches, is yellow fine sand. The subsoil, to a depth of 32 inches, is light olive gray sandy clay loam. Below the subsoil is

## Crystal River Preserve State Park Soil Descriptions

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hard limestone bedrock.

About 30 percent of the map unit is the Pineda soil, which typically has a surface layer that is dark grayish brown fine sand 2 inches thick. The subsurface layer, to a depth of 5 inches, is grayish brown fine sand. The upper part of the subsoil, to a depth of 25 inches, is brownish yellow and strong brown fine sand. The lower part, to a depth of 42 inches, is light brownish gray sandy clay loam. Hard limestone bedrock is below the subsoil.

Included with these soils (about 15 percent of the map unit) are soils that have limestone bedrock at a depth of less than 24 inches. Small areas of rock outcrops are common in these shallow soils.

The soils in this complex have a high water table at a depth of less than 10 inches for 1 month to 6 months in most years. The water table recedes into the underlying limestone during the drier periods. During very wet periods, some small areas are ponded. Permeability is rapid in the sandy layers and slow to moderate in the finer textured layers. The available water capacity is low to very low in the sandy layer and moderate in the finer textured layers. Natural fertility is low.

**(53) Boca fine sand** - Boca fine sand is nearly level and poorly drained. It is on low, broad flats and in poorly defined drainageways on the flatwoods. The slopes are less than 2 percent.

Typically, the surface layer is dark grayish brown fine sand 5 inches thick. The subsurface layer, to a depth of 19 inches, is light gray fine sand. The next layer, to a depth of 21 inches, is yellow fine sand. The next layer, to a depth of 38 inches is grayish brown sandy clay loam underlain by limestone bedrock.

Included with this soil (about 25 percent of the map unit) are small areas of Basinger, EauGallie, Hallandale, Redlevel, and Myakka soils. Also included are some areas of soils near the Cross Florida Barge Canal that have been drained.

The water table is within 10 inches of the surface for 2 to 4 months in most years. It recedes into the limestone during dry periods. Permeability is rapid in the sandy layers and moderate in the finer textured layers. The available water capacity is low to very low in the surface and subsurface layers and moderate in the subsoil. Natural fertility is low.

**(55) Udorthents, 0 to 5 percent slopes** – This map unit consists of nearly level to gently sloping manmade soils. These soils are mainly in the central part of the county and generally are adjacent to pits. Most of these soils are in areas that have been mined and in a few areas where the mines are still active. In some areas, pits have been partly filled with the Udorthents. The slopes are dominantly 5 percent or less. In a few areas, these soils have a somewhat undulating surface consisting of a series of short, moderately steep slopes that range from 12 to 20 percent.

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These soils are a highly variable mixture of sandy and loamy overburden material (removed to obtain the phosphate or limestone deposits), geologic material from mining operations, and colloidal clay material. Each area of these soils differ, reflecting the differences in individual mined deposits and mining methods used.

Three very generalized kinds of pedons make up the Udorthents. One kind consists chiefly of loamy material to a depth of 80 inches or more. A second kind consists of thick to thin layers of sands alternating with finer textured material, mainly colloidal clays. The third kind consists of a sandy to loamy matrix that contains few to common bands, strips, and pockets of clayey material mixed throughout.

All of these generalized pedons are in most areas and are intermixed. In most areas, few to common broken fragments of limestone, chert, and low-grade phosphate rock are throughout the soils. Boulders of these materials are in a few areas. In most areas, the surface is sandy, but in a few areas, it is a thin to thick layer of clayey material. Soil color is variable and ranges from white and gray to shades of yellow, brown, and red. In vegetated areas, a dark layer has formed on the surface. The thickness of the Udorthents is commonly 80 inches or more but ranges from 20 to more than 80 inches. In a few areas, hard or soft bedrock is at a depth of 60 to 80 inches

Included with these soils in mapping are small areas of Arredondo, Astatula, Candler, Ft. Meade, Kendrick, Lake, Sparr, and Tavares soils. Also included are slime ponds (areas upon which colloidal suspensions of clayey material were pumped) and areas of Candler soils and Udorthents which have had a thin layer of clayey material spread on the surface to improve the agricultural properties of the soils.

Soil drainage is variable and ranges from excessively drained to well drained in sandy areas and is poorly drained in areas that have a high content of clay. A perched water table is on the clayey layers. Permeability ranges from rapid in the sandy areas to slow in areas of high clay content. The available water capacity ranges from very low to medium.

**(58) Myakka, limestone substratum-EauGallie, limestone substratum complex** - This complex consists of nearly level, poorly drained Myakka and EauGallie soils. These soils are on the coastal flatwoods and are also on some islands adjacent to saltwater marshes in the northern part of Citrus county. The slopes are less than 2 percent.

Myakka soil, which comprises 40 percent of the map unit, typically has a surface layer that is dark gray fine sand about 5 inches thick. The subsurface layer, to a depth of 23 inches, is light brownish gray fine sand. The upper part of the subsoil, to a depth of 34 inches, is very dark gray fine sand. The lower part, to a depth of about 62 inches, is brown and light brownish gray fine sand. Below the subsoil is hard limestone bedrock.

EauGallie soil, which makes up 25 percent of the map unit, typically has a

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surface layer that is black fine sand about 4 inches thick. The subsurface layer, to a depth of 25 inches, is light brownish gray fine sand. The upper part of the subsoil, to a depth of 39 inches, is black fine sand. The middle part, to a depth of 59 inches, is grayish brown fine sand. The lower part, to a depth of 63 inches, is light olive gray sandy clay loam. Below the subsoil is hard limestone bedrock.

Included with these soils (about 35 percent of the map unit) are Immokalee soils, as well as some small depressional areas of Myakka, EauGallie, and Immokalee soils. Small areas of Basinger and Hallandale soils and rock outcrop are also included.

The soils in this complex have a high water table at a depth of less than 10 inches for 1 month to 4 months in most years. It gradually recedes to a depth of 40 inches or more during drier periods. Internal drainage is moderately slow. The available water capacity is medium in the subsoil and low to very low in the surface and subsurface layers. Natural fertility is low.

**(59) Boca fine sand, depressional** - Nearly level and poorly drained, Boca fine sand is in depressions and other poorly defined drainageways along the coast. This soil is underlain by limestone bedrock at a depth of 24 to 40 inches, but solution pits extending to a depth of 60 inches or more are common.

Typically, the surface layer is black fine sand 8 inches thick. The subsurface layer, to a depth of 21 inches, is light gray fine sand. The subsoil, to a depth of 25 inches, is grayish brown sandy clay loam. The next layer to a depth of 27 inches is a mixture of white limestone fragments, marl, and yellowish brown sandy clay loam underlain by limestone bedrock.

Included with this soil (less than 20 percent of the map unit) are small areas of Hallandale soils. Also included are soils that have layers of marl, limestone fragments, and finer textured material up to 20 inches thick on the surface of the bedrock and some small areas of rock outcrop.

This soil is ponded for periods of 2 to 6 months in most years. The water table is generally within 10 inches of the surface and recedes below it during dry years. In very dry periods, the water table recedes into the limestone. Permeability is rapid in the sandy layers and moderate in the finer textured layers. The available water capacity is low to moderate. The content of organic matter and natural fertility are low.

**(60) Broward fine sand** – Nearly level and somewhat poorly drained, this soil is on broad flatwoods near the coast. It is underlain by limestone between depths of 20 and 40 inches. In some areas, scattered boulders and rocks are at or near the surface, and some previously cultivated areas have cobbles scattered across the surface. Rock outcrop occurs in a few areas.

Typically, the surface layer is very dark gray fine sand 5 inches thick. The upper part of the underlying material, to a depth of 15 inches, is gray fine

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sand. The lower part to a depth of 35 inches is brownish yellow fine sand underlain by limestone bedrock.

Included with this soil (about 20 percent of the map unit) are small areas of Boca and Redlevel soils. Also included are some areas of soils near the Cross Florida Barge Canal that have been drained.

The water table is at a depth of 20 to 30 inches for periods of 2 to 6 months. In very wet years, it may rise above 20 inches for brief periods. Permeability is rapid throughout, and the available water capacity is low to very low. Rain is rapidly absorbed, and runoff is slow. Natural fertility is low.

**(61) Orsino fine sand, 0 to 5 percent slopes** – This soil is nearly level and moderately well drained. It is on knolls and ridges throughout the eastern part of the county. The slopes are 5 percent or less.

Typically, the surface layer is dark grayish brown fine sand about 5 inches thick. The subsurface layer, to a depth of 14 inches, is white fine sand. The subsoil, to a depth of 48 inches, is brownish yellow and very pale brown fine sand. The substratum to a depth of 80 inches is white fine sand.

Included with this soil (about 20 percent of the map unit) are small areas of Basinger, Paola, Pamella, and Tavares soils.

The water table is between depths of 40 and 72 inches for 6 months. Permeability is rapid, and the available water capacity is very low. Natural fertility is low.

**(64) Citronelle fine sand** – This soil, on the flatwoods, is nearly level and somewhat poorly drained. Limestone bedrock is at a depth of 20 inches or less.

Typically, the surface layer is dark yellowish brown fine sand 2 inches thick. The subsoil to a depth of 9 inches is yellowish red fine sand underlain by limestone bedrock.

Included with this soil (25 percent of the map unit) are areas of Boca, Broward, and Hallandale soils. Within the map unit are randomly scattered rock outcrops which range from 2 to 10 square feet. In some areas, the bedrock has been broken off and the surface layer is cobbly fine sand.

The high water table is within 2 to 3 feet of the surface for periods of up to 4 months. In drained areas, the water level fluctuates with the water level in the drainage ditches. Permeability is moderate to moderately rapid, and runoff is slow. Natural fertility is low.

**(99) Water**

## **Addendum 5—Plant and Animal List**



**Crystal River Preserve State Park Plants**

Common Name	Scientific Name	Primary Habitat Codes (for imperiled species)
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**PTERIDOPHYTES**

Giant leather fern.....	<i>Acrostichum danaeifolium</i>	
Rattlesnake fern .....	<i>Botrychium virginianum</i>	
Japanese climbing fern .....	<i>Lygodium japonicum</i> *	
Cinnamon fern.....	<i>Osmunda cinnamomea</i> .....	FS, BS, DS
Golden polypody .....	<i>Phlebodium aureum</i>	
Resurrection fern .....	<i>Pleopeltis polypodioides</i> var. <i>michauxiana</i>	
Bracken fern.....	<i>Pteridium aquilinum</i>	

**GYMNOSPERMS**

Red cedar .....	<i>Juniperus virginiana</i>	
Slash pine .....	<i>Pinus elliotii</i>	
Longleaf pine.....	<i>Pinus palustris</i>	
Pond pine.....	<i>Pinus serotina</i>	
Loblolly pine .....	<i>Pinus taeda</i>	
Coontie.....	<i>Zamia pumila</i>	

**ANGIOSPERMS**

**Monocots**

Southern colicroot.....	<i>Aletris obovata</i>	
Broomsedge bluestem .....	<i>Andropogon virginicus</i>	
Greendragon .....	<i>Arisaema dracontium</i>	
Wiregrass.....	<i>Aristida stricta</i> var. <i>beyrichiana</i>	
Manyflowered grasspink.....	<i>Calopogon multiflorus</i> .....	WF, MF
Tuberous grasspink .....	<i>Calopogon tuberosus</i>	
Chapman's sedge.....	<i>Carex chapmannii</i> .....	MH, HH
Sandywoods sedge.....	<i>Carex dasycarpa</i>	
Florida sedge.....	<i>Carex floridana</i>	
Gholson's sedge.....	<i>Carex gholsonii</i>	
Godfrey's sedge.....	<i>Carex godfreyi</i>	
Bristlystalked sedge .....	<i>Carex leptalea</i>	
Long's sedge .....	<i>Carex longii</i>	
False hop sedge.....	<i>Carex lupuliformis</i>	
Peninsula sedge .....	<i>Carex paeninsulae</i> .....	MH, HH
Awlfruit sedge .....	<i>Carex stipata</i>	
Florida hammock sedge .....	<i>Carex vexans</i>	
Slender sandbur .....	<i>Cenchrus gracillimus</i>	
Shiny woodoats .....	<i>Chasmanthium nitidum</i>	
Jamaica swamp sawgrass.....	<i>Cladium jamaicense</i>	
Whitemouth dayflower.....	<i>Commelina erecta</i>	
Seven-sisters; string-lily .....	<i>Crinum americanum</i>	
Baldwin's flatsedge.....	<i>Cyperus croceus</i>	

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**Crystal River Preserve State Park Plants**

<b>Common Name</b>	<b>Scientific Name</b>	<b>Primary Habitat Codes (for imperiled species)</b>
Yellow nutgrass .....	<i>Cyperus esculentus</i> *	
Variable witchgrass .....	<i>Dichanthelium commutatum</i>	
Saltgrass .....	<i>Distichlis spicata</i>	
Florida butterfly orchid.....	<i>Encyclia tampensis</i>	
Saltmarsh fingergrass.....	<i>Eustachys glauca</i>	
Pinewoods fingergrass .....	<i>Eustachys petraea</i>	
Toothpetal false reinorchid .....	<i>Habenaria floribunda</i>	
Spiked crested coralroot .....	<i>Hexalectris spicata</i> .....	MH
Fringed yellow stargrass .....	<i>Hypoxis juncea</i>	
Bighead rush .....	<i>Juncus megacephalus</i>	
Catesby's lily .....	<i>Lilium catesbaei</i> .....	MF, WF
Hairawn muhly .....	<i>Muhlenbergia capillaris</i>	
Redtop panicum.....	<i>Panicum rigidulum</i>	
Switchgrass.....	<i>Panicum virgatum</i>	
Florida paspalum .....	<i>Paspalum floridanum</i>	
Field paspalum .....	<i>Paspalum laeve</i>	
Bahiagrass .....	<i>Paspalum notatum</i> var. <i>saurae</i> *	
Pickernelweed .....	<i>Pontederia cordata</i>	
Starrush whitetop .....	<i>Rhynchospora colorata</i>	
Cabbage palm .....	<i>Sabal palmetto</i>	
Sugarcane plumegrass .....	<i>Saccharum giganteum</i>	
Chapman's arrowhead .....	<i>Sagittaria graminea</i> var. <i>chapmanii</i>	
Bulltongue arrowhead.....	<i>Sagittaria lancifolia</i>	
Saw palmetto .....	<i>Serenoa repens</i>	
Yellow bristlegrass .....	<i>Setaria parviflora</i>	
Narrowleaf blue-eyed grass .....	<i>Sisyrinchium angustifolium</i>	
Annual blue-eyed grass .....	<i>Sisyrinchium rosulatum</i> *	
Earleaf greenbrier .....	<i>Smilax auriculata</i>	
Saw greenbrier .....	<i>Smilax bona-nox</i>	
Yellow Indiangrass .....	<i>Sorghastrum nutans</i>	
Lopsided Indiangrass.....	<i>Sorghastrum secundum</i>	
Spring ladiestresses .....	<i>Spiranthes vernalis</i>	
Eastern gamagrass.....	<i>Tripsacum dactyloides</i>	
Carolina yelloweyed grass .....	<i>Xyris caroliniana</i>	
Richard's yelloweyed grass.....	<i>Xyris jupicai</i>	
Adam's needle .....	<i>Yucca filamentosa</i>	
Rainlily .....	<i>Zephyranthes atamasca</i> .....	MF

**DICOTS**

Boxelder .....	<i>Acer negundo</i>
Red maple.....	<i>Acer rubrum</i>
Oppositeleaf spotflower .....	<i>Acmella oppositifolia</i> var. <i>repens</i>
Saltmarsh false foxglove.....	<i>Agalinis maritima</i>
Mimosa.....	<i>Albizia julibrissin</i> *
Common ragweed .....	<i>Ambrosia artemisiifolia</i>
Bastard false indigo.....	<i>Amorpha fruticosa</i>

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## Crystal River Preserve State Park Plants

Common Name	Scientific Name	Primary Habitat Codes (for imperiled species)
Peppervine .....	<i>Ampelopsis arborea</i>	
Bluestem pricklypoppy .....	<i>Argemone albiflora</i>	
Florida Indian plaintain .....	<i>Arnoglossum floridanum</i>	
Scarlet milkweed .....	<i>Asclepias curassavica</i> *	
Swamp milkweed .....	<i>Asclepias incarnata</i>	
Fewflower milkweed .....	<i>Asclepias lanceolata</i>	
Longleaf milkweed .....	<i>Asclepias longifolia</i>	
Savannah milkweed .....	<i>Asclepias pedicellata</i>	
Velvetleaf milkweed .....	<i>Asclepias tomentosa</i>	
Butterflyweed .....	<i>Asclepias tuberosa</i>	
Whorled milkweed.....	<i>Asclepias verticillata</i>	
Showy milkwort .....	<i>Asemeia violacea</i>	
Dwarf pawpaw .....	<i>Asimina pygmea</i>	
Netted pawpaw.....	<i>Asimina reticulata</i>	
Smooth yellow false foxglove ...	<i>Aureolaria flava</i>	
Fernleaf yellow false foxglove ...	<i>Aureolaria pectinata</i>	
Black mangrove .....	<i>Avicennia germinans</i>	
Saltwater falsewillow .....	<i>Baccharis angustifolia</i>	
Groundsel tree; sea-myrtle .....	<i>Baccharis halimifolia</i>	
Herb-of-grace.....	<i>Bacopa monnieri</i>	
Tarflower .....	<i>Bejaria racemosa</i>	
Rattan vine .....	<i>Berchemia scandens</i>	
Florida greeneyes.....	<i>Berlandiera subacaulis</i>	
Beggarticks .....	<i>Bidens alba</i>	
Spanish needles.....	<i>Bidens mitis</i>	
Bushy seaside oxeye .....	<i>Borrichia frutescens</i>	
American bluehearts.....	<i>Buchnera americana</i>	
American beautyberry .....	<i>Callicarpa americana</i>	
Florida bellflower.....	<i>Campanula floridana</i>	
Trumpet creeper .....	<i>Campsis radicans</i>	
Florida paintbrush .....	<i>Carphephorus corymbosus</i>	
Vanillaleaf .....	<i>Carphephorus odoratissimus</i>	
Hairy chaffhead .....	<i>Carphephorus paniculatus</i>	
Scrub wild olive .....	<i>Cartrema floridana</i>	
Pignut hickory .....	<i>Carya glabra</i>	
Sugarberry; hackberry.....	<i>Celtis laevigata</i>	
Spurred butterfly pea .....	<i>Centrosema virginianum</i>	
Common buttonbush .....	<i>Cephalanthus occidentalis</i>	
Redbud.....	<i>Cercis canadensis</i>	
Snowberry; milkberry .....	<i>Chiococca alba</i>	
Scrubland goldenaster .....	<i>Chrysopsis subulata</i>	
Camphor-tree.....	<i>Cinnamomum camphora</i> *	
Nuttall's thistle .....	<i>Cirsium nuttallii</i>	
Pine-hyacinth .....	<i>Clematis baldwinii</i>	
Atlantic pigeonwings.....	<i>Clitoria mariana</i>	
Tread-softly.....	<i>Cnidocolus stimulosus</i>	

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## Crystal River Preserve State Park Plants

Common Name	Scientific Name	Primary Habitat Codes (for imperiled species)
Buttonwood.....	<i>Conocarpus erectus</i>	
Blue mistflower.....	<i>Conoclinium coelestinum</i>	
Leavenworth's tickseed.....	<i>Coreopsis leavenworthii</i>	
Swamp dogwood.....	<i>Cornus foemina</i>	
Lanceleaf rattlebox.....	<i>Crotalaria lanceolata</i> *	
Rabbitbells.....	<i>Crotalaria rotundifolia</i>	
Showy rattlebox.....	<i>Crotalaria spectabilis</i> *	
Silver croton.....	<i>Croton argyranthemus</i>	
Fiveangled dodder.....	<i>Cuscuta pentagona</i>	
Whitetassels.....	<i>Dalea carnea</i>	
Carolina ponysfoot.....	<i>Dichondra carolinensis</i>	
Sixangle foldwing.....	<i>Dicliptera sexangularis</i>	
Virginia buttonweed.....	<i>Diodia virginiana</i>	
Oblongleaf twinflower.....	<i>Dyschoriste oblongifolia</i>	
Tall elephantsfoot.....	<i>Elephantopus elatus</i>	
Carolina scalystem.....	<i>Elytraria caroliniensis</i>	
Florida tasselflower.....	<i>Emilia fosbergii</i>	
Oakleaf fleabane.....	<i>Erigeron quercifolius</i>	
Early whitetop fleabane.....	<i>Erigeron vernus</i>	
Dogtongue wild buckwheat.....	<i>Eriogonum tomentosum</i>	
Rattlesnakemaster.....	<i>Eryngium aquaticum</i>	
Baldwin's eryngo.....	<i>Eryngium baldwinii</i>	
Button rattlesnakemaster.....	<i>Eryngium yuccifolium</i>	
Coralbean; Cherokee bean.....	<i>Erythrina herbacea</i>	
Dogfennel.....	<i>Eupatorium capillifolium</i>	
Semaphore thoroughwort.....	<i>Eupatorium mikanioides</i>	
Mohr's thoroughwort.....	<i>Eupatorium mohrii</i>	
False horehound.....	<i>Eupatorium rotundifolium</i>	
Marsh gentian.....	<i>Eustoma exaltatum</i>	
Slender flattop goldenrod.....	<i>Euthamia caroliniana</i>	
Silver dwarf morning-glory.....	<i>Evolvulus sericeus</i>	
Narrowleaf yellowtops.....	<i>Flaveria linearis</i>	
Carolina ash.....	<i>Fraxinus caroliniana</i>	
Green ash; pumpkin ash.....	<i>Fraxinus pennsylvanica</i>	
Elliott's milkpea.....	<i>Galactia elliotii</i>	
Stiff marsh bedstraw.....	<i>Galium tinctorium</i>	
Dwarf huckleberry.....	<i>Gaylussacia dumosa</i>	
Blue huckleberry.....	<i>Gaylussacia frondosa</i> var. <i>tomentosa</i>	
Yellow jessamine.....	<i>Gelsemium sempervirens</i>	
Carolina cranesbill.....	<i>Geranium carolinianum</i>	
Rose mock vervain.....	<i>Glandularia canadensis</i>	
Honey locust.....	<i>Gleditsia triacanthos</i>	
Purplehead sneezeweed.....	<i>Helenium flexuosum</i>	
Southeastern sneezeweed.....	<i>Helenium pinnatifidum</i>	
Narrowleaf sunflower.....	<i>Helianthus angustifolius</i>	
Stiff sunflower.....	<i>Helianthus radula</i>	

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## Crystal River Preserve State Park Plants

Common Name	Scientific Name	Primary Habitat Codes (for imperiled species)
Seaside heliotrope.....	<i>Heliotropium curassavicum</i>	
Scarlet rosemallow .....	<i>Hibiscus coccineus</i>	
Swamp rosemallow .....	<i>Hibiscus grandiflorus</i>	
Coastalplain hawkweed.....	<i>Hieracium megacephalon</i>	
Innocence; roundleaf bluet.....	<i>Houstonia procumbens</i>	
Manyflower marshpennywort ....	<i>Hydrocotyle umbellata</i>	
Skyflower.....	<i>Hydrolea corymbosa</i>	
Coastalplain St. John's-wort .....	<i>Hypericum brachyphyllum</i>	
Roundpod St. John's-wort .....	<i>Hypericum cistifolium</i>	
Dward St. John's-wort .....	<i>Hypericum mutilum</i>	
Fourpetal St. John's-wort .....	<i>Hypericum tetrapetalum</i>	
Clustered bushmint .....	<i>Hyptis alata</i>	
Dahoon.....	<i>Ilex cassine</i>	
Gallberry.....	<i>Ilex glabra</i>	
Yaupon .....	<i>Ilex vomitoria</i>	
Carolina indigo .....	<i>Indigofera caroliniana</i>	
Trailing indigo.....	<i>Indigofera spicata</i> *	
Tievine .....	<i>Ipomoea cordatotriloba</i>	
Man-of-the-earth .....	<i>Ipomoea pandurata</i>	
Saltmarsh morning-glory .....	<i>Ipomoea sagittata</i>	
Dixie iris .....	<i>Iris hexagona</i>	
Virginia willow .....	<i>Itea virginica</i>	
Bigleaf sumpweed .....	<i>Iva frutescens</i>	
Virginia saltmarsh mallow .....	<i>Kosteletzkya pentacarpos</i>	
Virginia dwarfdandelion .....	<i>Krigia virginica</i>	
Lantana; Shrubverbena .....	<i>Lantana camara</i> *	
Virginia pepperweed.....	<i>Lepidium virginicum</i>	
Chapman's gayfeather.....	<i>Liatris chapmanii</i>	
Grassleaf gayfeather .....	<i>Liatris elegantula</i>	
Fewflower gayfeather .....	<i>Liatris pauciflora</i>	
Shortleaf gayfeather.....	<i>Liatris tenuifolia</i>	
Gopher apple.....	<i>Licania michauxii</i>	
Carolina sealavender .....	<i>Limonium carolinianum</i>	
Canadian toadflax .....	<i>Linaria canadensis</i>	
Savannah false pimpernel .....	<i>Lindernia grandiflora</i>	
Stiff yellow flax .....	<i>Linum medium</i> var. <i>texanum</i>	
Sweetgum.....	<i>Liquidambar styraciflua</i>	
Cardinalflower .....	<i>Lobelia cardinalis</i> .....	FS
Glade lobelia .....	<i>Lobelia glandulosa</i>	
White lobelia .....	<i>Lobelia paludosa</i>	
Coral honeysuckle.....	<i>Lonicera sempervirens</i>	
Christmasberry .....	<i>Lycium carolinianum</i>	
Rose-rush .....	<i>Lygodesmia aphylla</i>	
Rusty staggerbush .....	<i>Lyonia ferruginea</i>	
Coastalplain staggerbush .....	<i>Lyonia fruticosa</i>	
Fetterbush .....	<i>Lyonia lucida</i>	

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## Crystal River Preserve State Park Plants

Common Name	Scientific Name	Primary Habitat Codes (for imperiled species)
Wild bushbean .....	<i>Macroptilium lathyroides</i>	
Southern magnolia .....	<i>Magnolia grandiflora</i>	
Axilflower .....	<i>Mecardonia acuminata</i> ssp. <i>peninsularis</i>	
Snow squarestem .....	<i>Melanthera nivea</i>	
White sweetclover .....	<i>Melilotus albus</i>	
Creeping cucumber .....	<i>Melothria pendula</i>	
Climbing hempvine.....	<i>Mikania scandens</i>	
Sensitive brier .....	<i>Mimosa quadrivalvis</i> var. <i>angustata</i>	
Spotted beebalm.....	<i>Monarda punctata</i>	
Wax myrtle .....	<i>Myrica cerifera</i>	
Myrsine.....	<i>Myrsine cubana</i>	
Cutleaf eveningprimrose .....	<i>Oenothera laciniata</i>	
Southern beeblossom .....	<i>Oenothera simulans</i>	
Pricklypear .....	<i>Opuntia humifusa</i>	
Shell-mound pricklypear .....	<i>Opuntia stricta</i>	
Common yellow woodsorrel.....	<i>Oxalis corniculata</i>	
Pink woodsorrel .....	<i>Oxalis debilis</i> var. <i>corymbosa</i> *	
Coastalplain palafox .....	<i>Palafoxia integrifolia</i>	
Purple passionflower.....	<i>Passiflora incarnata</i>	
Florida false sunflower .....	<i>Phoebanthus grandiflorus</i>	
Red chokeberry .....	<i>Photina pyrifolia</i>	
Turkey tangle fogfruit .....	<i>Phyla nodiflora</i>	
Cypresshead groundcherry.....	<i>Physalis arenicola</i>	
Walter's groundcherry .....	<i>Physalis walteri</i>	
Eastern false dragonhead.....	<i>Physostegia purpurea</i>	
American pokeweed .....	<i>Phytolacca americana</i>	
Wild pennyroyal.....	<i>Piloblephis rigida</i>	
Blueflower butterwort .....	<i>Pinguicula caerulea</i> .....	MF, WF
Yellow butterwort.....	<i>Pinguicula lutea</i> .....	MF, WF
Small butterwort .....	<i>Pinguicula pumila</i>	
Pitted stripeseed .....	<i>Piriqueta cistoides</i> subsp. <i>caroliniana</i>	
Narrowleaf silkgrass .....	<i>Pityopsis graminifolia</i>	
Virginia plantain.....	<i>Plantago virginica</i>	
Rosy camphorweed .....	<i>Pluchea baccharis</i>	
Stinking camphorweed .....	<i>Pluchea foetida</i>	
Baldwin's milkwort .....	<i>Polygala balduinii</i>	
Orange milkwort .....	<i>Polygala lutea</i>	
Candyroot .....	<i>Polygala nana</i>	
Yellow milkwort .....	<i>Polygala rugelii</i>	
Rustweed.....	<i>Polypremum procumbens</i>	
Carolina laurelcherry .....	<i>Prunus caroliniana</i>	
Black cherry .....	<i>Prunus serotina</i>	
Wild coffee .....	<i>Psychotria nervosa</i>	
Blackroot .....	<i>Pterocaulon pycnostachyum</i>	
Mock bishopsweed .....	<i>Ptilimnium capillaceum</i>	
Sand live oak.....	<i>Quercus geminata</i>	

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## Crystal River Preserve State Park Plants

Common Name	Scientific Name	Primary Habitat Codes (for imperiled species)
Turkey oak.....	<i>Quercus laevis</i>	
Laurel oak; diamond oak.....	<i>Quercus laurifolia</i>	
Sand post oak .....	<i>Quercus margarettae</i>	
Myrtle oak.....	<i>Quercus myrtifolia</i>	
Shumard's oak .....	<i>Quercus shumardii</i>	
Wild radish.....	<i>Raphanus raphanistrum</i> *	
Pale meadowbeauty .....	<i>Rhexia mariana</i>	
Fringed meadowbeauty.....	<i>Rhexia petiolata</i>	
Winged sumac .....	<i>Rhus copallinum</i>	
Michaux's snoutbean .....	<i>Rhynchosia michauxii</i>	
Tropical Mexican clover.....	<i>Richardia brasiliensis</i> *	
Sand blackberry.....	<i>Rubus cuneifolius</i>	
Sawtooth blackberry.....	<i>Rubus pensilvanicus</i>	
Blackeyed Susan.....	<i>Rudbeckia hirta</i>	
Carolina wild petunia .....	<i>Ruellia caroliniensis</i>	
Shortleaf rosegentian .....	<i>Sabatia brevifolia</i>	
Coastal rosegentian.....	<i>Sabatia calycina</i>	
Rose-of-Plymouth .....	<i>Sabatia stellaris</i>	
Carolina willow .....	<i>Salix caroliniana</i>	
Lyreleaf sage.....	<i>Salvia lyrata</i>	
American elder; elderberry.....	<i>Sambucus nigra</i> subsp. <i>canadensis</i>	
Water pimpernel .....	<i>Samolus ebracteatus</i>	
Pineland pimpernel.....	<i>Samolus valerandi</i> subsp. <i>parviflorus</i>	
Lizard's tail.....	<i>Saururus cernuus</i>	
Brazilian pepper.....	<i>Schinus terebinthifolia</i> *	
Florida scrub skullcap .....	<i>Scutellaria arenicola</i>	
Maryland wild sensitive plant ....	<i>Senna marilandica</i>	
Coffeeweed; sicklepod .....	<i>Senna obtusifolia</i>	
Whitetop aster.....	<i>Sericocarpus tortifolius</i>	
Danglepod .....	<i>Sesbania herbacea</i>	
Rattlebox .....	<i>Sesbania punicea</i> *	
Shoreline seapurslane.....	<i>Sesuvium portulacastrum</i>	
Gulf coast swallowwort .....	<i>Seutera angustifolia</i>	
Cuban jute; Indian hemp .....	<i>Sida rhombifolia</i>	
Saffron plum .....	<i>Sideroxylon celastrinum</i>	
Florida bully .....	<i>Sideroxylon reclinatum</i>	
Starry rosinweed.....	<i>Silphium asteriscus</i>	
Kidneyleaf rosinweed.....	<i>Silphium compositum</i>	
American black nightshade.....	<i>Solanum americanum</i>	
Florida horsenettle .....	<i>Solanum carolinense</i> var. <i>floridanum</i>	
Chapman's goldenrod .....	<i>Solidago odora</i> var. <i>chapmanii</i>	
Seaside goldenrod.....	<i>Solidago sempervirens</i>	
Spiny sowthistle.....	<i>Sonchus asper</i> *	
Yellow necklacepod .....	<i>Sophora tomentosa</i> var. <i>truncata</i>	
Woodland false buttonweed.....	<i>Spermacoce remota</i>	
Sweet shaggytuft.....	<i>Stenandrium dulce</i>	

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## Crystal River Preserve State Park Plants

Common Name	Scientific Name	Primary Habitat Codes (for imperiled species)
Queensdelight .....	<i>Stillingia sylvatica</i>	
Climbing aster .....	<i>Symphyotrichum carolinianum</i>	
Yellow hatpins .....	<i>Syngonanthus flavidulus</i>	
Wood sage .....	<i>Teucrium canadense</i>	
Water cowbane .....	<i>Tiedemannia filiformis</i>	
Eastern poison ivy .....	<i>Toxicodendron radicans</i>	
Chinese tallowtree .....	<i>Triadica sebifera</i>	
Forked bluecurls .....	<i>Trichostema dichotomum</i>	
Field clover .....	<i>Trifolium campestre</i>	
White clover .....	<i>Trifolium repens</i> *	
Clasping Venus' looking-glass ...	<i>Triodanis perfoliata</i>	
Winged elm .....	<i>Ulmus alata</i>	
American elm .....	<i>Ulmus americana</i>	
Caesarweed .....	<i>Urena lobata</i> *	
Little floating bladderwort .....	<i>Utricularia radiata</i>	
Zigzag bladderwort .....	<i>Utricularia subulata</i>	
Sparkleberry .....	<i>Vaccinium arboreum</i>	
Highbush blueberry .....	<i>Vaccinium corymbosum</i>	
Shiny blueberry .....	<i>Vaccinium myrsinites</i>	
Deerberry .....	<i>Vaccinium stamineum</i>	
Brazilian vervain .....	<i>Verbena brasiliensis</i> *	
White crownbeard .....	<i>Verbesina virginica</i>	
Tall ironweed .....	<i>Vernonia angustifolia</i>	
Giant ironweed .....	<i>Vernonia gigantea</i>	
Walter's viburnum .....	<i>Viburnum obovatum</i>	
Fourleaf vetch .....	<i>Vicia acutifolia</i>	
Hairy pod cowpea .....	<i>Vigna luteola</i>	
Bog white violet .....	<i>Viola lanceolata</i>	
Early blue violet .....	<i>Viola palmata</i>	
Primroseleaf violet .....	<i>Viola primulifolia</i>	
Common blue violet .....	<i>Viola sororia</i>	
Summer grape .....	<i>Vitis aestivalis</i>	
Muscadine .....	<i>Vitis rotundifolia</i>	
Callose grape .....	<i>Vitis shuttleworthii</i>	
Hercules-club .....	<i>Zanthoxylum clava-herculis</i>	
Wild lime .....	<i>Zanthoxylum fagara</i>	

\* Non-native species    ^ Garden species

Crystal River Preserve State Park Animals

Common Name	Scientific Name	Primary Habitat Codes (for all species)
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**INVERTEBRATES**

**Beetles**

Bronzed Tiger Beetle ..... *Cicindela repanda* .....SAM

**True Bugs**

Cotton Stainer ..... *Dysdercus suturellus* .....MTC

Jagged Ambush Bug ..... *Phymata fasciata* .....MTC

**Spiders**

Trap Door Spider ..... *Ummidia* sp. .... SCF

**Grasshoppers (GH)**

Longheaded Toothpick GH ..... *Achurum carnatum* .....MTC

Olivegreen Swamp GH ..... *Paroxya clavuliger* .....MTC

Eastern Lubber GH ..... *Romalea microptera* .....MTC

American GH ..... *Schistocerca americana* .....MTC

Marbled GH ..... *Spharagemon marmorata* .....MTC

**Dragonflies and Damselflies**

Common Green Darner ..... *Anax junius* .....MTC

Atlantic Bluet ..... *Enallagma doubledayi* .....SAM

Eastern Pondhawk ..... *Erythemis simplicicollis* .....MTC

Seaside Dragonlet ..... *Erythrodiplax berenice* .....SAM

Citrine Forktail ..... *Ischnura hastata* .....SAM

Golden-winged Skimmer ..... *Libellula auripennis* .....MTC

Needham's Skimmer ..... *Libellula needhami* .....MTC

Great Blue Skimmer ..... *Libellula vibrans* .....MTC

Marl Pennant ..... *Macrodiplax balteata* .....SAM

Southern Sprite ..... *Nehalennia integricollis* .....MTC

Blue Dasher ..... *Pachydiplax longipennis* .....MTC

Carolina Saddlebags ..... *Tamea carolina* .....MTC

Red Saddlebags ..... *Tamea onusta* .....MTC

**Butterflies and Moths**

Gulf Fritillary ..... *Agraulis vanillae* .....MTC

White Peacock ..... *Anartia jatrophae* .....MTC

Great Southern White ..... *Ascia monuste* ..... SAM, HH

Great Purple Hairstreak ..... *Atlides halesus* .....MTC

Viceroy ..... *Basilarchia archippus* .....MTC

Red-spotted Purple ..... *Basilarchia arthemis astyanax* .....MTC

Pipevine Swallowtail ..... *Battus philenor* .....SH, MF

Polydamas Swallowtail ..... *Battus polydamas* .....HH

Sweadner's Juniper Hairstreak .. *Callophrys gryneus sweadnerii* .....MTC

Gemmed Satyr ..... *Calloopsis gemma* .....MTC

Red-banded Hairstreak ..... *Calycopis cecrops* .....MTC

\* Non-native species    ^ Garden species

## Crystal River Preserve State Park Animals

Common Name	Scientific Name	Primary Habitat Codes (for all species)
Southern Dogface .....	<i>Colias cesonja</i> .....	SH
Southern Skipperling .....	<i>Copaeodes minima</i> .....	BM, DM
Gemmed Satyr .....	<i>Cyllopsis gemma</i> .....	MEH
Queen .....	<i>Danaus gilippus berenice</i> .....	MTC
Monarch .....	<i>Danaus plexippus</i> .....	MTC
Silver-spotted Skipper .....	<i>Epargyreus clarus</i> .....	MTC
Horace's Duskywing .....	<i>Erynnis horatius</i> .....	MTC
Variiegated Fritillary .....	<i>Euptoieta claudia</i> .....	MTC
Barred Yellow .....	<i>Eurema daira</i> .....	MTC
Little Yellow .....	<i>Eurema lisa</i> .....	MTC
Sleepy Orange .....	<i>Eurema nicippe</i> .....	MTC
Zebra Swallowtail .....	<i>Eurytides marcellus</i> .....	SH
Zebra Heliconian .....	<i>Heliconius charithonia</i> .....	MTC
Ceranus Blue .....	<i>Hemiargus ceranus</i> .....	MTC
Giant Swallowtail .....	<i>Heraclides cresphontes</i> .....	MTC
Carolina Satyr .....	<i>Hermeuptychia sosybius</i> .....	MTC
Fiery Skipper .....	<i>Hylephila phyleus</i> .....	MTC
Common Buckeye .....	<i>Junonia coenia</i> .....	MTC
Clouded Skipper .....	<i>Lerema accuis</i> .....	MTC
American Snout .....	<i>Libytheana carinenta</i> .....	MTC
Dainty Sulphur .....	<i>Nathalis iole</i> .....	MTC
Morning Cloak .....	<i>Nymphalis antiopa</i> .....	MEH, HH
Twin-spotted Skipper .....	<i>Oligoria maculata</i> .....	MTC
Ocola Skipper .....	<i>Panoquina ocola</i> .....	MTC
Salt Marsh Skipper .....	<i>Panoquina panoquin</i> .....	MTC
Black Swallowtail .....	<i>Papilio polyxenes</i> .....	MTC
White M Hairstreak .....	<i>Parhasius m-album</i> .....	MTC
Cloudless Sulphur .....	<i>Phoebis sennae</i> .....	MTC
Phaon Crescent .....	<i>Phyciodes phaon</i> .....	MTC
Pearl Crescent .....	<i>Phyciodes tharos</i> .....	MTC
Whirlabout .....	<i>Polites vibex</i> .....	MTC
Question Mark .....	<i>Polygonia interrogationis</i> .....	MEH, BF, UHF
Checkered White .....	<i>Pontia protodice</i> .....	MTC
Palamedes Swallowtail .....	<i>Pterourus palamedes</i> .....	MTC
Spicebush Swallowtail .....	<i>Pterourus troilus</i> .....	MTC
Tropical Checkered Skipper .....	<i>Pyrgus oileus</i> .....	MTC
Cabbage White .....	<i>Pyris rapae</i> .....	MTC
Gray Hairstreak .....	<i>Strymon melinus</i> .....	MTC
Long-tailed Skipper .....	<i>Urbanus proteus</i> .....	MTC
Red Admiral .....	<i>Vanessa atalanta</i> .....	MTC
Painted Lady .....	<i>Vanessa cardui</i> .....	MTC
American Lady .....	<i>Vanessa virginiensis</i> .....	MTC
Southern Broken-dash .....	<i>Wallengrenia otho</i> .....	MTC

## FISH

## Crystal River Preserve State Park Animals

Common Name	Scientific Name	Primary Habitat Codes (for all species)
Flat Needlefish	<i>Ablennes hians</i>	EUS, FM
Diamond Killifish	<i>Adinia xenica</i>	BM, FM
Yellow Bullhead	<i>Ameiurus natalis</i>	IM
Sheepshead	<i>Archosargus probatocephalus</i>	EUS, ECNS
Common Snook	<i>Centropomus undecimalis</i>	EUS, MS
Sheepshead Minnow	<i>Cyprinodon variegatus</i>	BM, EUS, FS
Spotfin Mojarra	<i>Ecinostomus argenteus</i>	EUS, ECNS, MS
Swamp Darter	<i>Etheostoma fusiforme</i>	DM, BM, IM
Golden Topminnow	<i>Fundulus chrysotus</i>	DM, BM
Marsh Killifish	<i>Fundulus confluentus</i>	EUS, FM, DM, BM
Gulf Killifish	<i>Fundulus grandis</i>	EUS, ECNS, MS
Longnose Killifish	<i>Fundulus similis</i>	EUS, FM
Mosquitofish	<i>Gambusia affinis</i>	BM, FS
Least Killifish	<i>Heterandria formosa</i>	BM, DM
Brown Hoplo	<i>Hoplosternum littorale</i> *	IM, BM
Flagfish	<i>Jordanella floridae</i>	BS, FS, BM, DM
Longnose Gar	<i>Lepisosteus osseus</i>	EUS
Florida Gar	<i>Lepisosteus platyrhincus</i>	FS, IM
Warmouth	<i>Lepomis gulosus</i>	IM, FS, BM
Bluegill	<i>Lepomis macrochirus</i>	IM, FS, BM
Dollar Sunfish	<i>Lepomis marginatus</i>	IM, FS, BM
Readear Sunfish	<i>Lepomis microlophus</i>	IM, FS, BM
Rainwater Killifish	<i>Lucania parva</i>	FM, FS
Bluefin Killifish	<i>Lucania goodei</i>	FM, FS
Atlantic Tarpon	<i>Megalops atlanticus</i>	EUS, ECNS
Inland Silverside	<i>Menidia beryllina</i>	EUS, ECNS
Largemouth Bass	<i>Micropterus salmoides</i>	IM, BM, FS
Striped Mullet	<i>Mugil cephalus</i>	EUS, ECNS
Golden Shiner	<i>Notemigonus crysoleucas</i>	DM, BM
Oyster Toadfish	<i>Opsanus tau</i>	EUS, ECNS
Sailfin Molly	<i>Poecilia latipinna</i>	DM, BM
Hog Choker	<i>Trinectes maculatus</i>	EUS, ECNS, FS

### AMPHIBIANS

#### Frogs and Toads

Florida Cricket Frog	<i>Acris gryllus dorsalis</i>	MTC
Oak Toad	<i>Anaxyrus quercicus</i>	MF, SF, DM
Southern Toad	<i>Anaxyrus terrestris</i>	MTC
Greenhouse Frog	<i>Eleutherodactylus planirostris</i> *	MTC
Eastern Narrowmouth Toad	<i>Gastrophryne carolinensis</i>	MTC
Green Treefrog	<i>Hyla cinerea</i>	MTC
Pine Woods Treefrog	<i>Hyla femoralis</i>	MF, SF
Squirrel Treefrog	<i>Hyla squirella</i>	MTC
American Bullfrog	<i>Lithobates catesbeianus</i>	SKLK, BS

\* Non-native species    ^ Garden species

## Crystal River Preserve State Park Animals

Common Name	Scientific Name	Primary Habitat Codes (for all species)
Southern Leopard Frog .....	<i>Lithobates sphenoccephala</i> .....	DM, MF, BM
Spring Peeper .....	<i>Pseudacris crucifer bartramiana</i> .....	BS, SST
Southern Chorus Frog.....	<i>Pseudacris nigrita</i> .....	DM, MF, BM
Little Grass Frog .....	<i>Pseudacris ocularis</i> .....	DM, MF, BM
Eastern Spadefoot.....	<i>Scaphiopus holbrookii</i> .....	SCF, SC, DM

### Salamanders

Greater Siren .....	<i>Siren lacertina</i> .....	BM, BS, DS, FS
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## REPTILES

### Crocodylians

American Alligator .....	<i>Alligator mississippiensis</i> .....	BM, FM
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### Turtles

Florida Softshell .....	<i>Apalone ferox</i> .....	IM, BM
Loggerhead .....	<i>Caretta caretta</i> .....	EUS, ECNS
Green Turtle .....	<i>Chelonia mydas</i> .....	EUS, ECNS
Florida Snapping Turtle .....	<i>Chelydra serpentina osceola</i> .....	BS, FS
Florida Chicken Turtle .....	<i>Deirochelys reticularia chrysea</i> .....	DM, BM, FM
Hawksbill .....	<i>Eretmochely imbricata</i> .....	EUS, ECNS
Gopher Tortoise .....	<i>Gopherus polyphemus</i> .....	SC, MF, SCF
Striped Mud Turtle .....	<i>Kinosternon baurii</i> .....	BS, FS
Florida Mud Turtle .....	<i>Kinosternon subrubrum steindachneri</i> .....	BM, FM
Kemp's Ridley Turtle.....	<i>Lepidochelys kempii</i> .....	EUS, ECNS
Ornate Diamondback Terrapin ..	<i>Malaclemys terrapin macrospilota</i> .....	EUS, ECNS
Loggerhead Musk Turtle.....	<i>Sternotherus minor</i> .....	SST, FM
Eastern Musk Turtle .....	<i>Sternotherus odoratus</i> .....	BS, FS
Florida Box Turtle.....	<i>Terrapene carolina bauri</i> .....	HH, MEH
Gulf Coast Box Turtle.....	<i>Terrapene carolina major</i> .....	HH, MEH
Yellowbelly Slider .....	<i>Trachemys scripta scripta</i> .....	BS, EUS, IM

### Snakes

Florida Cottonmouth.....	<i>Agkistrodon piscivorus conanti</i> .....	HH, BS, FS
Southern Black Racer .....	<i>Coluber constrictor priapus</i> .....	MTC
E. Diamond-backed Rattlesnake.....	<i>Crotalus adamanteus</i> .....	SC, SH, MF
Southern Ring-necked Snake....	<i>Diadophis punctatus punctatus</i> .....	MEH, HH
Eastern Indigo Snake .....	<i>Drymarchon couperi</i> .....	SC, MEH, HH
Scarlet Kingsnake .....	<i>Lampropeltis elapsoides</i> .....	MEH, FS
Common Kingsnake.....	<i>Lampropeltis getula</i> .....	SST, FS
Eastern Coral Snake .....	<i>Micrurus fulvius</i> .....	MTC
Gulf Salt Marsh Snake .....	<i>Nerodia clarkii clarkii</i> .....	SAM, MS
Florida Watersnake .....	<i>Nerodia fasciata pictiventris</i> .....	MTC
Brown Watersnake .....	<i>Nerodia taxispilota</i> .....	FS, SST
Rough Greensnake .....	<i>Opheodrys aestivus</i> .....	MTC

## Crystal River Preserve State Park Animals

Common Name	Scientific Name	Primary Habitat Codes (for all species)
Eastern Ratsnake .....	<i>Pantherophis alleghaniensis</i> .....	MTC
Eastern Corn Snake.....	<i>Pantherophis guttatus</i> .....	MTC
Glossy Crayfish Snake .....	<i>Regina rigida</i> .....	BM, DM
Dusky Pygmy Rattlesnake .....	<i>Sistrurus miliarius barbouri</i> .....	MEH, HH
Peninsula Ribbonsnake .....	<i>Thamnophis sauritus sackenii</i> .....	MTC
Blue-striped Gartersnake .....	<i>Thamnophis sirtalis similis</i> .....	MTC
Eastern Gartersnake.....	<i>Thamnophis sirtalis sirtalis</i> .....	MTC

### Lizards

Green Anole .....	<i>Anolis carolinensis</i> .....	MTC
Brown Anole .....	<i>Anolis sagrei</i> * .....	DV
Six-lined Racerunner .....	<i>Aspidoscelis sexlineata</i> .....	SC, SCF, SH
Mediterranean Gecko.....	<i>Hemidactylus turcicus</i> * .....	DV
Eastern Glass Lizard .....	<i>Ophisaurus ventralis</i> .....	MTC
Southeastern Five-lined Skink ..	<i>Plestiodon inexpectatus</i> .....	MEH, HH
Broad-headed Skink .....	<i>Plestiodon laticeps</i> .....	MEH, HH
Eastern Fence Lizard .....	<i>Sceloporus undulatus</i> .....	SC, SCF, MF, SH
Ground Skink .....	<i>Scincella lateralis</i> .....	MTC

## BIRDS

### Waterfowl

Snow Goose .....	<i>Chen caerulescens</i> .....	EUS, SAM, OF
Ross's Goose .....	<i>Chen rossii</i> .....	EUS, SAM, OF
Muscovy Duck .....	<i>Cairina moschata</i> * .....	IAP, OF
Wood Duck.....	<i>Aix sponsa</i> .....	BS, DS, FS, FM, OF
Mallard .....	<i>Anas platyrhynchos</i> .....	EUS, SAM, IAP, OF
Blue-winged Teal .....	<i>Anas discors</i> .....	EUS, SAM, OF
Green-winged Teal .....	<i>Anas crecca</i> .....	EUS, SAM, OF
Ring-necked Duck .....	<i>Aythya collaris</i> .....	EUS, SAM, OF
Bufflehead .....	<i>Bucephala islandica</i> .....	EUS, OF
Common Goldeneye .....	<i>Bucephala clangula</i> .....	EUS, OF
Hooded Merganser .....	<i>Lophodytes cucullatus</i> .....	EUS, SAM, IAP, OF
Red-breasted Merganser .....	<i>Mergus serrator</i> .....	EUS, OF

### Turkeys

Wild Turkey.....	<i>Meleagris gallopavo</i> .....	MTC
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### New World Quails

Northern Bobwhite .....	<i>Colinus virginianus</i> .....	ABP, PSI
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### Loons

Common Loon .....	<i>Gavia immer</i> .....	EUS, OF
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\* Non-native species    ^ Garden species

## Crystal River Preserve State Park Animals

Common Name	Scientific Name	Primary Habitat Codes (for all species)
<b>Grebes</b>		
Pied-billed Grebe .....	<i>Podilymbus podiceps</i> .....	EUS, IAP
Horned Grebe.....	<i>Podiceps auritus</i> .....	EUS
<b>Pelicans</b>		
American White Pelican.....	<i>Pelecanus erythrorhynchos</i> .....	EUS, OF
Brown Pelican.....	<i>Pelecanus occidentalis</i> .....	EUS, MS, OF
<b>Cormorants</b>		
Double-crested Cormorant .....	<i>Phalacrocorax auritus</i> .....	EUS, SAM, MS, IAP, OF
<b>Anhingas</b>		
Anhinga .....	<i>Anhinga anhinga</i> .....	EUS, FM, IAP, OF
<b>Frigatebirds</b>		
Magnificent Frigatebird .....	<i>Fregata magnificens</i> .....	OF
<b>Herons, Egrets, and Bitterns</b>		
Least Bittern .....	<i>Ixobrychus exilis</i> .....	SAM, FM
Great Blue Heron .....	<i>Ardea herodias</i> .....	SAM, FM, BM
Great Egret .....	<i>Ardea alba</i> .....	SAM, FM
Snowy Egret.....	<i>Egretta thula</i> .....	SAM, FM, MS
Little Blue Heron .....	<i>Egretta caerulea</i> .....	SAM, FM, BM
Tricolored Heron .....	<i>Egretta tricolor</i> .....	SAM, FM
Cattle Egret.....	<i>Bubulcus ibis</i> .....	MTC
Green Heron.....	<i>Butorides virescens</i> .....	SAM, FM, BM
Black-crowned Night-heron .....	<i>Nycticorax nycticorax</i> .....	SAM, FM, BM
Yellow-crowned Night-heron.....	<i>Nyctanassa violacea</i> .....	SAM, FM
<b>Ibis and Spoonbills</b>		
White Ibis .....	<i>Eudocimus albus</i> .....	SAM, FM, BM, OF
Roseate Spoonbill .....	<i>Platalea ajaja</i> .....	SAM, OF
<b>Storks</b>		
Wood Stork.....	<i>Mycteria americana</i> .....	SAM, FM, BM, OF
<b>New World Vultures</b>		
Black Vulture .....	<i>Coragyps atratus</i> .....	MTC, OF
Turkey Vulture.....	<i>Cathartes aura</i> .....	MTC, OF
<b>Hawks, Eagles, and Kites</b>		
Osprey .....	<i>Pandion haliaetus</i> .....	EUS, FM, IAP, OF
Swallow-tailed Kite.....	<i>Elanoides forficatus</i> .....	OF
Mississippi Kite .....	<i>Ictinia mississippiensis</i> .....	OF
Bald Eagle.....	<i>Haliaeetus leucocephalus</i> .....	EUS, OF
Northern Harrier .....	<i>Circus cyaneus</i> .....	OF

**Crystal River Preserve State Park Animals**

<b>Common Name</b>	<b>Scientific Name</b>	<b>Primary Habitat Codes (for all species)</b>
Sharp-shinned Hawk .....	<i>Accipiter striatus</i> .....	MTC, OF
Cooper's Hawk.....	<i>Accipiter cooperi</i> .....	MF, HH, OF
Red-shouldered Hawk.....	<i>Buteo lineatus</i> .....	MTC
Red-tailed Hawk .....	<i>Buteo jamaicensis</i> .....	ABP, PSI, OF
<b>Rails and Coots</b>		
Black Rail.....	<i>Laterallus jamaicensis</i> .....	SAM
Clapper Rail.....	<i>Rallus crepitans</i> .....	SAM
Sora .....	<i>Porzana carolina</i> .....	FM, SAM
Purple Gallinule.....	<i>Porphyrio martinicus</i> .....	FM
Common Gallinule.....	<i>Gallinula galeata</i> .....	FM
American Coot .....	<i>Fulica americana</i> .....	SAM, FM
<b>Limpkins</b>		
Limpkin .....	<i>Aramus guarauna</i> .....	FM
<b>Cranes</b>		
Sandhill Crane .....	<i>Grus canadensis</i> .....	FM, OF
Whooping Crane .....	<i>Grus americana</i> .....	FM, OF
<b>Avocets and Stilts</b>		
American Avocet .....	<i>Recurvirostra americana</i> .....	EUS
<b>Oystercatchers</b>		
American Oystercatcher.....	<i>Haematopus palliatus</i> .....	EUS
<b>Plovers</b>		
Black-bellied-Plover.....	<i>Pluvialis squatarola</i> .....	EUS, FM
Wilson's Plover .....	<i>Charadrius wilsonia</i> .....	EUS
Semipalmated Plover .....	<i>Charadrius semipalmatus</i> .....	EUS
Killdeer .....	<i>Charadrius vociferus</i> .....	FM, ABP, OF
<b>Sandpipers</b>		
Spotted Sandpiper .....	<i>Actitis macularius</i> .....	EUS, FM
Solitary Sandpiper.....	<i>Tringa solitaria</i> .....	FM
Greater Yellowlegs .....	<i>Tringa melanoleuca</i> .....	EUS, FM
Willet.....	<i>Tringa semipalmata</i> .....	SAM, EUS
Lesser Yellowlegs .....	<i>Tringa flavipes</i> .....	EUS, FM
Ruddy Turnstone.....	<i>Arenaria interpres</i> .....	EUS
Red Knot.....	<i>Calidris canutus</i> .....	EUS
Sanderling .....	<i>Calidris alba</i> .....	EUS
Dunlin .....	<i>Calidris alpina</i> .....	EUS
Semipalmated Sandpiper .....	<i>Calidris pusilla</i> .....	EUS, FM
Western Sandpiper.....	<i>Calidris mauri</i> .....	EUS, FM
Short-billed Dowitcher .....	<i>Limnodromus griseus</i> .....	EUS, FM
Wilson's Snipe .....	<i>Gallinago delicata</i> .....	FM, SAM

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**Crystal River Preserve State Park Animals**

<b>Common Name</b>	<b>Scientific Name</b>	<b>Primary Habitat Codes (for all species)</b>
American Woodcock .....	<i>Scolopax minor</i> .....	HH, FS, BS
<b>Gulls, Terns, and Skimmers</b>		
Laughing Gull .....	<i>Leucophaeus atricilla</i> .....	EUS, FM, OF
Ring-billed Gull .....	<i>Larus delawarensis</i> .....	EUS, FM, OF
Herring Gull.....	<i>Larus argentatus</i> .....	EUS, FM, OF
Least Tern.....	<i>Sternula antillarum</i> .....	EUS, FM, OF
Forster's Tern.....	<i>Sterna forsteri</i> .....	EUS, FM, OF
Royal Tern .....	<i>Thalasseus maximus</i> .....	EUS, FM, OF
Sandwich Tern.....	<i>Thalasseus sandvicensis</i> .....	EUS, OF
Black Skimmer .....	<i>Rynchops niger</i> .....	EUS, OF
<b>Pigeons and Doves</b>		
Rock Pigeon .....	<i>Columba livia</i> * .....	DV, OF
Eurasian Collared-Dove.....	<i>Streptopelia decaocto</i> * .....	DV, OF
Common Ground-Dove .....	<i>Columbina passerina</i> .....	SH, ABP
Mourning Dove .....	<i>Zenaida macroura</i> .....	MTC
<b>Cuckoos and Anis</b>		
Yellow-billed Cuckoo .....	<i>Coccyzus americanus</i> .....	MEH, HH, SHF
<b>Owls</b>		
Eastern Screech-Owl .....	<i>Megascops asio</i> .....	MEH, SHF
Great Horned Owl .....	<i>Bubo virginianus</i> .....	MTC
Barred Owl.....	<i>Strix varia</i> .....	MTC
<b>Nightjars</b>		
Common Nighthawk .....	<i>Chordeiles minor</i> .....	SH, OF
Chuck-will's-widow .....	<i>Antrostomus carolinensis</i> .....	MEH, SHF
<b>Swifts</b>		
Chimney Swift .....	<i>Chaetura pelagica</i> .....	OF
<b>Hummingbirds</b>		
Ruby-throated Hummingbird ....	<i>Archilochus colubris</i> .....	MTC
<b>Kingfishers</b>		
Belted Kingfisher.....	<i>Megaceryle alcyon</i> .....	FM, SAM, EUS, IAP
<b>Woodpeckers</b>		
Red-headed Woodpecker .....	<i>Melanerpes erythrocephalus</i> .....	MF, SCF, SH
Red-bellied Woodpecker.....	<i>Melanerpes carolinus</i> .....	MTC
Yellow-bellied Sapsucker.....	<i>Sphyrapicus varius</i> .....	HH, MEH, SHF
Downy Woodpecker.....	<i>Picoides pubescens</i> .....	MTC
Hairy Woodpecker.....	<i>Picoides villosus</i> .....	MF, SCF
Northern Flicker .....	<i>Colaptes auratus</i> .....	SH, ABP, PSI

\* Non-native species    ^ Garden species

**Crystal River Preserve State Park Animals**

<b>Common Name</b>	<b>Scientific Name</b>	<b>Primary Habitat Codes (for all species)</b>
Pileated Woodpecker .....	<i>Dryocopus pileatus</i> .....	MTC
<b>Falcons and Caracaras</b>		
American Kestrel.....	<i>Falco sparverius</i> .....	SH, ABP, PSI, OF
Merlin .....	<i>Falco columbarius</i> .....	OF
Peregrine Falcon .....	<i>Falco peregrinus</i> .....	OF
<b>Tyrant Flycatchers</b>		
Eastern Wood-Pewee .....	<i>Contopus virens</i> .....	SH
Eastern Phoebe.....	<i>Sayornis phoebe</i> .....	MTC
Great Crested Flycatcher.....	<i>Myiarchus crinitus</i> .....	MTC
Eastern Kingbird .....	<i>Tyrannus tyrannus</i> .....	ABP, PSI, DV
Gray Kingbird .....	<i>Tyrannus dominicensis</i> .....	ABP, DV
<b>Shrikes</b>		
Loggerhead Shrike .....	<i>Lanius ludovicianus</i> .....	ABP
<b>Vireos and Allies</b>		
White-eyed Vireo .....	<i>Vireo griseus</i> .....	MTC
Yellow-throated Vireo .....	<i>Vireo flavifrons</i> .....	SH, SHF
Blue-headed Vireo.....	<i>Vireo solitarius</i> .....	MEH, HH, SHF
Red-eyed Vireo .....	<i>Vireo olivaceus</i> .....	MEH, HH, SHF
<b>Crows and Jays</b>		
Blue Jay .....	<i>Cyanocitta cristata</i> .....	MTC
Florida Scrub-jay .....	<i>Aphelocoma coerulescens</i> .....	SCF, SC
American Crow .....	<i>Corvus brachyrhynchos</i> .....	MTC, OF
Fish Crow.....	<i>Corvus ossifragus</i> .....	MTC, OF
<b>Swallows</b>		
Purple Martin.....	<i>Progne subis</i> .....	OF
Tree Swallow .....	<i>Tachycineta bicolor</i> .....	OF
N. Rough-winged Swallow .....	<i>Stelgidopteryx serripennis</i> .....	OF
Barn Swallow.....	<i>Hirundo rustica</i> .....	ABP, DV, OF
<b>Tits and Allies</b>		
Carolina Chickadee.....	<i>Poecile carolinensis</i> .....	MTC
Tufted Titmouse.....	<i>Baeolophus bicolor</i> .....	MTC
<b>Wrens</b>		
House Wren .....	<i>Troglodytes aedon</i> .....	ABP, PSI, DV
Sedge Wren .....	<i>Cistothorus platensis</i> .....	SAM, FM
Marian's Marsh Wren .....	<i>Cistothorus palustris marianae</i> .....	SAM
Carolina Wren.....	<i>Thryothorus ludovicianus</i> .....	MTC
<b>Kinglets</b>		

\* Non-native species    ^ Garden species

## Crystal River Preserve State Park Animals

Common Name	Scientific Name	Primary Habitat Codes (for all species)
Ruby-crowned Kinglet.....	<i>Regulus calendula</i> .....	MTC
<b>Old World Warblers</b>		
Blue-gray Gnatcatcher.....	<i>Poliophtila caerulea</i> .....	MTC
<b>Thrushes</b>		
Eastern Bluebird .....	<i>Sialia sialis</i> .....	SH, MF, ABP
Veery .....	<i>Catharus fuscescens</i> .....	MEH, SHF
Hermit Thrush .....	<i>Catharus guttatus</i> .....	MEH, HH, SHF
Wood Thrush.....	<i>Hylocichla mustelina</i> .....	MEH, SHF
American Robin .....	<i>Turdus migratorius</i> .....	MTC
<b>Mockingbirds and Thrashers</b>		
Gray Catbird.....	<i>Dumetella carolinensis</i> .....	MTC
Brown Thrasher .....	<i>Toxostoma rufum</i> .....	MTC
Northern Mockingbird .....	<i>Mimus polyglottos</i> .....	MTC
<b>Starlings</b>		
European Starling .....	<i>Sturnus vulgaris</i> *	DV
<b>Waxwings</b>		
Cedar Waxwing.....	<i>Bombycilla cedrorum</i> .....	MTC
<b>New World Warblers</b>		
Ovenbird.....	<i>Seiurus aurocapilla</i> .....	HH, SHF
Worm-eating Warbler .....	<i>Helmitheros vermivorum</i> .....	HH, SHF
Louisiana Waterthrush.....	<i>Parkesia motacilla</i> .....	FS, BS, HH
Northern Waterthrush.....	<i>Parkesia noveboracensis</i> .....	FS, BS, HH
Blue-winged Warbler .....	<i>Vermivora cyanoptera</i> .....	HH, SHF
Black-and-white Warbler.....	<i>Mniotilta varia</i> .....	MTC
Tennessee Warbler.....	<i>Oreothlypis peregrina</i> .....	HH, SHF
Orange-crowned Warbler .....	<i>Oreothlypis celata</i> .....	HH, SHF
Common Yellowthroat.....	<i>Geothlypis trichas</i> .....	FM, BM, WF
Hooded Warbler.....	<i>Setophaga citrina</i> .....	HH, SHF
American Redstart .....	<i>Setophaga ruticilla</i> .....	HH, SHF
Northern Parula .....	<i>Setophaga americana</i> .....	MTC
Magnolia Warbler .....	<i>Setophaga magnolia</i> .....	HH, SHF
Yellow Warbler.....	<i>Setophaga petechia</i> .....	FM, BM
Chestnut-sided Warbler .....	<i>Setophaga pensylvanica</i> .....	HH, SHF
Blackpoll Warbler .....	<i>Setophaga striata</i> .....	HH, SHF
Black-throated Blue Warbler.....	<i>Setophaga caeruleascens</i> .....	HH, SHF
Palm Warbler.....	<i>Setophaga palmarum</i> .....	SH, FM, ABP
Pine Warbler.....	<i>Setophaga pinus</i> .....	SH, SHF, MF
Yellow-rumped Warbler.....	<i>Setophaga coronata</i> .....	MTC
Yellow-throated Warbler .....	<i>Setophaga dominica</i> .....	HH, SHF
Prairie Warbler.....	<i>Setophaga discolor</i> .....	MF, WF, SHF

\* Non-native species    ^ Garden species

**Crystal River Preserve State Park Animals**

Common Name	Scientific Name	Primary Habitat Codes (for all species)
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Yellow-breasted Chat ..... *Icteria virens* ..... SCF

**Sparrows and Allies**

Eastern Towhee ..... *Pipilo erythrophthalmus*..... MF, SCF  
 Savannah Sparrow ..... *Passerculus sandwichensis*..... FM, BM, ABP  
 Grasshopper Sparrow ..... *Ammodramus savannarum* .....ABP, PSI  
 Nelson's Sparrow ..... *Ammodramus nelsoni*.....SAM, FM  
 Swamp Sparrow ..... *Melospiza georgiana*..... FM, BM, BS  
 White-crowned Sparrow ..... *Zonotrichia leucophrys* ..... ABP

**Cardinals, Grosbeaks, and Allies**

Summer Tanager ..... *Piranga rubra* .....MF, SH  
 Scarlet Tanager ..... *Piranga olivacea* .....HH, SHF  
 Northern Cardinal ..... *Cardinalis cardinalis* .....MTC  
 Rose-breasted Grosbeak ..... *Pheucticus ludovicianus*.....HH  
 Blue Grosbeak ..... *Passerina caerulea*..... SH, ABP  
 Indigo Bunting ..... *Passerina cyanea*..... SH, ABP

**Blackbirds and Allies**

Bobolink ..... *Dolichonyx oryzivorus* .....FM, BM  
 Red-winged Blackbird ..... *Agelaius phoeniceus*.....MTC  
 Eastern Meadowlark ..... *Sturnella magna*.....ABP, PSI  
 Common Grackle ..... *Quiscalus quiscula* .....ABP, DV  
 Boat-tailed Grackle..... *Quiscalus major* .....FM, BM  
 Brown-headed Cowbird ..... *Molothrus ater* .....MTC  
 Baltimore Oriole..... *Icterus galbula*.....HH, SHF

**Finches and Allies**

American Goldfinch ..... *Spinus tristis*.....MTC

**Old World Sparrows**

House Sparrow ..... *Passer domesticus* \* .....DV

**MAMMALS**

**Didelphids**

Virginia Opossum ..... *Didelphis virginiana* .....MTC

**Insectivores**

Southern Short-tailed Shrew .... *Blarina carolinensis*.....MTC  
 Eastern Mole ..... *Scalopus aquaticus* .....HH  
 Southeastern Shrew ..... *Sorex longirostris* .....HH, BS, MF, SCF

**Bats**

Seminole Bat ..... *Lasiurus seminolus* .....HH

\* Non-native species    ^ Garden species

## Crystal River Preserve State Park Animals

Common Name	Scientific Name	Primary Habitat Codes (for all species)
Southeastern Myotis.....	<i>Myotis austroriparius</i> .....	MTC
Tricolored Bat.....	<i>Perimyotis subflavus</i> .....	ABP, PSI, DV
Brazilian/Mex. Free-tailed Bat ...	<i>Tadarida brasiliensis</i> .....	ABP, DV
<b>Edentates</b>		
Nine-banded Armadillo .....	<i>Dasypus novemcinctus</i> * .....	MTC
<b>Lagomorphs</b>		
Eastern Cottontail .....	<i>Sylvilagus floridanus</i> .....	MTC
Marsh Rabbit .....	<i>Sylvilagus palustris</i> .....	SAM, FM
<b>Rodents</b>		
Southeastern Pocket Gopher ....	<i>Geomys pinetis</i> .....	SH, ABP, PSI
Southern Flying Squirrel .....	<i>Glaucomys volans</i> .....	HH
Eastern Woodrat .....	<i>Neotoma floridana</i> .....	HH
Golden Mouse.....	<i>Ochrotomys nuttalli</i> .....	HH, MEH, SHF
Marsh Rice Rat .....	<i>Oryzomys palustris</i> .....	HH, FM, BM
Cotton Mouse .....	<i>Peromyscus gossypinus</i> .....	MF, MEH, SHF
Florida Mouse .....	<i>Podomys floridanus</i> .....	SH, SCF
Eastern Gray Squirrel .....	<i>Sciurus carolinensis</i> .....	MTC
Sherman's Fox Squirrel.....	<i>Sciurus niger shermani</i> .....	SH, ABP
Hispid Cotton Rat .....	<i>Sigmodon hispidus</i> .....	MF, ABP
<b>Carnivores</b>		
Dog.....	<i>Canis familiaris</i> * .....	MTV
Coyote.....	<i>Canis latrans</i> * .....	MTV
Cat.....	<i>Felis domesticus</i> * .....	MTV
River Otter .....	<i>Lutra canadensis</i> .....	FS, BS, CD
Bobcat.....	<i>Lynx rufus</i> .....	MTC
Florida Long-tailed Weasel .....	<i>Mustela frenata peninsulae</i> .....	SH, SCF, MF, ABP
Salt Marsh Mink .....	<i>Mustela vison halilimnetes</i> .....	SAM
Raccoon.....	<i>Procyon lotor</i> .....	MTC
Gray Fox.....	<i>Urocyon cinereoargenteus</i> .....	SH, ABP, SHF
Florida Black Bear .....	<i>Ursus americanus floridanus</i> .....	BS, FS, HH
<b>Artiodactyls</b>		
White-tailed Deer.....	<i>Odocoileus virginianus</i> .....	MTC
Feral Pig .....	<i>Sus scrofa</i> * .....	MTC

\* Non-native species    ^ Garden species

## Primary Habitat Codes

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### TERRESTRIAL

Beach Dune.....	BD
Coastal Berm.....	CB
Coastal Grassland.....	CG
Coastal Strand.....	CS
Dry Prairie.....	DP
Keys Cactus Barren.....	KCB
Limestone Outcrop.....	LO
Maritime Hammock.....	MAH
Mesic Flatwoods.....	MF
Mesic Hammock.....	MEH
Pine Rockland.....	PR
Rockland Hammock.....	RH
Sandhill.....	SH
Scrub.....	SC
Scrubby Flatwoods.....	SCF
Shell Mound.....	SHM
Sinkhole.....	SK
Slope Forest.....	SPF
Upland Glade.....	UG
Upland Hardwood Forest.....	UHF
Upland Mixed Woodland.....	UMW
Upland Pine.....	UP
Wet Flatwoods.....	WF
Xeric Hammock.....	XH

### PALUSTRINE

Alluvial Forest.....	AF
Basin Marsh.....	BM
Basin Swamp.....	BS
Baygall.....	BG
Bottomland Forest.....	BF
Coastal Interdunal Swale.....	CIS
Depression Marsh.....	DM
Dome Swamp.....	DS
Floodplain Marsh.....	FM
Floodplain Swamp.....	FS
Glades Marsh.....	GM
Hydric Hammock.....	HH
Keys Tidal Rock Barren.....	KTRB
Mangrove Swamp.....	MS
Marl Prairie.....	MP
Salt Marsh.....	SAM
Seepage Slope.....	SSL
Shrub Bog.....	SHB
Slough.....	SLO
Slough Marsh.....	SLM
Strand Swamp.....	STS

## Primary Habitat Codes

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Wet Prairie ..... WP

### LACUSTRINE

Clastic Upland Lake ..... CULK

Coastal Dune Lake ..... CDLK

Coastal Rockland Lake ..... CRLK

Flatwoods/Prairie ..... FPLK

Marsh Lake ..... MLK

River Floodplain Lake ..... RFLK

Sandhill Upland Lake ..... SULK

Sinkhole Lake ..... SKLK

Swamp Lake ..... SWLK

### RIVERINE

Alluvial Stream ..... AST

Blackwater Stream ..... BST

Seepage Stream ..... SST

Spring-run Stream ..... SRST

### SUBTERRANEAN

Aquatic Cave ..... ACV

Terrestrial Cave ..... TCV

### ESTUARINE

Algal Bed ..... EAB

Composite Substrate ..... ECPS

Consolidated Substrate ..... ECNS

Coral Reef ..... ECR

Mollusk Reef ..... EMR

Octocoral Bed ..... EOB

Seagrass Bed ..... ESGB

Sponge Bed ..... ESPB

Unconsolidated Substrate ..... EUS

Worm Reef ..... EWR

## Primary Habitat Codes

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### MARINE

Algal Bed .....	MAB
Composite Substrate .....	MCPS
Consolidated Substrate .....	MCNS
Coral Reef .....	MCR
Mollusk Reef .....	MMR
Octocoral Bed .....	MOB
Seagrass Bed .....	MSGB
Sponge Bed .....	MSPB
Unconsolidated Substrate .....	MUS
Worm Reef .....	MWR

### ALTERED LANDCOVER TYPES

Abandoned field/Abandoned pasture .....	AFP
Agriculture .....	AG
Artificial Pond .....	AP
Borrow Area .....	BA
Canal/ditch .....	CD
Clearcut pine plantation .....	CPP
Clearing/Regeneration .....	CL
Developed .....	DV
Impoundment .....	IM
Invasive exotic monoculture .....	IEM
Pasture - improved .....	PI
Pasture - semi-improved .....	PSI
Pine plantation .....	PP
Restoration Natural Community .....	RNC
Road .....	RD
Spoil area .....	SA
Successional hardwood forest .....	SHF
Utility corridor .....	UC

### MISCELLANEOUS

Many Types of Communities .....	MTC
Overflying .....	OF



## **Addendum 6—Imperiled Species Ranking Definitions**



## **Imperiled Species Ranking Definitions**

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The Nature Conservancy and the Natural Heritage Program Network (of which FNAI is a part) define an element as any exemplary or rare component of the natural environment, such as a species, natural community, bird rookery, spring, sinkhole, cave or other ecological feature. An element occurrence (EO) is a single extant habitat that sustains or otherwise contributes to the survival of a population or a distinct, self-sustaining example of a particular element.

Using a ranking system developed by The Nature Conservancy and the Natural Heritage Program Network, the Florida Natural Areas Inventory assigns two ranks to each element. The global rank is based on an element's worldwide status; the state rank is based on the status of the element in Florida. Element ranks are based on many factors, the most important ones being estimated number of Element occurrences, estimated abundance (number of individuals for species; area for natural communities), range, estimated adequately protected EOs, relative threat of destruction, and ecological fragility.

Federal and State status information is from the U.S. Fish and Wildlife Service; and the Florida Fish and Wildlife Conservation Commission (animals), and the Florida Department of Agriculture and Consumer Services (plants), respectively.

### **FNAI GLOBAL RANK DEFINITIONS**

- G1 ..... Critically imperiled globally because of extreme rarity (5 or fewer occurrences or less than 1000 individuals) or because of extreme vulnerability to extinction due to some natural or fabricated factor.
- G2 ..... Imperiled globally because of rarity (6 to 20 occurrences or less than 3000 individuals) or because of vulnerability to extinction due to some natural or man-made factor.
- G3 ..... Either very rare or local throughout its range (21-100 occurrences or less than 10,000 individuals) or found locally in a restricted range or vulnerable to extinction of other factors.
- G4 ..... apparently secure globally (may be rare in parts of range)
- G5 ..... demonstrably secure globally
- GH ..... of historical occurrence throughout its range may be rediscovered (e.g., ivory-billed woodpecker)
- GX ..... believed to be extinct throughout range
- GXC ..... extirpated from the wild but still known from captivity or cultivation
- G#? ..... Tentative rank (e.g., G2?)
- G#G# ..... range of rank; insufficient data to assign specific global rank (e.g., G2G3)
- G#T# ..... rank of a taxonomic subgroup such as a subspecies or variety; the G portion of the rank refers to the entire species and the T portion refers to the specific subgroup; numbers have same definition as above (e.g., G3T1)
- G#Q..... rank of questionable species - ranked as species but questionable whether it is species or subspecies; numbers have same definition as above (e.g., G2Q)
- G#T#Q..... same as above, but validity as subspecies or variety is questioned.

## **Imperiled Species Ranking Definitions**

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- GU ..... due to lack of information, no rank or range can be assigned (e.g., GUT2).
- G?..... Not yet ranked (temporary)
- S1..... Critically imperiled in Florida because of extreme rarity (5 or fewer occurrences or less than 1000 individuals) or because of extreme vulnerability to extinction due to some natural or man-made factor.
- S2..... Imperiled in Florida because of rarity (6 to 20 occurrences or less than 3000 individuals) or because of vulnerability to extinction due to some natural or man-made factor.
- S3..... Either very rare or local throughout its range (21-100 occurrences or less than 10,000 individuals) or found locally in a restricted range or vulnerable to extinction of other factors.
- S4..... apparently secure in Florida (may be rare in parts of range)
- S5..... demonstrably secure in Florida
- SH ..... of historical occurrence throughout its range, may be rediscovered (e.g., ivory-billed woodpecker)
- SX..... believed to be extinct throughout range
- SA..... accidental in Florida, i.e., not part of the established biota
- SE..... an exotic species established in Florida may be native elsewhere in North America
- SN ..... regularly occurring but widely and unreliably distributed; sites for conservation hard to determine
- SU ..... due to lack of information, no rank or range can be assigned (e.g., SUT2).
- S?..... Not yet ranked (temporary)
- N ..... Not currently listed, nor currently being considered for listing, by state or federal agencies.

### **LEGAL STATUS**

#### **FEDERAL**

**(Listed by the U. S. Fish and Wildlife Service - USFWS)**

- LE ..... Listed as Endangered Species in the List of Endangered and Threatened Wildlife and Plants under the provisions of the Endangered Species Act. Defined as any species that is in danger of extinction throughout all or a significant portion of its range.
- PE ..... Proposed for addition to the List of Endangered and Threatened Wildlife and Plants as Endangered Species.
- LT ..... Listed as Threatened Species. Defined as any species that is likely to become an endangered species within the near future throughout all or a significant portion of its range.
- PT ..... Proposed for listing as Threatened Species.
- C ..... Candidate Species for addition to the list of Endangered and Threatened Wildlife and Plants. Defined as those species for which the USFWS currently has on file sufficient information on biological vulnerability and threats to support proposing to list the species as endangered or threatened.
- E(S/A) ..... Endangered due to similarity of appearance.

## **Imperiled Species Ranking Definitions**

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T(S/A) ..... Threatened due to similarity of appearance.

EXPE, XE..... Experimental essential population. A species listed as experimental and essential.

EXPN, XN.... Experimental non-essential population. A species listed as experimental and non-essential. Experimental, nonessential populations of endangered species are treated as threatened species on public land, for consultation purposes.

### **STATE**

#### **ANIMALS .. (Listed by the Florida Fish and Wildlife Conservation Commission - FWC)**

FE ..... Federally-designated Endangered

FT ..... Federally-designated Threatened

FXN..... Federally-designated Threatened Nonessential Experimental Population

FT(S/A) ..... Federally-designated Threatened species due to similarity of appearance

ST..... Listed as Threatened Species by the FWC. Defined as a species, subspecies, or isolated population, which is acutely vulnerable to environmental alteration, declining in number at a rapid rate, or whose range or habitat, is decreasing in area at a rapid rate and therefore is destined or very likely to become an endangered species within the near future.

SSC..... Listed as Species of Special Concern by the FWC. Defined as a population which warrants special protection, recognition or consideration because it has an inherent significant vulnerability to habitat modification, environmental alteration, human disturbance or substantial human exploitation that, in the near future, may result in its becoming a threatened species.

#### **PLANTS .... (Listed by the Florida Department of Agriculture and Consumer Services - FDACS)**

LE ..... Listed as Endangered Plants in the Preservation of Native Flora of Florida Act. Defined as species of plants native to the state that are in imminent danger of extinction within the state, the survival of which is unlikely if the causes of a decline in the number of plants continue, and includes all species determined to be endangered or threatened pursuant to the Federal Endangered Species Act of 1973, as amended.

LT ..... Listed as Threatened Plants in the Preservation of Native Flora of Florida Act. Defined as species native to the state that are in rapid decline in the number of plants within the state, but which have not so decreased in such number as to cause them to be endangered.



## **Addendum 7—Cultural Resources and Management Procedures**



**Crystal River Preserve State Park Cultural Resources**

<b>Table 8. Cultural Sites Listed in the Florida Master Site File</b>					
<b>FMSF # and Site Name</b>	<b>Culture/Period</b>	<b>Description</b>	<b>Significance</b>	<b>Condition</b>	<b>Treatment</b>
C100017 Rock Landing	Prehistoric/Unspecified	Prehistoric mound(s)	NE	G	P
C100022 Mullet Key	Prehistoric/Late Archaic/Deptford	Prehistoric shell midden/Prehistoric campsite	NRL	G	P
C100042 Crystal River 8 - Wash Island	Prehistoric/Archaic, 8500 B.C.- 1000 B.C.	Prehistoric campsite	NE	G	P
C100050 Crevasse Island	Prehistoric/Weeden Island II	Prehistoric shell midden	NE	G	P
C100087 Ozello 3	Prehistoric/Unspecified	Prehistoric shell midden	NE	G	P
C100088 Ozello 5	Prehistoric/Unspecified	Prehistoric shell midden	NE	G	P
C100118 Fort Island	Prehistoric/Late Archaic/Weeden Island	Prehistoric shell midden	NE	G	P
C100121 FPC 43 (Florida Power Corporation)	Prehistoric/Weeden Island, A.D. 450-1000	Prehistoric shell midden	NE	F	ST
C100132 Tiger Tail Bay	Prehistoric/Unspecified	Prehistoric shell midden	NE	G	P
C100137 North Shivers Bay Midden	Prehistoric/Deptford, 700 B.C.- 300 B.C.	Prehistoric campsite	NE	G	P
C100138 Salt River 2	Prehistoric/Archaic, 8500 B.C.- 1000 B.C.	Prehistoric shell midden	NE	F	P
C100224 Spice Key	Prehistoric/Weeden Island 1	Prehistoric shell midden/Prehistoric campsite	NE	G	P
C100225 Four Palms	Prehistoric/Unspecified Woodland	Prehistoric campsite	NE	G	P

**Crystal River Preserve State Park Cultural Resources**

<b>Table 8. Cultural Sites Listed in the Florida Master Site File</b>					
<b>FMSF # and Site Name</b>	<b>Culture/Period</b>	<b>Description</b>	<b>Significance</b>	<b>Condition</b>	<b>Treatment</b>
C100226 Unnamed	Prehistoric/Unspecified; Historic/19th century American, 1821-present	Prehistoric shell midden/Historic refuse dump	NE	G	P
C100230 Unnamed	Prehistoric/Unspecified	Prehistoric shell midden/Historic refuse dump	NE	G	P
C100231 Unnamed	Prehistoric/Unspecified	Prehistoric shell midden	NE	G	P
C100232 Unnamed	Prehistoric/Unspecified	Prehistoric shell midden	NE	G	P
C100233 Unnamed	Prehistoric/Unspecified	Prehistoric shell midden	NE	G	P
C100234 Unnamed	Prehistoric/Unspecified	Prehistoric shell midden	NE	G	P
C100418 Salt River Narrows 1	Prehistoric/Deptford, 700 B.C.- 300 B.C.	Prehistoric campsite	NE	G	P
C100419 Salt River Narrows 2	Prehistoric/Weeden Island, Safety Harbor; Historic/20th century American, 1900-present	Prehistoric campsite/Historic	NE	G	P
C100427 Stoney/Lane Tract I	Prehistoric/Weeden Island A.D. 450-1000	Prehistoric campsite	NE	G	P
C100444 Last Island	Prehistoric/Unspecified	Prehistoric campsite	NE	G	P
C100449 Stone Wall	Historic/American unspecified	Historic Farmstead	NE	F	ST
C100450 White Sand Hammock	Prehistoric/Unspecified	Prehistoric campsite	NE	F	ST
C100451 Willey Point	Prehistoric/Deptford, 700 B.C.- 300 B.C.	Prehistoric campsite	NE	F	ST
C100556 Houle #1	Prehistoric/Unspecified	Prehistoric campsite	NE	F	ST

**Crystal River Preserve State Park Cultural Resources**

<b>Table 8. Cultural Sites Listed in the Florida Master Site File</b>					
<b>FMSF # and Site Name</b>	<b>Culture/Period</b>	<b>Description</b>	<b>Significance</b>	<b>Condition</b>	<b>Treatment</b>
C100557 Ocala and Gulf Railroad	Historic/19th century American, 1821-1899	Historic railroad linear resource group	NE	P	ST
C100575 Bagley Cove	Prehistoric/Archaic, Deptford, Weeden Island; Historic/20th century American	Prehistoric habitation	NE	F	ST
C100576 Opposite the Rocks	Prehistoric/Unspecified	Prehistoric campsite	NE	F	ST
C100578 South Salt River I	Prehistoric/Deptford; Historic/20th century American, 1900-present	Prehistoric habitation/Historic	NE	F	ST
C100582 South Tiger Tail Bay I	Prehistoric/Deptford, 700 B.C. - 300 B.C.	Prehistoric shell midden	NE	F	P
C100585 Willey Point I	Prehistoric/Woodland	Prehistoric shell midden	NE	F	P
C100586 Willey Point II	Prehistoric/Woodland	Prehistoric/Spec. site for procurement of raw materials	NE	F	P
C100601 False Channel Island	Prehistoric/Deptford, 700 B.C. - 300 B.C.	Prehistoric shell midden/ Prehistoric habitation	NE	F	P
C100604 Hell Gate West III	Prehistoric/Unspecified	Prehistoric shell midden	NE	F	P
C100607 Lashley Point	Prehistoric/Deptford, 700 B.C. - 300 B.C.	Prehistoric campsite	NE	F	P
C100869 Little Homosassa River I	Prehistoric/Deptford, 700 B.C. - 300 B.C.	Prehistoric shell midden	NE	F	P

**Crystal River Preserve State Park Cultural Resources**

<b>Table 8. Cultural Sites Listed in the Florida Master Site File</b>					
<b>FMSF # and Site Name</b>	<b>Culture/Period</b>	<b>Description</b>	<b>Significance</b>	<b>Condition</b>	<b>Treatment</b>
C100870 Little Homosassa River II	Prehistoric/Unspecified	Prehistoric shell midden	NE	F	P
C100871 Little Homosassa River III	Prehistoric/Unspecified	Prehistoric shell midden	NE	F	P
C100872 Little Homosassa River IV	Prehistoric/Deptford, 700 B.C.- 300 B.C.	Prehistoric shell midden	NE	F	P
C100873 Little Homosassa River V	Prehistoric/Weeden Island, A.D. 450-1000	Prehistoric shell midden	NE	F	P
C100874 Little Homosassa River VB	Prehistoric/Unspecified	Prehistoric shell midden	NE	F	P
C100875 Little Homosassa River VI	Prehistoric/Unspecified	Prehistoric shell midden	NE	F	P
C100876 Little Homosassa River VII	Prehistoric/Unspecified	Prehistoric shell midden	NE	F	P
C100877 Little Homosassa River VIII	Prehistoric/Unspecified	Prehistoric shell midden	NE	F	P
C100878 Little Homosassa River IX	Prehistoric/Weeden Island, A.D. 450-1000	Prehistoric shell midden	NE	F	P
C100879 Little Homosassa River X	Prehistoric/Unspecified	Prehistoric shell midden	NE	F	P

**Crystal River Preserve State Park Cultural Resources**

**Table 8. Cultural Sites Listed in the Florida Master Site File**

<b>FMSF # and Site Name</b>	<b>Culture/Period</b>	<b>Description</b>	<b>Significance</b>	<b>Condition</b>	<b>Treatment</b>
C100880 Little Homosassa River XI	Prehistoric/Unspecified	Prehistoric shell midden	NE	F	P
C100881 Little Homosassa River XII	Prehistoric/Unspecified	Prehistoric shell midden	NE	F	P
C100882 Little Homosassa River XIII	Prehistoric/Unspecified	Prehistoric shell midden	NE	F	P
C100884 Little Homosassa River XV	Prehistoric/Deptford, 700 B.C.- 300 B.C.	Prehistoric shell midden	NE	F	P
C101059 Hollins Tract 1	Prehistoric/Unspecified	Prehistoric campsite	NE	F	ST
C101060 North Lashley 1	Prehistoric/Deptford, 700 B.C.- 300 B.C.	Prehistoric campsite	NE	P	ST
C101065 Game Creek 1	Prehistoric/Unspecified; Historic/20th century American, 1900-present	Prehistoric shell midden/Historic habitation	NE	P	ST
C101066 Mud Creek 1	Prehistoric/Deptford, 700 B.C.- 300 B.C.	Prehistoric campsite	NE	P	ST
C101068 Narrows	Prehistoric/Unspecified	Prehistoric campsite	NE	P	ST
C101069 Point One	Prehistoric/Unspecified	Prehistoric campsite	NE	P	ST
C101193 Camp Island	Prehistoric/Deptford, 700 B.C.- 300 B.C./Weeden Island 1	Prehistoric shell midden	NE	F	P
C101194 Keith's 2	Prehistoric/Archaic, 8500 B.C.- 1000 B.C.	Prehistoric campsite	NE	P	P
C101195 Wasted	Prehistoric/Unspecified	Prehistoric shell midden	NE	P	ST

**Crystal River Preserve State Park Cultural Resources**

**Table 8. Cultural Sites Listed in the Florida Master Site File**

<b>FMSF # and Site Name</b>	<b>Culture/Period</b>	<b>Description</b>	<b>Significance</b>	<b>Condition</b>	<b>Treatment</b>
CI01196 Washed Up	Prehistoric/Unspecified	Prehistoric shell midden	NE	P	ST
CI01197 Sickle Midden	Prehistoric/Unspecified; Historic/19th century American, 1821-1899	Prehistoric shell midden/Historic campsite	NE	G	P
CI01198 Ofunlv Midden	Prehistoric/Unspecified	Prehistoric shell midden	NE	F	P
CI01199 Etoh Midden	Prehistoric/Unspecified	Prehistoric campsite	NE	P	ST
CI01200 Hidden Midden	Prehistoric/Unspecified	Prehistoric midden(s)	NE	F	P
CI01201 Illifoki	Prehistoric/Deptford, 700 B.C.- 300 B.C./Weeden Island 1	Prehistoric shell midden/Prehistoric campsite	NE	P	ST
CI01202 Chiento Illifoki	Prehistoric/Deptford, 700 B.C.- 300 B.C.	Prehistoric campsite	NE	G	P
CI01204 Wash Island Shadow	Prehistoric/Deptford, 700 B.C.- 300 B.C.	Prehistoric campsite	NE	G	P
CI01205 Lakache	Prehistoric/Deptford, 700 B.C.- 300 B.C.	Prehistoric campsite	NE	G	P
CI01206 Land's End	Prehistoric/Deptford, 700 B.C.- 300 B.C.	Prehistoric campsite	NE	G	P
CI01207 Lost Cedar	Prehistoric/Deptford, 700 B.C.- 300 B.C.	Prehistoric campsite	NE	P	ST
CI01208 Gomez Midden	Prehistoric/Deptford, 700 B.C.- 300 B.C.	Prehistoric campsite	NE	P	ST
CI01209 Kings Creek Midden	Prehistoric/Unspecified	Prehistoric shell midden	NE	P	ST

**Crystal River Preserve State Park Cultural Resources**

<b>Table 8. Cultural Sites Listed in the Florida Master Site File</b>					
<b>FMSF # and Site Name</b>	<b>Culture/Period</b>	<b>Description</b>	<b>Significance</b>	<b>Condition</b>	<b>Treatment</b>
CI01210 Dying Palms Midden	Prehistoric/Deptford, 700 B.C.- 300 B.C./Weeden Island 1	Prehistoric campsite	NE	P	ST
CI01212 Deer Mouth	Prehistoric/Unspecified	Prehistoric campsite	NE	P	ST
CI01213 Deer Creek 1	Prehistoric/Unspecified	Prehistoric campsite	NE	P	ST
CI01214 Deer Creek 2	Prehistoric/Unspecified	Prehistoric campsite	NE	P	ST
CI01215 Pig's Last Stand	Prehistoric/Unspecified	Prehistoric shell midden	NE	P	ST
CI01216 Eagle Scout Hill	Prehistoric/Unspecified	Prehistoric campsite	NE	G	P
CI01217 Mother Osprey	Prehistoric/Deptford, 700 B.C.- 300 B.C./Transitional	Prehistoric shell midden/Prehistoric campsite	NE	F	P
CI01218 Deer Stand 3	Prehistoric/Unspecified	Prehistoric/Spec. site for procurement of raw materials	NE	F	P
CI01219 Deer Creek 4	Prehistoric/Unspecified	Prehistoric campsite	NE	G	P
CI01282 THLU'THLU	Prehistoric/Weeden Island 2	Prehistoric/Spec. site for procurement of raw materials	NE	G	P
CI01283 AMPA 1	Prehistoric/Weeden Island 1 and 2	Prehistoric/Spec. site for procurement of raw materials	NE	F	P
CI01284 AMPA 2	Prehistoric/Weeden Island 1 and 2	Prehistoric/Spec. site for procurement of raw materials	NE	F	P
CI01285 Iste'lane - 1	Historic/19th century American, 1821-1899	Historic building remains	NE	P	ST

**Crystal River Preserve State Park Cultural Resources**

**Table 8. Cultural Sites Listed in the Florida Master Site File**

<b>FMSF # and Site Name</b>	<b>Culture/Period</b>	<b>Description</b>	<b>Significance</b>	<b>Condition</b>	<b>Treatment</b>
CI01286 Ampa 3	Prehistoric/Weeden Island 1	Prehistoric midden/ habitation	NE	G	P
CI01287 AMPA 4	Prehistoric/Weeden Island 1	Prehistoric midden/ habitation	NE	G	P
CI01288 THLA 2	Prehistoric/Deptford, 700 B.C.- 300 B.C./Weeden Island 1	Prehistoric midden/ habitation	NE	P	ST
CI01289 THLA 3	Prehistoric/Deptford, 700 B.C.- 300 B.C./Weeden Island 1	Prehistoric midden/ habitation	NE	P	ST
CI01290 THLA 4	Prehistoric/Deptford, 700 B.C.- 300 B.C./Weeden Island 1	Prehistoric midden/ habitation	NE	P	ST
CI01291 THLA 5	Prehistoric/Weeden Island 1 and 2	Prehistoric midden/ habitation	NE	P	ST
CI01292 THLA 6	Prehistoric/Deptford, 700 B.C.- 300 B.C./Weeden Island 1	Prehistoric midden/ habitation	NE	P	ST
CI01294 Huti 2	Prehistoric/Deptford, 700 B.C.- 300 B.C./Weeden Island 1	Prehistoric midden/ habitation	NE	F	P
CI01295 Huti 3	Prehistoric/Weeden Island 1	Prehistoric midden/ habitation	NE	G	P
CI01296 Huti 4	Prehistoric/Deptford, 700 B.C.- 300 B.C./Weeden Island 1	Prehistoric midden/ habitation	NE	G	P
CI01298 Huti 6	Prehistoric/Weeden Island 1 and 2	Prehistoric midden/ habitation	NE	G	P
CI01299 Huti 7	Prehistoric/Weeden Island 1 and 2	Prehistoric midden/ habitation	NE	G	P
CI01300 Iste Lane 2	Historic/20th century American, 1900-present	Historic habitation/ cistern	NE	P	ST
CI01301 Thampko 7	Prehistoric/Deptford, 700 B.C.- 300 B.C./Weeden Island 1	Prehistoric midden/ habitation	NE	P	ST
CI01302 Thampko 8	Prehistoric/Archaic, 8500 B.C.- 1000 B.C./Deptford 700 B.C.- 300 B.C.	Prehistoric midden/ habitation	NE	P	ST
CI01303 Thampko 1	Prehistoric/Deptford, 700 B.C.- 300 B.C.	Prehistoric midden/ habitation	NE	G	P
CI01304 Thampko 2	Prehistoric/Deptford, 700 B.C.- 300 B.C.	Prehistoric midden/ habitation	NE	G	P

**Crystal River Preserve State Park Cultural Resources**

**Table 8. Cultural Sites Listed in the Florida Master Site File**

<b>FMSF # and Site Name</b>	<b>Culture/Period</b>	<b>Description</b>	<b>Significance</b>	<b>Condition</b>	<b>Treatment</b>
CI01305 Thampko 3	Prehistoric/Deptford, 700 B.C.- 300 B.C.	Prehistoric midden/ habitation	NE	G	P
CI01306 Thampko 4	Prehistoric/Deptford, 700 B.C.- 300 B.C.	Prehistoric midden/ habitation	NE	G	P
CI01307 Thampko 5	Prehistoric/Deptford, 700 B.C.- 300 B.C.	Prehistoric midden/ habitation	NE	G	P
CI01308 Thampko 6	Prehistoric/Archaic, 8500 B.C.- 1000 B.C./Deptford 700 B.C.- 300 B.C.	Prehistoric midden/ habitation	NE	G	P
CI01309 THLA 9	Prehistoric/Unspecified	Prehistoric midden/ habitation	NE	P	ST
CI01310 THLA 10	Prehistoric/Unspecified/Deptford, 700 B.C.-300 B.C.	Prehistoric midden/ habitation	NE	P	ST
CI01311 THLA 11	Prehistoric/Unspecified/Deptford, 700 B.C.-300 B.C.	Prehistoric midden/ habitation	NE	P	ST
CI01312 Chiento 1	Prehistoric/Archaic, 8500 B.C.- 1000 B.C./Deptford 700 B.C.- 300 B.C.	Prehistoric midden/ habitation	NE	G	P
CI01377 CR 490A Halls River Road	Historic/19th century American, 1821-1899	Historic road linear resource group	NE	P	ST
CI01457 Old Tallahassee Road	Historic/19th century American, 1821-1899	Historic road linear resource group	NE	P	ST

**Significance**

NRL National Register listed  
 NR National Register eligible  
 NE not evaluated  
 NS not significant

**Condition**

G Good  
 F Fair  
 P Poor  
 NA Not accessible  
 NE Not evaluated

**Recommended**

**Treatment**

RS Restoration  
 RH Rehabilitation  
 ST Stabilization  
 P Preservation  
 R Removal  
 N/A Not applicable

## **Management Procedures for Archaeological and Historical Sites and Properties on State-Owned or Controlled Properties (revised March 2013)**

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**These procedures apply to state agencies, local governments, and non-profits that manage state-owned properties.**

### **A. General Discussion**

Historic resources are both archaeological sites and historic structures. Per Chapter 267, Florida Statutes, *'Historic property' or 'historic resource' means any prehistoric district, site, building, object, or other real or personal property of historical, architectural, or archaeological value, and folklife resources. These properties or resources may include, but are not limited to, monuments, memorials, Indian habitations, ceremonial sites, abandoned settlements, sunken or abandoned ships, engineering works, treasure trove, artifacts, or other objects with intrinsic historical or archaeological value, or any part thereof, relating to the history, government, and culture of the state.'*

### **B. Agency Responsibilities**

Per State Policy relative to historic properties, state agencies of the executive branch must allow the Division of Historical Resources (Division) the opportunity to comment on any undertakings, whether these undertakings directly involve the state agency, i.e., land management responsibilities, or the state agency has indirect jurisdiction, i.e. permitting authority, grants, etc. No state funds should be expended on the undertaking until the Division has the opportunity to review and comment on the project, permit, grant, etc.

State agencies shall preserve the historic resources which are owned or controlled by the agency.

Regarding proposed demolition or substantial alterations of historic properties, consultation with the Division must occur, and alternatives to demolition must be considered.

State agencies must consult with Division to establish a program to location, inventory and evaluate all historic properties under ownership or controlled by the agency.

### **C. Statutory Authority**

Statutory Authority and more in-depth information can be found at: <http://www.flheritage.com/preservation/compliance/guidelines.cfm>

### **D. Management Implementation**

Even though the Division sits on the Acquisition and Restoration Council and approves land management plans, these plans are conceptual. Specific information regarding individual projects must be submitted to the Division for review and recommendations.

**Management Procedures for Archaeological and Historical Sites and Properties on State-Owned or Controlled Properties (revised March 2013)**

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Managers of state lands must coordinate any land clearing or ground disturbing activities with the Division to allow for review and comment on the proposed project. Recommendations may include, but are not limited to: approval of the project as submitted, cultural resource assessment survey by a qualified professional archaeologist, modifications to the proposed project to avoid or mitigate potential adverse effects.

Projects such as additions, exterior alteration, or related new construction regarding historic structures must also be submitted to the Division of Historical Resources for review and comment by the Division's architects. Projects involving structures fifty years of age or older, must be submitted to this agency for a significance determination. In rare cases, structures under fifty years of age may be deemed historically significant. These must be evaluated on a case by case basis.

Adverse impacts to significant sites, either archaeological sites or historic buildings, must be avoided. Furthermore, managers of state property should make preparations for locating and evaluating historic resources, both archaeological sites and historic structures.

**E. Minimum Review Documentation Requirements**

In order to have a proposed project reviewed by the Division, certain information must be submitted for comments and recommendations. The minimum review documentation requirements can be found at:

[http://www.flheritage.com/preservation/compliance/docs/minimum\\_review\\_documentation\\_requirements.pdf](http://www.flheritage.com/preservation/compliance/docs/minimum_review_documentation_requirements.pdf) .

\* \* \*

Questions relating to the treatment of archaeological and historic resources on state lands should be directed to:

Deena S. Woodward  
Division of Historical Resources  
Bureau of Historic Preservation  
Compliance and Review Section  
R. A. Gray Building  
500 South Bronough Street  
Tallahassee, FL 32399-0250

Phone: (850) 245-6425  
Toll Free: (800) 847-7278  
Fax: (850) 245-6435

## Eligibility Criteria for National Register of Historic Places

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The criteria to be used for evaluating eligibility for listing in the National Register of Historic Places are as follows:

- 1) Districts, sites, buildings, structures, and objects may be considered to have significance in American history, architecture, archaeology, engineering, and/or culture if they possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:
  - a) are associated with events that have made a significant contribution to the broad patterns of our history; and/or
  - b) are associated with the lives of persons significant in our past; and/or
  - c) embody the distinctive characteristics of type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; and/or
  - d) have yielded, or may be likely to yield, information important in prehistory or history.
  
- 2) Ordinarily cemeteries, birthplaces, or graves of historical figures; properties owned by religious institutions or used for religious purposes; structures that have been moved from their original locations; reconstructed historic buildings; properties primarily commemorative in nature; and properties that have achieved significance within the past 50 years shall not be considered eligible for the *National Register*. However, such properties will qualify if they are integral parts of districts that do meet the criteria or if they fall within the following categories:
  - a) a religious property deriving its primary significance from architectural or artistic distinction or historical importance; or
  - b) a building or structure removed from its original location but which is significant primarily for architectural value, or which is the surviving structure most importantly associated with a historic person or event; or
  - c) a birthplace or grave of an historical figure of outstanding importance if there is no appropriate site or building directly associated with his productive life; or
  - d) a cemetery which derives its primary significance from graves of persons of transcendent importance, from age, distinctive design features, or association with historic events; or a reconstructed building, when it is accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and no other building or structure with the same association has survived; or a property primarily commemorative in intent, if design, age, tradition, or symbolic value has invested it with its own exceptional significance; or
  - e) a property achieving significance within the past 50 years, if it is of exceptional importance.

## Preservation Treatments as Defined by Secretary of Interior's Standards and Guidelines

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**Restoration** is defined as the act or process of accurately depicting the form, features, and character of a property as it appeared at a particular period of time by means of the removal of features from other periods in its history and reconstruction of missing features from the restoration period. The limited and sensitive upgrading of mechanical, electrical and plumbing systems and other code-required work to make properties functional is appropriate within a restoration project.

**Rehabilitation** is defined as the act or process of making possible a compatible use for a property through repair, alterations and additions while preserving those portions or features that convey its historical, cultural or architectural values.

**Stabilization** is defined as the act or process of applying measures designed to reestablish a weather resistant enclosure and the structural stability of an unsafe or deteriorated property while maintaining the essential form as it exists at present.

**Preservation** is defined as the act or process of applying measures necessary to sustain the existing form, integrity and materials of an historic property. Work, including preliminary measures to protect and stabilize the property, generally focuses upon the ongoing maintenance and repair of historic materials and features rather than extensive replacement and new construction. New exterior additions are not within the scope of this treatment; however, the limited and sensitive upgrading of mechanical, electrical and plumbing systems and other code-required work to make properties functional is appropriate within a preservation project.



## **Addendum 8—Timber Management Analysis**



# **Crystal River Preserve State Park Timber Management Analysis**

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## **1. Management Context and Best Management Practices**

Timber management prescriptions and actions at CRPSP are based on the desired future condition (DFC) of a stand or natural community as determined by guidelines determined by the DRP. In most cases, the DFC will be closely related to the historic natural community. However, where the historic community has been severely altered by past land use practices, the DFC may not always be the same as the historic natural community. All forest/stand/timber management activities undertaken will adhere to the current Florida Silvicultural Best Management Practices and Florida Forestry Wildlife Best Management Practices for State Imperiled Species. DRP is responsible for managing timber resources within corresponding management zones. This timber assessment was conducted by F4 Tech on behalf of DRP.

## **2. Purpose of Timber Management Activities**

Timber management activities will be conducted to help restore and/or improve current conditions so that the associated DFC (typically an historic condition) can be achieved or maintained. Timber management will primarily be conducted in pine-dominated natural communities. Upland communities typically include mesic flatwoods, sandhill, upland pine, upland mixed woodland, and altered landcover areas such as successional hardwood forest and pine plantations. Other historically hardwood-dominated natural communities will likely have little to no scheduled timber management activities. In some circumstances, actions may be conducted to remove over-story invasive/exotic trees, e.g. melaleuca, Chinese tallow, Brazilian pepper, occupying contiguous areas of land to help restore or maintain natural communities.

## **3. Potential Silvicultural Treatments**

Several silvicultural treatments may be considered and utilized over the next ten years to achieve the long-term DFC for candidate natural communities at the CRPSP. These treatments include timber harvests, timber stand improvement, and reforestation. The various types of timber harvests may include pine thinning, targeted hardwood removal, and clearcutting. Silvicultural treatments should be implemented to minimize disturbance to non-target vegetation, soil, and wildlife.

Thinning is conducted to reduce the basal area (BA) or density of stems in a stand to improve forest health and growth conditions for residual trees. The "opening up" of high density forest stands increases tree and stand vigor, which helps mitigate the potential for damaging insect outbreaks. Thinning also increases sunlight reaching the forest floor, which when combined with routine prescribed fire, can increase groundcover vegetation abundance, species richness, and overall ecological diversity. The disruption of a historic natural fire regime and/or fire return interval can often result in the need to remove undesirable or overstocked hardwood stems that currently occupy growing space in the canopy and sub-canopy. Tree removal/harvest also increases groundcover vegetation, ecological diversity, and fine fuels that facilitate consistent fire return intervals and responses.

## **Crystal River Preserve State Park Timber Management Analysis**

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Clearcutting supports restoration goals by removing offsite pine or hardwood species and is a precursor to establishing site-appropriate species. It is also used to control insect infestations that are damaging or threatening forest resources and ecosystem conditions on or off site.

A tangible by-product of conducting timber harvests for restoring or improving forested communities is the generation of revenue.

Stand or natural community improvement activities are often conducted to reduce unwanted hardwood, palm or palmetto competition. Stand improvement treatments reduce fuel or fuel height, which can improve groundcover conditions and aid in maintaining proper prescribed burning return intervals. The two main stand improvement activities used on park property are herbicide treatments and mechanically cutting vegetation. Herbicide may be applied aerially, by mechanized ground-based equipment, or via backpack sprayers. Herbicides are used to reduce the amount of hardwood competition in areas that are unable to carry sufficient prescribed fire due to shading and lack of adequate groundcover fuels. Mechanical cutting is used to reduce the height of smaller shrub and hardwood competition, allowing for the establishment of fire-dependent herbs and grasses. Decreasing fuel loadings and enhancing groundcover allows prescribed fire to be reintroduced safely into a stand that has been unable to carry fire adequately. In selected areas, mechanical or chemical control is also used to control excessive palm density promoted by past disturbance or fire exclusion to the same ends described above. Unlike hardwoods, these areas can burn with too much intensity under certain conditions.

Reforestation is used to establish the appropriate southern pine species in areas that have been harvested and lack sufficient natural regeneration in terms of abundance (seedlings/acre) and/or species composition. Reforestation candidate areas can also include those that are fire suppressed or have been recently impacted by natural events such as windthrow, bark beetle attack, or wildfire. The two methods used to reestablish the over-story will be natural and artificial regeneration. Both methods may require site preparation to facilitate survival of the desired species. Site preparation activities may include the use of prescribed fire, herbicides, and/or mechanical treatments such as roller chopping. Site preparation technique(s) will be selected that address the current vegetative cover type and condition, and the need to minimize seedling competition while avoiding/minimizing any long-term impacts to native groundcover species and native wildlife. Natural generation may be used in areas where artificial regeneration is not needed, such as areas that have an adequate seed source of the desired tree species located on site or in the immediate vicinity. Artificial regeneration may include machine or hand planting. Hand planting is preferred on wetter sites, rougher sites, and/or sites where groundcover protection is a concern and a more natural appearance of randomly spaced trees is desired. Machine planting generally allows for more consistent planting and often allows higher survival rates if the site is properly prepared.

## Crystal River Preserve State Park Timber Management Analysis

### 4. Inventory Data and Potential Actions per Area of Interest or Management Zone

CRPSP comprises 27,417 acres in Citrus County. A total of 2,234 acres are associated with several upland natural communities that are potential candidates for timber management. For this region, upland natural communities include mesic flatwoods, mesic hammock, sandhill, scrub, scrubby flatwoods, upland mixed woodland, and wet flatwoods. In April, May, and June of 2016, a plot-based forest/vegetation inventory was conducted across and within these areas to quantify over-story, mid-story and understory conditions. A review and analysis of this data suggests that current ecological conditions for multiple management zones and associated forested communities could benefit from vegetation treatments. This assessment was based on a comparison of current conditions and the corresponding natural community analog or target conditions as defined per FNAI Reference Site descriptions. In general, inventory data indicates that upland habitats in several management zones have an average pine BA that is outside the acceptable range for the DFC of the natural community types. Some natural communities considered may need mid-story and over-story control to become, or remain, in compliance with FNAI defined ranges for palmetto and non-pine mid-story. Stands with low stocking levels or a complete lack of preferred tree species would likely benefit from mid-story control and artificial regeneration. In areas where planting is deemed necessary, the site should be assessed for site preparation needs including mid-story/understory reduction.

The following contains a general description of each management zone within the CRPSP that contains upland natural communities as well as their general condition and need for restoration and/or improvement actions via timber management.

<b>General Summary Statistics for CRPSP</b>	
Number of Management Zones within the Park	95
Number of Management Zones needing timber management	41
Number of unique upland Natural Communities (split by management zone)	122
Number of unique upland Natural Communities potentially needing timber management	122
Upland Natural Community acres	2,234
Acres potentially needing timber management	2,234

## Crystal River Preserve State Park Timber Management Analysis

### Mesic Flatwoods (1,425 acres)

Dominant pine in mesic flatwoods in the region usually is longleaf pine (*Pinus palustris*) with occasional stands of South Florida slash (*P. elliotii* var. *densa*) in coastal situations adjacent to tidal marsh. Native herbaceous groundcover will cover at least 50% of the area at a height of less than three feet. Saw palmetto (*Serenoa repens*) will comprise less than 50% of the total shrub cover, also at a height of less than three feet. Other common shrub species may include gallberry (*Ilex glabra*), winged sumac (*Rhus copallinum*), fetterbush (*Lyonia lucida*), wax myrtle (*Myrica cerifera*), yaupon holly (*Ilex vomitoria*), running oak (*Quercus pumila*), pawpaw (*Asimina* spp.), dwarf live oak (*Q. minima*), shiny blueberry (*Vaccinium myrsinites*), and coontie (*Zamia pumila*). The optimal fire return interval for this community is two to three years. The preferred pine species, as determined by FNAI reference sites, is longleaf pine and should be stocked at a level of 10 to 50 square feet per acre BA while non-pine species should remain between 0 and 26.2 stems per acre. The following management zone(s) contain mesic flatwoods which could be considered for some form of timber management including over-story removal, mid-story mitigation, site preparation, and planting of preferred pine species.

Mesic Flatwoods					
Management Zone(s)	Mesic Flatwoods (Acres)	Basal Area (ft <sup>2</sup> /acre)	Basal Area Preferred Species	Basal Area Non-Preferred Species	Average Diameter at breast height (inches)
CR-C03	19	22	0	22	4.9
CR-C03A	22	135	0	135	7.8
CR-C03B	8	103	0	103	6.2
CR-C03D	6	104	15	89	7.1
CR-C03F	2	56	0	56	9.5
CR-C03J	10	36	0	36	7.9
CR-C05A	29	37	5	32	8.1
CR-C05B	29	4	0	4	2
CR-C05D	25	77	0	77	6
CR-C05F	75	12	0	12	5.7
CR-C05G	4	44	0	44	7.4
CR-C07A	17	70	3	67	8.7
CR-C07F	6	69	5	64	4.8
CR-C07H	13	75	0	75	5.1
CR-H02	17	161	80	81	9.2
CR-H04A	6	201	0	201	10.1
CR-H05A	8	159	30	129	10.9
CR-H06A	42	166	48	118	9.4

## Crystal River Preserve State Park Timber Management Analysis

Mesic Flatwoods					
Management Zone(s)	Mesic Flatwoods (Acres)	Basal Area (ft <sup>2</sup> /acre)	Basal Area Preferred Species	Basal Area Non-Preferred Species	Average Diameter at breast height (inches)
CR-H15	64	69	21	48	9.5
CR-H16	76	102	38	64	8.7
CR-H17	34	78	35	43	8.8
CR-H19	3	107	0	107	9
CR-H20	36	143	65	78	12.2
CR-H21	48	94	19	75	8.5
CR-H22	30	28	10	18	3.3
CR-H23	36	76	26	50	7.3
CR-H24	63	102	36	66	9.2
CR-H25	8	91	36	55	12.1
CR-H26	5	103	36	67	9.2
CR-H27	65	81	31	50	6.9
CR-H28	21	104	40	64	13.5
CR-H29	42	106	31	75	6.2
CR-H30	14	165	60	105	10
CR-H32	34	134	31	103	8.9
CR-H33	38	86	25	61	10.1
CR-H33E	10	153	70	83	9.1
CR-H34	18	103	27	76	9.9
CR-H64	2	186	80	106	4.8
CR-H66	52	112	35	77	7
CR-H67	41	99	38	61	8.7
CR-H70A	15	101	43	58	8.4
CR-H71A	85	100	4	96	14.8
CR-H71B	71	102	34	68	9.8
CR-H72	37	35	15	20	6.3
CR-H73	4	49	20	29	2.8
CR-H75	20	60	26	34	6.8
CR-S03*	26	--	--	--	--
CR-S04*	23	--	--	--	--
CR-H01*	1	--	--	--	--
CR-C05K*	26	--	--	--	--
CR-H70B*	12	--	--	--	--
CR-C01D*	0	--	--	--	--
CR-C01C*	2	--	--	--	--

\*Unsampled upland areas are present and could require vegetation management in the future.

## Crystal River Preserve State Park Timber Management Analysis

### Mesic Hammock (128 acres)

Mesic hammocks are characterized by a well-developed evergreen hardwood and/or palm forest which can occur through much of peninsular Florida. The canopy, often dense, will typically be dominated by live oak (*Q. virginiana*) with cabbage palm (*Sabal palmetto*) mixed into the understory. Southern magnolia (*Magnolia grandiflora*) and pignut hickory (*Carya glabra*) can be common components in the sub-canopy. Pine trees, particularly slash pine or loblolly pine (*P. taeda*), may form a sparse emergent layer. Mesic hammocks can arise in naturally pine-dominated areas when shielded from fire because of human activities and timber management activities can support restoration goals. There is currently no FNAI recommendations on preferred species or stocking levels for this natural community but in areas where restoration is considered, slash pine and loblolly pine will be considered the preferred species. The following management zone(s) contain mesic hammock which could be considered for some form of timber management including over-story removal, mid-story mitigation, site preparation, and planting of preferred pine species.

Mesic Hammock					
Management Zone(s)	Mesic Hammock (Acres)	Basal Area (ft <sup>2</sup> /acre)	Basal Area Preferred Species	Basal Area Non-Preferred Species	Average Diameter at breast height (inches)
CR-H71A	8	142	--	--	11.1
CR-H67	10	114	--	--	14.2
CR-H21	3	73	--	--	13.4
CR-C07A*	3	--	--	--	--
CR-H04B*	2	--	--	--	--
CR-H17*	1	--	--	--	--
CR-H19*	1	--	--	--	--
CR-H20*	4	--	--	--	--
CR-H23*	1	--	--	--	--
CR-H29*	0	--	--	--	--
CR-H70B*	21	--	--	--	--
CR-H73*	1	--	--	--	--
CR-S03*	34	--	--	--	--

### Sandhill (62 acres)

The dominant pine tree in sandhill in the region is longleaf pine. Herbaceous cover, dominated by wiregrass (*Aristida stricta*), should be 80% or greater and reach a height of less than three feet. Sandhill communities in the region will contain

## **Crystal River Preserve State Park Timber Management Analysis**

scattered individual trees, clumps, or ridges of onsite oak species such as turkey oak (*Q. laevis*), sand post oak (*Q. margaretta*), and bluejack oak (*Q. incana*). In old growth conditions, sand post oaks will commonly be 150-200 years old, and some turkey oaks will be over 100 years old. The optimal fire return interval for this community is two to three years. In this region, the preferred species, as determined by FNAI reference sites, is longleaf pine and should be stocked at a level of 20 to 60 square feet per acre BA while non-pine species should remain between 0 and 78.8 stems per acre. The following management zone(s) contain sandhill which could be considered for some form of timber management including mid-story mitigation, site preparation, and planting of preferred pine species.

<b>Sandhill</b>					
<b>Management Zone(s)</b>	<b>Sandhill (Acres)</b>	<b>Basal Area (ft<sup>2</sup>/acre)</b>	<b>Basal Area Preferred Species</b>	<b>Basal Area Non-Preferred Species</b>	<b>Average Diameter at breast height (inches)</b>
CR-C07C	11	76	3	73	6.9
CR-C07F	14	118	30	88	6
CR-C07H	21	69	30	39	6.3
CR-H20	8	54	20	34	11.6
CR-C07D*	2	--	--	--	--
CR-C07E*	1	--	--	--	--
CR-C07G*	0	--	--	--	--
CR-H21*	0	--	--	--	--
CR-H24*	0	--	--	--	--
CR-H25*	0	--	--	--	--
CR-S03*	0	--	--	--	--

### **Scrub (169 acres)**

Dominant plant species in scrub include rusty staggerbush (*Lyonia ferruginea*), sand live oak, myrtle oak (*Q. myrtifolia*), Chapman's oak (*Q. chapmanii*), fetterbush (*Lyonia lucida*), shiny blueberry (*Vaccinium myrsinites*), and saw palmetto. In this region, preferred or likely pine species, as determined by FNAI reference sites, are longleaf (*Pinus palustris*) and slash (*P. elliottii*) and should be stocked at a level of 0 to 20 square feet per acre BA while non-pine species should remain between 0 and 13.1 stems per acre. The following management zone(s) contain scrub which could be considered for some form of timber management including over-story removal, mid-story mitigation, site preparation, and planting of preferred pine species.

## Crystal River Preserve State Park Timber Management Analysis

Scrub					
Management Zone(s)	Scrub (Acres)	Basal Area (ft <sup>2</sup> /acre)	Basal Area Preferred Species	Basal Area Non-Preferred Species	Average Diameter at breast height (inches)
CR-C07C	18	28	0	28	1.5
CR-S03*	70	--	--	--	--
CR-S04*	79	--	--	--	--

### Scrubby Flatwoods (419 acres)

The dominant tree in the scrubby flatwoods of north Florida will usually be longleaf pine. Mature sand pines (*P. clausa*) will typically be absent. A diverse shrub understory will be characteristic, with up to 25 percent bare sand coverage. Dominant shrubs include sand live oak, myrtle oak, Chapman's oak, saw palmetto, rusty staggerbush, and tarflower. The optimal fire return interval for this community is regionally variable, but coastal scrub has shown an ability to reach fuel height and fire carrying potential faster than interior examples. Areas may be burned as frequently as every three to eight years when burn prescriptions are designed to achieve a mosaic of burned and unburned areas. In this region, the preferred species, as determined by FNAI reference sites, is longleaf pine and should be stocked at a level of 10 to 60 square feet per acre BA while non-pine species should remain between 0 and 26.2 stems per acre. The following management zone(s) contain mesic flatwoods which could be considered for some form of timber management including over-story removal, mid-story mitigation, site preparation, and planting of preferred pine species.

Scrubby Flatwoods					
Management Zones	Scrubby Flatwoods (Acres)	Basal Area (ft <sup>2</sup> /acre)	Basal Area Preferred Species	Basal Area Non-Preferred Species	Average Diameter at breast height (inches)
CR-C03	13	91	0	91	4.8
CR-C03A	36	72	0	72	6
CR-C03B	13	43	1	42	4.5
CR-C03C	15	89	0	89	5.3
CR-C03D	7	25	0	25	1.4
CR-C05A	26	34	0	34	6.9
CR-C05B	18	6	0	6	1.6
CR-C05C	34	116	3	113	5.2
CR-C05D	19	83	6	77	5.4

## Crystal River Preserve State Park Timber Management Analysis

Scrubby Flatwoods					
Management Zones	Scrubby Flatwoods (Acres)	Basal Area (ft <sup>2</sup> /acre)	Basal Area Preferred Species	Basal Area Non-Preferred Species	Average Diameter at breast height (inches)
CR-C05G	13	26	0	26	3.1
CR-C07A	20	49	0	49	5.8
CR-C07B	16	57	0	57	4.6
CR-C07F	9	79	36	43	6.1
CR-C07G	9	108	40	68	5.6
CR-C07H	3	113	40	73	5.5
CR-H04A	20	80	2	78	8.9
CR-S03	17	88	15	73	6.8
CR-C07D*	4	--	--	--	--
CR-S04*	41	--	--	--	--
CR-H01*	3	--	--	--	--
CR-C07E*	6	--	--	--	--
CR-C07C*	4	--	--	--	--
CR-C05K*	1	--	--	--	--
CR-H72*	0	--	--	--	--
CR-H25*	1	--	--	--	--
CR-C05E*	20	--	--	--	--
CR-WI2*	1	--	--	--	--
CR-C05F*	33	--	--	--	--
CR-C03J*	3	--	--	--	--

### Wet Flatwoods (243 acres)

Within wet flatwoods the dominant pines species will usually be longleaf pine, slash pine, pond pine (*P. serotina*), and/or loblolly pine. The species composition within a location will be determined by drainage and periods of higher moisture content. Pond cypress (*Taxodium ascendens*) may reach canopy in some locations. The canopy will be open, with pines being widely scattered and of variable age classes. In this region, the preferred species, as determined by FNAI reference sites, is slash pine and should be stocked at a level of 10 to 50 square feet per acre BA while non-pine species should remain at 0 stems per acre. The following management zone(s) contain Wet Flatwoods which could be considered for some form of timber management including over-story removal, mid-story mitigation, site preparation, and planting of preferred pine species.

## Crystal River Preserve State Park Timber Management Analysis

Wet Flatwoods					
Management Zones	Wet Flatwoods (Acres)	Basal Area (ft <sup>2</sup> /acre)	Basal Area Preferred Species	Basal Area Non-Preferred Species	Average Diameter at breast height (inches)
CR-C03	15	156	30	126	5.7
CR-C03A	1	149	40	109	6.7
CR-H01	24	88	0	88	9.8
CR-H02	35	54	0	54	10.3
CR-H35	12	114	30	84	6.9
CR-H73	43	43	0	43	7.3
CR-H75	6	126	60	66	9.5
CR-S03*	2	--	--	--	--
CR-C07G*	61	--	--	--	--
CR-H72*	33	--	--	--	--
CR-C05H*	1	--	--	--	--
CR-H66*	2	--	--	--	--

## Crystal River Preserve State Park Timber Management Analysis

Summary of Potential Timber Management Actions for Upland Natural Community (NatCom) Types											
Management Zones (MZ)	MZ (acres)	Candidate NatComs	Candidate NatComs (acres)	Current Average Over-Story Pine BA (ft <sup>2</sup> /AC)	Target Over-Story Pine BA (ft <sup>2</sup> /AC)	Current Non-Pine Over-Story TPA	Target Non-Pine Over-Story TPA	Potential Actions/Treatments			
								Harvest or Thin	Stand Improvement*	Site Prep	Plant
CR-C03	366	Scrubby Flatwoods	13	40	10 - 60	371	0 - 26	Y	Y	Y	N
CR-C03	366	Wet Flatwoods	15	40	10 - 50	371	0 - 0	Y	Y	Y	N
CR-C03A	81	Scrubby Flatwoods	36	30	10 - 60	483	0 - 26	Y	Y	Y	N
CR-C03A	81	Wet Flatwoods	1	30	10 - 50	483	0 - 0	Y	Y	Y	N
CR-C03B	47	Scrubby Flatwoods	13	84	10 - 60	900	0 - 26	Y	Y	Y	N
CR-C03C	34	Scrubby Flatwoods	15	65	10 - 60	646	0 - 26	Y	Y	Y	N
CR-C03D	39	Scrubby Flatwoods	7	10	10 - 60	1378	0 - 26	Y	Y	Y	Y
CR-C05A	96	Scrubby Flatwoods	26	28	10 - 60	1499	0 - 26	Y	Y	Y	N
CR-C05B	253	Scrubby Flatwoods	18	3	10 - 60	300	0 - 26	Y	Y	Y	Y
CR-C05C	44	Scrubby Flatwoods	34	13	10 - 60	1153	0 - 26	Y	Y	Y	N
CR-C05D	276	Scrubby Flatwoods	19	33	10 - 60	1090	0 - 26	Y	Y	Y	N
CR-C05F	1342	Scrubby Flatwoods	33	1	10 - 60	100	0 - 26	Y	Y	Y	Y
CR-C05G	53	Scrubby Flatwoods	13	40	10 - 60	600	0 - 26	Y	Y	Y	N
CR-C07A	77	Mesic Hammock	3	4	-	744	-	N	N	Y	N
CR-C07A	77	Scrubby Flatwoods	20	4	10 - 60	744	0 - 26	Y	Y	Y	Y
CR-C07C	46	Sandhill	11	3	20 - 60	607	0 - 79	Y	Y	Y	Y
CR-C07C	46	Scrub	18	3	0 - 20	607	0 - 13	Y	Y	Y	N

## Crystal River Preserve State Park Timber Management Analysis

Summary of Potential Timber Management Actions for Upland Natural Community (NatCom) Types											
Management Zones (MZ)	MZ (acres)	Candidate NatComs	Candidate NatComs (acres)	Current Average Over-Story Pine BA (ft <sup>2</sup> /AC)	Target Over-Story Pine BA (ft <sup>2</sup> /AC)	Current Non-Pine Over-Story TPA	Target Non-Pine Over-Story TPA	Potential Actions/Treatments			
								Harvest or Thin	Stand Improvement*	Site Prep	Plant
CR-C07F	95	Sandhill	14	10	20 - 60	413	0 - 79	Y	Y	Y	Y
CR-C07F	95	Scrubby Flatwoods	9	10	10 - 60	413	0 - 26	Y	Y	Y	Y
CR-C07G	406	Scrubby Flatwoods	9	40	10 - 60	1032	0 - 26	Y	Y	Y	N
CR-C07G	406	Wet Flatwoods	61	40	10 - 50	1032	0 - 0	Y	Y	Y	N
CR-C07H	53	Sandhill	21	40	20 - 60	514	0 - 79	Y	Y	Y	N
CR-C07H	53	Scrubby Flatwoods	3	40	10 - 60	514	0 - 26	Y	Y	Y	N
CR-H01	151	Wet Flatwoods	24	5	10 - 50	358	0 - 0	Y	Y	Y	Y
CR-H02	137	Wet Flatwoods	35	10	10 - 50	300	0 - 0	Y	Y	Y	Y
CR-H04A	114	Scrubby Flatwoods	20	4	10 - 60	329	0 - 26	Y	Y	Y	Y
CR-H20	69	Sandhill	8	30	20 - 60	105	0 - 79	Y	Y	Y	N
CR-H21	70	Mesic Hammock	3	20	-	607	-	N	N	Y	N
CR-H35	25	Wet Flatwoods	12	40	10 - 50	1,247	0 - 0	Y	Y	Y	N
CR-H67	57	Mesic Hammock	10	40	-	367	-	N	N	Y	N
CR-H71A	136	Mesic Hammock	8	10	-	663	-	N	N	Y	N
CR-H72	818	Wet Flatwoods	33	15	10 - 50	312	0 - 0	Y	Y	Y	N
CR-H73	827	Wet Flatwoods	43	20	10 - 50	880	0 - 0	Y	Y	Y	N
CR-H75	276	Wet Flatwoods	6	60	10 - 50	300	0 - 0	Y	Y	Y	N

## Crystal River Preserve State Park Timber Management Analysis

Summary of Potential Timber Management Actions for Upland Natural Community (NatCom) Types											
Management Zones (MZ)	MZ (acres)	Candidate NatComs	Candidate NatComs (acres)	Current Average Over-Story Pine BA (ft <sup>2</sup> /AC)	Target Over-Story Pine BA (ft <sup>2</sup> /AC)	Current Non-Pine Over-Story TPA	Target Non-Pine Over-Story TPA	Potential Actions/Treatments			
								Harvest or Thin	Stand Improvement*	Site Prep	Plant
CR-S03	4989	Mesic Hammock	34	15	-	1,314	-	N	N	Y	N
CR-S03	4989	Scrub	70	15	0 - 20	1,314	0 - 13	Y	Y	Y	N
CR-S03	4989	Scrubby Flatwoods	17	15	10 - 60	1,314	0 - 26	Y	Y	Y	N
CR-S03	4989	Wet Flatwoods	2	15	10 - 50	1,314	0 - 0	Y	Y	Y	N
CR-C03J**	390	Scrubby Flatwoods	3	--	-	--	-	N	N	Y	N
CR-H29**	98	Mesic Hammock	0	--	-	--	-	N	N	Y	N
CR-C05E**	31	Scrubby Flatwoods	20	--	10 - 60	--	0 - 26	N	N	Y	N
CR-H20**	69	Mesic Hammock	4	--	-	--	-	N	N	Y	N
CR-H21**	70	Sandhill	0	--	-	--	-	N	N	Y	N
CR-H23**	66	Mesic Hammock	1	--	-	--	-	N	N	Y	N
CR-W12**	710	Scrubby Flatwoods	1	--	10 - 60	--	0 - 26	N	N	Y	N
CR-S04**	1025	Scrub	79	--	0 - 20	--	0 - 13	N	N	Y	N
CR-C07D**	19	Sandhill	2	--	-	--	-	N	N	Y	N
CR-C07G**	406	Sandhill	0	--	-	--	-	N	N	Y	N
CR-C07E**	25	Scrubby Flatwoods	6	--	-	--	-	N	N	Y	N
CR-H72**	818	Scrubby Flatwoods	0	--	-	--	-	N	N	Y	N
CR-S04**	1025	Scrubby Flatwoods	41	--	10 - 60	--	0 - 26	N	N	Y	N
CR-C07C**	46	Scrubby Flatwoods	4	--	-	--	-	N	N	Y	N
CR-H24**	78	Sandhill	0	--	-	--	-	N	N	Y	N

## Crystal River Preserve State Park Timber Management Analysis

Summary of Potential Timber Management Actions for Upland Natural Community (NatCom) Types											
Management Zones (MZ)	MZ (acres)	Candidate NatComs	Candidate NatComs (acres)	Current Average Over-Story Pine BA (ft <sup>2</sup> /AC)	Target Over-Story Pine BA (ft <sup>2</sup> /AC)	Current Non-Pine Over-Story TPA	Target Non-Pine Over-Story TPA	Potential Actions/Treatments			
								Harvest or Thin	Stand Improvement*	Site Prep	Plant
CR-H70B**	34	Mesic Hammock	21	--	-	--	-	N	N	Y	N
CR-H01**	151	Scrubby Flatwoods	3	--	-	--	-	N	N	Y	N
CR-H04B**	171	Mesic Hammock	2	--	-	--	-	N	N	Y	N
CR-C07D**	19	Scrubby Flatwoods	4	--	-	--	-	N	N	Y	N
CR-S03**	4989	Sandhill	0	--	-	--	-	N	N	Y	N
CR-C07E**	25	Sandhill	1	--	-	--	-	N	N	Y	N
CR-H25**	23	Sandhill	0	--	-	--	-	N	N	Y	N
CR-C07B**	25	Scrubby Flatwoods	16	--	10 - 60	1,155	0 - 26	Y	Y	Y	N
CR-H19**	16	Mesic Hammock	1	--	-	--	-	N	N	Y	N
CR-H17**	38	Mesic Hammock	1	--	-	--	-	N	N	Y	N
CR-C05H**	340	Wet Flatwoods	1	--	-	--	-	N	N	Y	N
CR-C05K**	279	Scrubby Flatwoods	1	--	-	--	-	N	N	Y	N
CR-H66**	102	Wet Flatwoods	2	--	-	--	-	N	N	Y	N
CR-H25**	23	Scrubby Flatwoods	1	--	-	--	-	N	N	Y	N
CR-H73**	827	Mesic Hammock	1	--	-	--	-	N	N	Y	N

\*Stand improvement, per Section 3 above, includes palmetto/mid-story reduction. While inventory data was not used to estimate this metric, remotely sensed images and on-site observations have indicated that the selected areas could benefit from such treatments.

\*\*Unsampled upland areas are present in this analysis and could require vegetation management in the future.

## **Addendum 9—Land Management Review**



# Crystal River Preserve State Park Land Management Review

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Memorandum

## Florida Department of Environmental Protection

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July 20, 2012

TO: Marianne Gengenbach, Program Administrator  
Division of State Lands

FROM: Parks Small, Chief, Bureau of Natural and Cultural Resources  
Division of Recreation and Parks

Albert Gregory, Chief, Office of Park Planning  
Division of Recreation and Parks

SUBJECT: Response to Draft Land Management Review (LMR)  
Crystal River Preserve State Park

The Land Management Review draft report provided to DRP determined that management of Crystal River Preserve State Park by the Division of Recreation and Parks met the two tests prescribed by law. Namely, the review team concluded that the land is being managed for the purposes for which it was acquired and in accordance with the land management plan.

Below are Additional Recommendations and Checklist Findings (items the LMR determined should be further addressed in the management plan update) of the draft LMR report, with our manager's response to each. The responses were prepared via a coordinated effort of the park, district office, and our offices.

**The team recommends that DRP pursue all opportunities for increasing field positions at this park to augment a dedicated but greatly depleted staff. (VOTE: 5+, 0-)**

*Managing Agency Response: Agree; If it is determined that additional staff are needed at the time of the next unit management plan revision, it will be included in the plan. However, no new staff can be assigned to this or any other park unit unless they are appropriated by the Legislature or reassigned from other units. Funding is determined annually by the Florida Legislature.*

**The team recommends that the DRP begin quantitative vegetative sampling in the mesic flatwoods. (VOTE: 5+, 0-)**

*Managing Agency Response: Agree; However due to the limited field staff at this park, vegetation monitoring must be prioritized along with other land management activities. Limitations on staff and funding may impinge on the park's ability to conduct vegetation monitoring at the level they would prefer.*

**The team recommends that DRP consider all available tactics in removing feral hogs on the property, including trapping, shooting, and the use of dogs, where practicable. (VOTE: 5+, 0-)**

*Managing Agency Response: Agree; Removal of feral hogs remains a high priority at Crystal River Preserve State Park.*

## PLAN REVIEW

### **Discussion in the management plan regarding Natural Communities, specifically upland mixed forest.**

*Managing Agency Response: The Upland Mixed Forest community type is no longer recognized as an FNAI community type in the 2010 FNAI Guide to Natural Communities. These areas will be reclassified in the next unit management plan update to reflect these changes.*

### **Discussion in the management plan regarding Restoration of Ruderal Areas, specifically borrow pits and pasture.**

*Managing Agency Response: Agree; The unit management plan update will include mitigation plans for improving the borrow pits in the CR-H70E management zone by adding a littoral shelf and contouring to connect the pit to adjacent artificial marsh. A cost estimate and optimal timeline of restoration of the pasture area and remaining ruderal areas dominated by wax myrtle and other shrubby growth will also be included in the next unit management plan.*

### **Discussion in the management plan regarding Non-Native, Invasive & Problem Species, specifically prevention of animals.**

*Managing Agency Response: Agree; The unit management plan update will expand upon prevention measures for exotic animals, including pests and pathogens.*

### **Discussion in the management plan regarding Hydrologic/Geologic function Hydro-Alteration, specifically hydro-period alteration and water level alteration.**

*Managing Agency Response: Agree; The park has identified several areas of historic ditching or other landscape alteration that inhibit optimal sheet flow and hydrologic function. A prioritized list of corrective actions to improve natural drainage will be included in the unit management plan update.*

### **Discussion in the management plan regarding Surface Water Monitoring, specifically water quality and quantity.**

*Managing Agency Response: Agree; Park staff have monitored Magnolia Creek for nearly 10 years through the Lakewatch Program. This will be included in the unit management plan update. Although MFLs have not been set at this time for any waterways within the park boundary, the major waterways are monitored by other agencies (CAMA, SWFWMD, etc.).*

### **Discussion in the management plan regarding Adjacent Property Concerns, specifically ozeillo homeowners (invasive species).**

*Managing Agency Response: Agree; Discussion of the actions taken by the park staff to contact, educate and generally interpret both the FPS general concerns and specific issues with exotic species will be included in the unit management plan update.*

## FIELD REVIEW

### **Increased natural communities, specifically sandhill, scrubby flatwoods and scrub, with documentation in the management plan.**

*Managing Agency Response: Agree; The management of scrubby flatwoods, sandhill, and scrub will continue to improve as funding and staff time become available for the following efforts: rollerchopping/mechanical fuel height reduction, fireline installation, seedling planting and groundcover assessment. Park staff will continue to cooperate with other agencies, including FFS, SWFWMD and FWC, to accomplish burning and other actions to improve the condition of these areas.*

### **Discussion regarding Restoration of Ruderal Areas, specifically borrow pits and pasture, with documentation in the management plan.**

*Managing Agency Response: Agree; Mitigation plans for improving the borrow pits in the CR-H70E management zone by adding a littoral shelf and contouring to connect the pit to adjacent*

## Crystal River Preserve State Park Land Management Review

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*artificial marsh will be developed. A cost estimate and optimal timeline of restoration of the pasture area and remaining ruderal areas dominated by wax myrtle and other shrubby growth will also be developed and included in the next unit management plan.*

**Discussion of the deficiencies in Management Resources, specifically staff and funding, with documentation in the management plan.**

*Managing Agency Response: Agree; If it is determined that additional staff are needed at the time of the next unit management plan update, it will be included in the plan. However, no new staff can be assigned to this or any other park unit unless they are appropriated by the Legislature or reassigned from other units. The updated unit management plan will address land management funding needs. However, Division funding is determined annually by the Florida Legislature and funds are allocated to the 160 state parks according to priority needs.*

Thank you for your attention.

/gk

CC: Clif Maxwell, Chief, Bureau of Parks District 2  
Willy Cutts, Assistant Chief, Bureau of Parks District 2  
Nick Robbins, Park Manager, Crystal River Preserve State Park  
Craig Parenteau, Environmental Specialist, Bureau of Parks District 2



## **Addendum 10—Recreational Carrying Capacity Guidelines**



## Recreational Carrying Capacity Guidelines

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### THE SELECTION AND CAPACITY DETERMINATION OF USE SITES

#### Introduction

The Division of Recreation and Parks has the responsibility of planning the use of and managing a sizable portion of Florida's public lands and water areas. With tremendous population increases and the constant and extensive development of private lands, the state recreation and parks system has a more significant role than ever before in (a) providing opportunities for quality outdoor recreation experiences, and (b) preserving representative and unique natural areas of the state. Both the quality of the recreation experience and the protection of the natural areas are directly affected by the implementation of the site plans, or land use plans, which are prepared for the various areas of the system and which designate sites to be established for public use and lands to be set aside for preservation purposes. Important factors given thorough study during the site planning process are the types of recreation activities to be provided, where these activities are to take place, and the amount of public use to be allowed.

#### Site Selection and Site Deterioration

Proper site selection is a critical part of the site planning process. Deterioration of recreation sites through normal use can be minimized when a designer remains sensitive to the plant communities he is working with. Some communities are significantly more tolerant of man's presence than others.

To assure the consideration of these factors, it is helpful to map plant communities existing at each site. This, coupled with analysis of plant communities' characteristics as summarized in Attachment A, should insure selection of the best available site which in turn will minimize the degree of deterioration from normal use.

Other factors, such as wildlife, soils, topography, and hydrology, should also be considered during the site planning process. Plant communities, once identified, suggest the soil makeup and animals which will be found at the site, but geology and hydrology should be considered separately.

#### Plant Community Limitations

Attachment A, "Characteristics of Florida's Major Plant Communities," was prepared to assist in the study of areas' plant community limitations. Included is a relative ranking of each community's ability to tolerate use other than that normally associated with wilderness. Practically all of the plant communities of Florida are represented on lands of the state recreation and parks system. They vary from unstable types which cannot withstand trampling, such as sand dunes, to stable types, such as pine flatwoods.

Several plant communities are rare or endangered because of extensive development which has taken place over the past 30 years. For example, the coastal hammocks which were once found in a continuous band along the barrier islands of the Atlantic Coast, have been reduced to remnants, due to extensive coastal development. To encourage active use of unstable and fragile plant communities is contrary to sound environmental management. Wherever possible, use sites will be located in communities and on terrain resistant to trampling. Similarly, communities which are considered to be rare or endangered, will be avoided. These areas best serve the public in scenic, interpretive, and biological research categories.

## Recreational Carrying Capacity Guidelines

In some instances, planners are faced with the dilemma of not having a stable community in which to place a use site. Many east coast barrier islands consist of three basic communities--dune, coastal hammock, and mangroves. The coastal hammock is stable but endangered, and the dunes and mangroves are unstable as well as endangered. The most suitable location, therefore, is the outer portion of the coastal hammock. In areas which do not possess suitable plant communities, and yet some degree of use is determined desirable, the degree of development and corresponding intensity of use will be low.

Additional biological factors must be considered during the initial planning. Sand dunes are unable to withstand trampling, but high intensity use of adjacent beaches can be allowed by the installation of boardwalks over the dunes. Also, the location of a use site adjacent to an important wildlife nesting or feeding area may be detrimental even though the community is well suited for active use. Early field investigations for the purpose of inventorying plant communities, will provide such information.

### Overcrowding and Site Deterioration

Areas in the state recreation and parks system have always been popular with large segments of the public and have accordingly received considerable use. But previously, they were seldom overcrowded to the extent that a lessening of the quality of the users' outdoor recreation experiences resulted. Now, in several areas, the number of persons seeking outdoor recreation exceeds the space allotments of the public use sites. Carrying capacities--limitations on the number of persons to use each site at a given time--can protect users' experiences by preventing overcrowding which (a) causes deterioration of the natural attribute of each use site and (b) impedes each user's ability to move freely and to fully enjoy the natural setting without undue distraction.

### Optimum Carrying Capacities for Users

In order to determine appropriate carrying capacities for each park situation, two guides are provided here: Attachment A, "Characteristics of Florida's Major Plant Communities," already discussed, and Attachment B, "Optimum Carrying Capacities for Outdoor Recreation Activities." Attachment B gives the recommended limits on the number of users for most outdoor recreation activities in an attempt to prevent overcrowding, and a recommended land base to assure that sufficient support area and buffer area are provided. A range is given for almost every activity, to allow for differences in each site. The site's classification is a main factor in density variation. For state parks, special feature sites and preserves, the carrying capacities should be reduced to insure compatibility with the management objectives of each category.

The carrying capacities determined by these guidelines are to be followed in the preparation of site plans for new use sites and for authorized alterations of existing use sites. The applicable carrying capacity for a given use site also governs the number of parking spaces, the size of restrooms, and all quantities of support facilities to be provided.

### Control of Established Carrying Capacities

Carrying capacity computations derived with the help of the guidelines contained here are vital to planning of new use sites, renovation of older developed sites and continuous management of all areas of the system, to prevent overcrowding and resource deterioration. The estimated optimum carrying capacity is included in each approved park unit management plan, in a tabular format. This estimate is evaluated and revised, as needed, as part of the periodic unit management plan update procedure.

# Recreational Carrying Capacity Guidelines

## ATTACHMENT A

### CHARACTERISTICS OF FLORIDA'S MAJOR PLANT COMMUNITIES

	Moisture Level Moist-▲ Dry-◇ Moderate-◇	Shade Potential Dense-▲ None-◇ Moderate-◇	Understory Buffer Dense-▲ None-◇ Moderate-◇
<u>Group 1</u>			
Pine Flatwoods	◇	◇	◇
Mixed Hardwood/Pine	◇	▲	▲
<u>Group 2</u>			
Xeric Hammock	◇	▲	◇
Coastal Hammock*	◇	▲	◇
Mesic Hammock	◇	▲	◇
Tropical Hammock*	◇	▲	◇
<u>Group 3</u>			
Sand Pine Scrub*	◇	◇	▲
Sandhill*	◇	◇	◇
<u>Group 4</u>			
Low Flatwoods	▲	◇	◇
Hydric Hammock	▲	▲	◇
<u>Group 5</u>			
Dunes*	◇	◇	◇
Wetlands*	▲	varies	▲

\*Indicates rare and endangered communities.

The group number indicates the relative degree to which each community is affected by development. Group 1 is least affected, Group 5 is most affected.

## Recreational Carrying Capacity Guidelines

### ATTACHMENT B OPTIMUM CARRYING CAPACITY FOR OUTDOOR RECREATION ACTIVITIES Updated 10/7/14

<u>Recreation Activity</u>	<u>Required Land Base</u>	<u>Area Requirements</u>	<u>People/Unit of Facility</u>	<u>Turnover Rate</u>
<b>Camping</b>				
Hike-in (Primitive, no restrooms)	10-50 acres/site	Sites clustered to a maximum of 4 sites/acre	8/site	1/day
Short-walk, Tent	2-10 acres/site	3-8 sites/acre	8/site	1/day
Rustic (no water/sewer)	1-5 acres/site	3-8 sites/acre	8/site	1/day
Standard Facility	1-3 acres/site	3-10 sites/acre	8/site	1/day
Groups (primitive)	20-50 acres/area	5-20 acres/area	10-30/site (4 tents/site)	1/day
Cabins	1-3 acres/cabin	2-6/acre	4-12/cabin (generally 6/cabin)	1/day
Yurt	n/a	n/a	8/yurt	1/day
Campfire Circle	1-2 acres/facility	1/4-1/2 acre/facility	1/2 camping capacity	1/day
Museum/Visitor Center	1-5 acres/structure (15 sq. ft./person)	1/4-1/2 acre/structure (1 acre/structure)	1/20 sq. ft.	4/day
Picnicking	1/4-4 acres/site of exhibit area	8-15 tables/acre	4/table	2/day
<b>Trails</b>				
Nature Trails	min. of 25 acres/mile of trail, max. length 1 mile	5-20 groups/mile (10-40 people/mile)	2/group	4/day
Primitive Hiking	min. of 100 acres/mile of trail, min. length 1 mile	1-5 groups/mile (2-10 people/mile)	2/group	2/day

## Recreational Carrying Capacity Guidelines

### ATTACHMENT B OPTIMUM CARRYING CAPACITY FOR OUTDOOR RECREATION ACTIVITIES Updated 10/7/14

<u>Recreation Activity</u>	<u>Required Land Base</u>	<u>Area Requirements</u>	<u>People/Unit of Facility</u>	<u>Turnover Rate</u>
Trails cont'd Bicycle (Off-road)	min. of 25 acres/mile of trail	10 bikes/lane/mile	1/bike	4/day
Shared Use Trail (Paved or Unpaved?) Note: depending on the trail, these numbers might need to be adjusted as appropriate based on actual/observed use.	n/a	10-20 people/mile	2/group	4/day
Equestrian	min. 75 acres/mile of trail min. length 5 miles	2-8 groups/mile (4-16 people/mile)	4/group	1 to 2/day
Parking (only use if no way to calculate capacity w/activities)	80 cars/acre 70 cars with trailer/acre	3 people/car	Bus (large touring coach = 50 people)	

#### WATER-BASED ACTIVITIES

Beach Use (Swimming)	min. 1/8 acre of land/swimmer	50-200 sq. ft. of water (spring/lakes) and 200-500 sq. ft. of beach/swimmer (note: measure 1/4-mile from beach access along length of beach)		2/day
Surfing (for designated surfing areas; subtract from beach use figures to avoid double-counting)	min. 1/2 mile of beach for surfing area, and 1/8 acre of land/surfer	40-100 linear ft. of beach/surfer		2/day
Fishing (note: subtract from beach use figures to avoid double-counting)				
Shoreline	min. 1/4 mile of shoreline for a fishing area, and 1/8 acre of land/fisherman	1 fisherman/20-100 linear feet		2/day
Jetty Pier	min. 1/8 acre of land/fisherman	1 fisherman/10-40 linear feet		2/day

## Recreational Carrying Capacity Guidelines

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### ATTACHMENT B OPTIMUM CARRYING CAPACITY FOR OUTDOOR RECREATION ACTIVITIES Updated 10/7/14

<u>Recreation Activity</u>	<u>Required Land Base</u>	<u>Area Requirements</u>	<u>People/Unit of Facility</u>	<u>Turnover Rate</u>
<b>Boating</b>				
<b>Limited Power (10 HP or less)</b>	min. 200 acres of water, and 1/4 acre of land/boat	1 boat/5-10 acres of water	2/boat	2/day
<b>Unlimited Power</b>	min. 600 acres of water and 1/4 acre of land/boat	1 boat/10-20 acres of water	4/boat	1/day
<b>Water-skiing</b>	min. 600 acres of water and 1/4 acre of land/boat	1 boat/20-50 acres of water	4/boat	1/day
<b>Sailing</b>	min. 200 acres of water and 1/4 acre of land/boat	1 boat/5-10 acres of water	2/boat	2/day
<b>No Power, Still Water</b>	min. 50 acres of water and 1/4 acre of land/boat	1 boat/5-10 acres of water	2/boat	2/day
<b>No Power, Moving Water</b>	min. 1 mile of stream	2-10 boats/mile	2/boat	2/day
<b>Kayak Rentals</b>		25 people at one time		2/day

**Addendum 11—Advisory Group Members and Report**



**Crystal River Preserve State Park  
Advisory Group Members**

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**Local Government Representative**

The Honorable Jim Farley, Mayor  
City of Crystal River

The Honorable Ronald Kitchen, Chair  
Citrus County  
Board of County Commissioners

**Agency Representatives**

John Lakich, Park Manager  
Division of Recreation and Parks  
Crystal River Preserve State Park

Michael Edwards  
Florida Forest Service

Chris Green  
Florida Fish and Wildlife  
Conservation Commission

Lt. Rama Shuster  
Florida Fish and Wildlife  
Conservation Commission  
Law Enforcement

Joshua Goodwin, Archaeologist  
Florida Department of State  
Division of Historical Resources

Rick Vaughn  
Southwest Florida  
Water Management District

Tim Jones, Aquatic Preserve Manager  
Florida Coastal Office  
St. Martins Marsh Aquatic Preserve

Joyce Kleen  
United State Fish and Wildlife Service  
Chassahowitzka  
National Wildlife Refuge

**Environmental and Conservation  
Group Representative**

Athena Philips  
Florida Native Plant Society  
Citrus County Chapter

Fred Hileman  
Citrus County Audubon

**Local Private Property Owners**

David Smith  
Local Resident

**Recreational User Group  
Representatives**

Gary Rankel  
Nature Coast Kayak Fishers

**Cultural and Historical Group  
Representative**

Gary Ellis  
Gulf Archaeological Research Institute

Carly Zervis  
Citrus County Historical Society

**Citizen Support Organization**

Kathryn Askins, President  
Friends of Crystal River

## **Crystal River Preserve State Park Advisory Group Summary Report**

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The advisory group meeting to review the proposed unit management plan (UMP) for Crystal River Preserve State Park was held at the Citrus County Chamber of Commerce on April 27, 2018 at 9:00 am.

Jim Farley, Ronald Kitchen, Michael Edwards, Rama Shuster, Joshua Goodwin, Fred Hileman, and Gary Rankel were not in attendance. Michael Edwards, Joshua Goodwin, and Gary Rankel provided written comments prior to the meeting, which are summarized below. All other appointed advisory group members were present, as well as Jaya Milam, Yvonne Smith, and Maxine Connor. Attending staff were Clif Maxwell, Brian Fugate, John Lakich, Rick Owen, Keith Morin, Diane Martin, and Tyler Maldonado.

Mr. Maldonado began the meeting by explaining the purpose of the advisory group and reviewing the meeting agenda. He provided a brief overview of the Division of Recreation and Parks' (DRP) planning process and summarized public comments received during the previous evening's public meeting. Mr. Maldonado then asked each member of the advisory group to express his or her comments on the plan.

During the two-week public comment period following the advisory group meeting, numerous comments were submitted to DRP from members of the public on the draft UMP for Crystal River Preserve State Park. The major themes of these comments are as follows:

- Several comments surrounded addressing the current and potential impacts of sea level rise on the park's natural and cultural resources. It was claimed that the UMP does not sufficiently outline any documented impacts to the park caused by sea level rise and does not discuss management objectives intended to mitigate future impacts. Those who provided these comments recommended improving the sea level rise section of the UMP.
- Most of the comments received referenced the proposed campground and boat ramp, and these comments were generally opposed to the concepts. Residents neighboring the park's current entrance were concerned about increased traffic along State Park Street and highlighted Mullet Hole as manatee habitat. Several members of the public stated they wished to see the park stay primitive in nature.

### **Summary of Advisory Group Comments**

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**Carly Zervis** (Citrus County Historical Society) stated her interest in cultural resources and recreational carrying capacity considerations. She did not provide comments on the UMP.

**Gary Ellis** (Gulf Archaeological Research Institute) has worked with the park on cultural resources research for over 20 years, and his work has helped DRP inventory the park's cultural sites. He stated that he plans on publishing a report on the impact of climate change and sea level rise on cultural resources. He commented that these phenomena are uncovering new cultural sites and causing changes in ecology that impact existing cultural sites. Given the park's coastal location and number of cultural sites, he concluded that this report could

## Crystal River Preserve State Park Advisory Group Summary Report

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provide park staff with a set of best management practices (BMPs) for the protection of cultural resources. These BMPs could aid in the development of cultural resource protection plans and help direct funding for restoration. He stated he will continue to collaborate with DRP and will coordinate with staff to provide information on newly discovered cultural sites.

**Rick Vaughn** (Southwest Florida Water Management District) commented that the UMP seems to be adequate from a hydrological perspective. He noted the sheetflow restoration projects outlined in the UMP and pointed out there are not any scheduled stormwater projects, although he also recognized the difficulty with stormwater projects. As outlined in the introduction to the UMP, the DRP does not find stormwater management projects to be consistent with the management purposes of parks in the Florida State Park system. He offered assistance and collaboration with DRP on hydrological restoration projects, if needed.

**Athena Philips** (Florida Native Plant Society, Citrus County Chapter) recommended improving the sea level rise section of the UMP. She stated the current paragraph discussing sea level rise is inadequate and should include information on how management intends on dealing with the impact of sea level rise, given that the park is particularly vulnerable to impacts. She noticed an inconsistency between the UMP and the land management review (LMR) contained in Addendum 9. She pointed out the LMR stated the UMP should discuss non-native, invasive and problem species, "specifically prevention of animals", but there is no discussion of the prevention of invasive animal species in the UMP. She suggested including information on the current work being done to address invasive species, as well as expounding on the education and awareness-building campaigns needed to help prevent the spread of invasive species from neighboring communities. She concluded by advising DRP to include more information on its management philosophy regarding prescribed fire management and the history of prescribed burning at the park.

**David Smith** (Local Resident) described a situation in which the park property may be used for unauthorized primitive campsites. He stated these unauthorized campsites are contributing to trash found in the park and suggested patrolling these areas to discourage unauthorized use of the property. He asked about the park's efforts to address invasive plant species, such as Brazilian pepper, and programs to educate neighboring property owners on techniques to help prevent the spread of these species. He complimented the park and district staff on their prescribed fire efforts, stating he recognizes the increase in wildlife and benefits to natural communities.

**Joyce Kleen** (United States Fish and Wildlife Service) applauded the park staff on their invasive plant species work, citing the benefits to USFWS's property adjacent to the park. She inquired about no-pay hog removal contracts that were discussed in the UMP. She stated that the Department of Interior is considering opening its properties to hunting, which could potentially help control hog populations in the area. She responded to concerns voiced by Ms. Connor by stating that the airspace above the Chassahowitzka National Wildlife Refuge is considered Class I airspace, meaning any potential industrial development would have to comply with stringent

## Crystal River Preserve State Park Advisory Group Summary Report

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Clean Air Act air quality standards. She shared similar concerns with Ms. Phillips, stating the sea level rise section should be improved to include any documented changes the park has experienced from sea level rise and potential future impacts to natural and cultural resources. She noted a few species found on the adjacent USFWS property that could presumably be added to the park's species list.

**Chris Green** (Florida Fish and Wildlife Conservation Commission) appreciated the opportunity to observe the meeting and seek areas of collaboration with the park, especially on efforts to address invasive plant and animal species.

**Tim Jones** (Florida Coastal Office) expressed his desire to maintain a close relationship between the park and the St. Martins Marsh Aquatic Preserve. He commented on the productive seagrass beds in the Gulf and the park's contribution to a pristine ecosystem. He acknowledged the direct connection between the health of the park and the health of the aquatic preserve. He offered support with education and outreach programs.

**Kathryn Askins** (Friends of Crystal River) stated the citizen support organization's (CSO) function is to support the park with fundraising, programming, and volunteering. She reiterated the CSO's continued support for the park. She recognized volunteers as vital members of the park and called for an increase in volunteers. She mentioned programs, such as the boat tours, that highlight the significance of the park. She acknowledged the importance of community outreach programs and understands the need to enhance visitor services.

### Summary of Public Comments

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**Jaya Milam** (Florida Native Plant Society, Big Bend Chapter) advocated for protecting the beautiful coastline of the Nature Coast. She urged DRP to keep Florida native and consider impacts to natural communities.

**Maxine Connor** (League of Women Voters) expressed her concerns regarding the potential development of a Liquefied Natural Gas (LNG) facility that is scheduled to be sited along Powerline Road adjacent to the northeastern boundary of the park. She cited public safety and health concerns associated with this type of facility and stated potential impacts to the park's resources and visitor experience. DRP will continue to monitor the progress of this potential facility.

**Yvonne Smith** (Local Resident) stated tourism and an increase in visitors to the park can be a double-edged sword when considering the potential impacts to natural communities. She expressed concern for the future of the park given the proposed changes in the UMP.

### Summary of Advisory Group Written Comments

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**Michael Edwards** (Florida Forest Service) recommended coordinating with the Florida Forest Service (FFS) when conducting prescribed burns. He referred DRP to the Waccasassa and Withlacoochee Wildfire Mitigation Specialists. He suggested conducting appropriate timber management treatments, as discussed in the UMP's timber management analysis. He advocated for keeping a GIS database of infested

## **Crystal River Preserve State Park Advisory Group Summary Report**

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and treated invasive plant species areas and urged park staff to coordinate with local Cooperative Invasive Species Management Areas (CISMA). He recommended having all park staff participate in Archaeological Resource Management (ARM) training, noting the management objective that states park staff will conduct annual monitoring efforts on the park's cultural resources. He encouraged the use of permeable and semi-permeable construction materials when developing new use areas and suggested converting facilities to local sewage systems to help protect water quality. He recommended obtaining a hydrological assessment for the property to help mitigate impacts of any future hydrological restoration projects.

**Joshua Goodwin** (Department of State, Division of Historical Resources) noted discrepancies in the number of recorded archaeological sites, with the UMP identifying 110 archaeological sites and the Florida Master Site File showing 111 archaeological sites and 3 resource groups. He recommended updating the plan to reflect recent and ongoing archaeological investigations that have been conducted by the University of South Florida. He stated certain sites that are listed as historic structures in the UMP should be classified as archaeological sites. He noted most of the sites in the Cultural Resources addendum have not been formally evaluated by the State Historic Preservation Officer and should be labeled as such. He suggested using the appropriate archaeological terminology when discussing cultural resource management objectives.

**Gary Rankel** (Nature Coast Kayak Fishers) commented on the prospect of the park becoming a premier paddling and kayak fishing destination. He stated that a first-class premier site would include an area where kayak anglers could gather, rest, and fish adjacent to a productive fishing area. He supported the UMP's goal of increasing recreational use at the park, but suggested that while the Mullet Hole area provides adequate kayak launching facilities, he would not consider this area to be a premier location for kayak anglers. He recommended surveying the Crystal River Preserve property for areas that could be developed or improved for kayak launching areas. He stated that informal roadside launches have been created, and these areas could potentially be improved.

### **Staff Recommendations**

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The staff recommends approval of the proposed management plans for Crystal River Preserve State Park as presented, with the following significant changes:

- The discussion of sea level rise and the impacts on park property will be improved.
- Discrepancies in the cultural resources section will be addressed and a discussion of current research will be added.
- The boat ramp proposal at the Mullet Hole will be removed from the UMP. Instead of proposing a boat ramp at the Mullet Hole area, the UMP will recommend improving the paddling launch and associated amenities in this area. Boat ramp locations in other areas of the park may be considered.

## **Crystal River Preserve State Park Advisory Group Summary Report**

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### Additional Recommendations:

- A new entrance area will be considered at the Ecowalk Trailhead to replace the State Park Street entrance in the future.
- Campground consideration at the Mullet Hole will be removed from the UMP, and potential campground locations will be explored in the area around the Ecowalk Trailhead. Campsite configuration will be up to two loops with central bathhouse facilities and an additional tent camping-only loop.

### **Notes on Composition of the Advisory Group**

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**Florida Statutes Chapter 259.032 Paragraph 10(b)** establishes a requirement that all state land management plans for properties greater than 160 acres will be reviewed by an advisory group:

"Individual management plans required by s. 253.034(5), for parcels over 160 acres, shall be developed with input from an advisory group. Members of this advisory group shall include, at a minimum, representatives of the lead land managing agency, co-managing entities, local private property owners, the appropriate soil and water conservation district, a local conservation organization, and a local elected official."

Advisory groups that are composed in compliance with these requirements complete the review of State park management plans. Additional members may be appointed to the groups, such as a representative of the park's Citizen Support Organization (if one exists), representatives of the recreational activities that exist in or are planned for the park, or representatives of any agency with an ownership interest in the property. Special issues or conditions that require a broader representation for adequate review of the management plan may require the appointment of additional members. The Division's intent in making these appointments is to create a group that represents a balanced cross-section of the park's stakeholders. Decisions on appointments are made on a case-by-case basis by Division of Recreation and Parks staff.

**Addendum 12—Local Government Comprehensive Plan Compliance**



## Citrus County Comprehensive Plan Compliance

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**From:** JOANNA L. COUTU [mailto:JOANNA.COUTU@citrusbocc.com]

**Sent:** Wednesday, July 25, 2018 3:14 PM

**To:** Baxley, Demi <Demi.Baxley@dep.state.fl.us>

**Cc:** JOSEPH C. HOCHADEL <joe.hochadel@citrusbocc.com>

**Subject:** RE: Citrus County - Crystal River Preserve SP RE: UMP Compliance with Local Comprehensive Plan

I appreciate the chance to provide input regarding the Crystal River Preserve Management Plan. Joe Hochadel in our office reviewed the plans that you provided for compliance with the Citrus County Comprehensive Plan. Here are the comments:

- The proposed boat launches are now all paddle launches. This is a good step as motorized launches would violate the Manatee Element of our Comprehensive Plan ( a quick review of an earlier draft indicated motorized launches were proposed).
- On pg. 106, the plan mentions the Conservation District and allowable uses. These uses are for all CON designations, not just for the Preserve and any CON property in Citrus County may develop based on these uses. The LDC allows residential development at one dwelling per lot of record in the CON district. This would facilitate the development of park staff residences for the preserve and also for a single-family dwelling if on a privately owned CON lot. As such, we do not believe it is appropriate to remove the ability to develop one residential lot of record in the CON district at this time.
- The Plan mentions development of a campground for RV's and tents. In order to develop an RV campground, the proposed site will need to have a Recreational Vehicle Park land use designation on the Comprehensive Plan and Land Development Code Atlas. Since the proposed area is currently CON, a Comprehensive Plan Amendment and Atlas Amendment will be required to change the designation. A Master Plan will also be required showing compliance with the Land Development Code Section 3310, Recreational Vehicle Park standards.

Other than those comments, the proposed Management Plan appears to comply with the Citrus County Comprehensive Plan. If you have any questions please don't hesitate to contact our office.

Joanna L. Coutu, AICP

Director

Citrus County Land Development Division

(352) 527-5244

