

**State of Florida Department of Environmental Protection
John D. MacArthur Beach State Park
Draft Unit Management Plan
Division of Recreation and Parks
February 2020**



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INTRODUCTION

John D. MacArthur Beach State Park is located in Palm Beach County (see Vicinity Map). Access to the park is from State Road A1A (see Reference Map). The Vicinity Map also reflects significant land and water resources existing near the park.

John D. MacArthur Beach State Park was initially acquired on July 7, 1981 with funds from the Land Acquisition Trust Fund (LATF). Currently, the park comprises 436.39 acres. The Board of Trustees of the Internal Improvement Trust Fund (Trustees) hold fee simple title to the park and on March 22, 1982, the Trustees leased (Lease Number 3205) the property to DRP under a fifty-year lease. The current lease will expire on March 21, 2032.

John D. MacArthur Beach 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 John D. MacArthur Beach State Park is to protect a unique and irreplaceable cross section of coastal Florida landscape for conservation and interpretation efforts that support valuable opportunities for resource-based recreation in one of Florida's most populous regions.

Park Significance

- The park contains many important and invaluable natural communities including mangrove, estuarine grass bed, worm reef, and 121 acres of maritime hammock which combine to make the park a prominent regional asset. The maritime hammock is one of the largest remaining examples of this natural community in SE Florida and has been identified as an exemplary site by the Florida Natural Areas Inventory.
- The natural communities present in the park provide significant habitat for 29 designated plant and animal species. The park's beach serves as critical habitat for nesting sea turtles and records more nests annually than any other state park. Florida manatees and juvenile green sea turtles can be observed foraging in the seagrass beds of the park's estuary.
- Cultural resources protected at this park span many periods of Florida's history from pre-historic Native American shell middens to the historic remains of the Hygeia Hotel, a popular resort from the early 1900s. The wealthy philanthropist and the park's namesake, John D. MacArthur, played an integral role in the development of the surrounding region.

- Recreational and interpretive opportunities of significance at the park include two miles of beach with nearshore reef and hardbottom habitat that provide visitors with excellent opportunities for swimming, snorkeling and fishing. The park also features a large estuarine lagoon with restricted boat access that is outstanding for kayaks, canoes, paddleboards and birdwatching. A nature center provides visitors with an informative overview of the resources the park has to offer.

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

Purpose and Scope of the Plan

This plan serves as the basic statement of policy and direction for the management of John D. MacArthur Beach 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 2005 approved plan.

The plan consists of three interrelated components: Resource Management Component, Land Use Component and 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.

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.

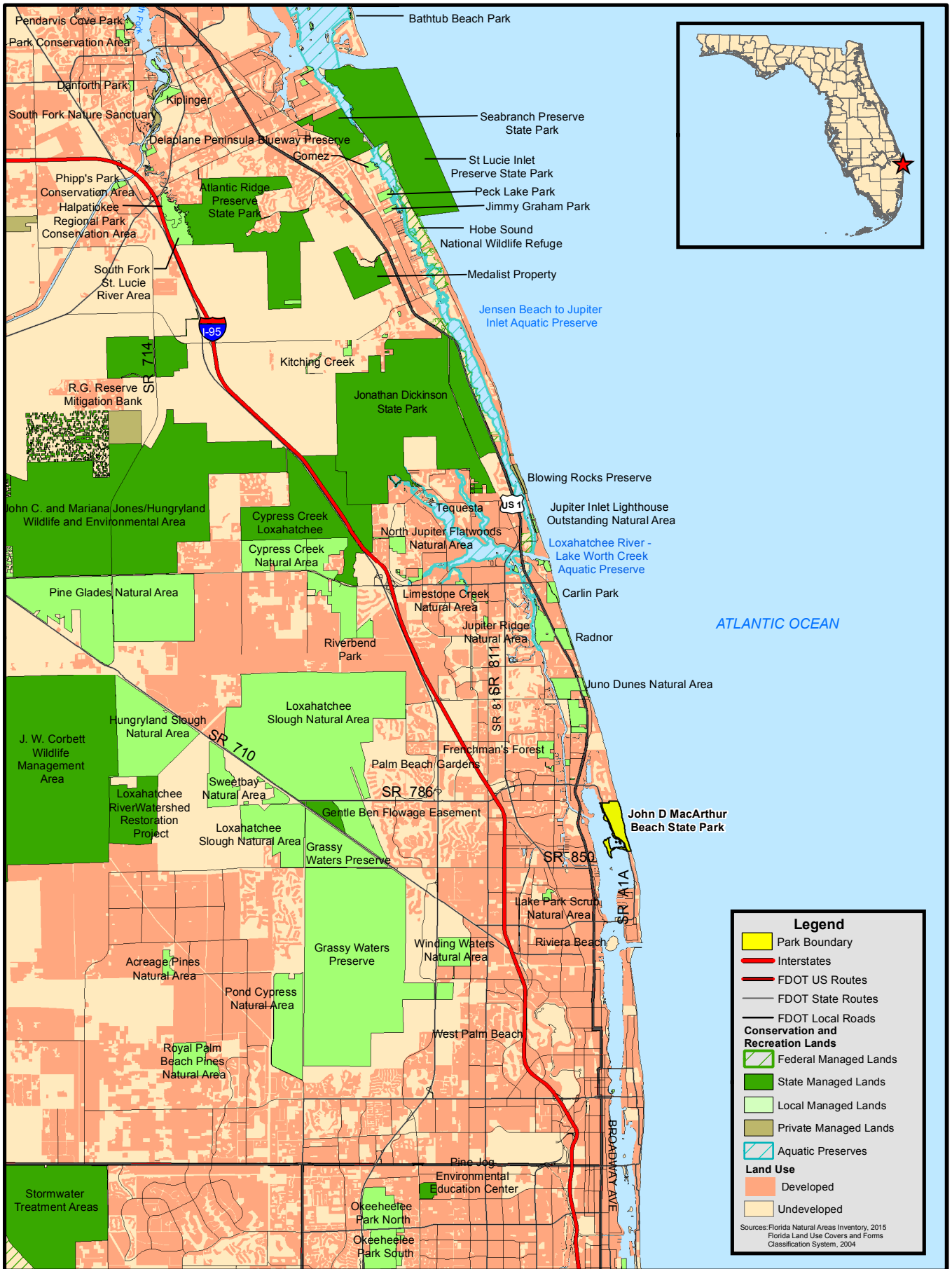
All development and resource alteration proposed in this plan is subject to the granting of appropriate permits, easements, licenses, and other required legal instruments. Approval of the management plan does not constitute an exemption from complying with the appropriate local, state or federal agencies. 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 the development of this plan, the potential of the park to accommodate secondary management purposes was analyzed. These secondary purposes were considered within the context of the DRP's statutory responsibilities and the resource needs and values of the park. This analysis considered the park natural and cultural resources, management needs, aesthetic values, visitation and visitor experiences. For this park, it was determined that no secondary purposes could be accommodated in a manner that would not interfere with the primary purpose of resource-based outdoor recreation and conservation. 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) are not consistent with this plan.

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 multiple-use management activities would not be appropriate as a means of generating revenues for land management. Instead, techniques such as entrance fees, concessions and similar measures will be employed on a case-by-case basis as a means of supplementing park management funding.

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).

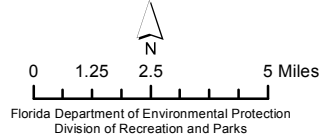


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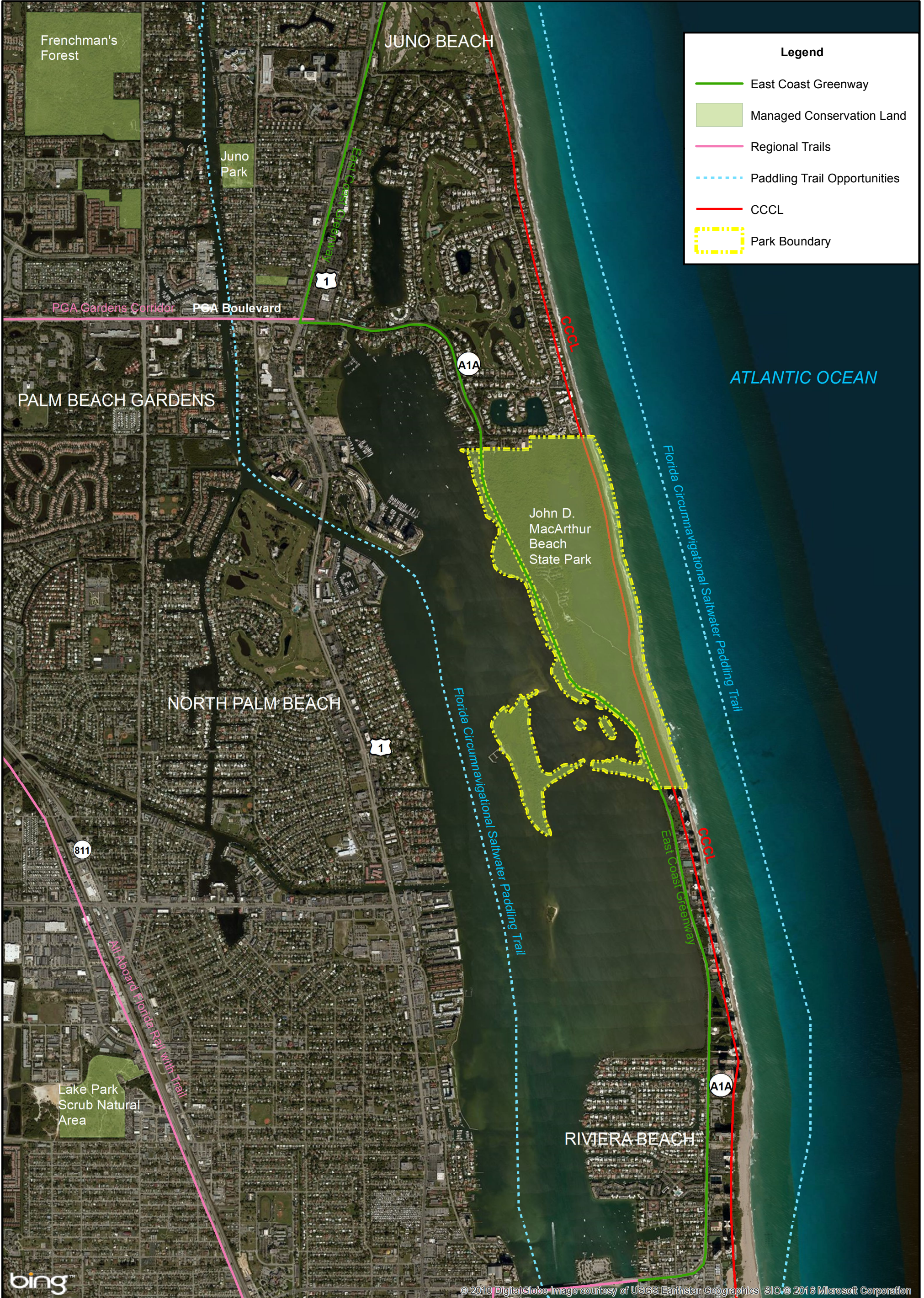
- Park Boundary
- Interstates
- FDOT US Routes
- FDOT State Routes
- FDOT Local Roads
- Conservation and Recreation Lands**
- Federal Managed Lands
- State Managed Lands
- Local Managed Lands
- Private Managed Lands
- Aquatic Preserves
- Land Use**
- Developed
- Undeveloped

Sources: Florida Natural Areas Inventory, 2015
Florida Land Use Covers and Forms Classification System, 2004

JOHN D. MACARTHUR BEACH STATE PARK



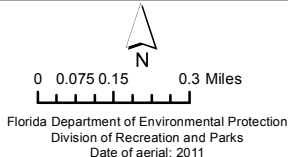
VICINITY MAP



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**JOHN D. MACARTHUR
BEACH STATE PARK**



REFERENCE MAP

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. The DEP, Bureau of Beaches and Coastal Systems aids staff in planning and construction activities seaward of the Coastal Construction Control Line (CCCL). In addition, the Bureau of Beaches and Coastal Systems aid the staff in the development of erosion control projects.

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 [INSERT Dates], respectively. Meeting notices were published in the Florida Administrative Register, [INSERT publication date, VOL/ISSUE], 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 (see Addendum 2).

Other Designations

John D. MacArthur Beach 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 not within or adjacent to an aquatic preserve as designated under the Florida Aquatic Preserve Act of 1975 (Section 258.35, Florida Statutes).

Resource Management Component



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.

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). 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. Table 1 reflects the management zones with the acres of each zone.

Management Zone	Acreage	Managed with Prescribed Fire	Contains Known Cultural Resources
MB-1	47.41	N	Y
MB-2	84.37	N	N
MB-3	72.22	N	N
MB-4	32.50	N	N
MB-5	63.83	N	N
MB-6	23.55	N	N
MB-7	28.94	N	Y
MB-8	42.25	N	N
MB-9	42.48	N	Y

RESOURCE DESCRIPTION AND ASSESSMENT

Natural Resources

Topography

John D. MacArthur Beach State Park lies within the Atlantic Coastal Ridge, a subzone of the Atlantic Coastal Lowlands that is a physiographic formation extending the entire length of the Florida peninsula from the Georgia/Florida line to the Homestead area (Puri and Vernon 1964). The upland acreage of the park is located on Singer Island, a barrier island of low topographic relief measuring 11.7 miles long and from 600 ft. to one mile wide. Elevations within the park range from sea level along the shoreline to 20 feet along the crest of the dune ridge.

Barrier islands are dynamic systems that are constantly changing. They are narrow, often linear deposits of sand that parallel the Florida coastline. Shaped by past geological changes, the wind, waves and tidal action, barrier islands often occur in long chains, separated from the mainland by estuaries and saltwater wetlands. Here the park is separated from the mainland by the northern portion of the Lake Worth Lagoon. Due to the nature of barrier islands, the topography of the park will continue to be influenced and altered by natural processes such as hurricanes, wind and ocean waves and currents. The dynamic nature of the barrier island is the result of interactions between plant growth habits and the physical processes such as wind-driven sand movement and salt spray deposition and wave-driven erosion, over wash, and accretion. Dunes are established and maintained as dune vegetation increases in surface area, which in turn causes wind to slow and sand grains to be deposited onto the land surface (Bagnold 1941). Thus, barrier islands are formed by the action of wind and waves on the unconsolidated sand and shell.

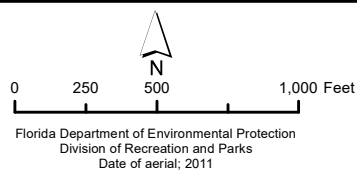
The upper beach and foredune areas are in a constant state of flux as sand is blown in or out of the area and the actions of waves rearranges their makeup. The



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JOHN D. MACARTHUR BEACH STATE PARK



MANAGEMENT ZONE MAP

transitional zone begins beyond the foredune and continues until a recognizable community such as a maritime hammock is reached. Transition zone vegetation is exposed to the same physical processes as the foredune in a lesser degree; thus, the vegetation is patchy, and the plants are constantly re-colonizing this area. The area beyond the transitional zone is more stable because the foredune and transitional zones provide a buffer from wind and wave action, except in the most severe storms.

The topography of the park is dominated by a series of dune ridges running north to south. Although not as high, the area west of Lake Worth Cove contains an old dune ridge, approximately 5 feet high, that extends south, divides into two fingers around Little Lake Worth Cove and then drops to sea level (Duever et al. 1981). Presumably, both the former large-scale erosion of the dune system and the drop in topography near the present main access trail may have been the results of amphibious maneuvers conducted by the military during the 1960s (Duever et al. 1981). The original name applied to this section of beach, Air Force Beach, did not have anything to do with these maneuvers. The name came from use by West Palm Beach Air Force Base personnel between the early 1940s and 1956 when the base was closed.

In conjunction with the topographic relief of the property, there are also exposed rocks from the Anastasia formation that appear at low tide along the northern and southern ends of the beach. In addition to these geological outcrops, there are sabellariidae worm reefs offshore. The original topographic surface of Munyon Island was significantly enlarged by dredging operations in the 1930s and 1960s when the island was used to store dredged material during the construction and maintenance of the Intracoastal Waterway (ICW). The material was deposited on and around the island's wetlands tripling the size of the island from 15 to 45 acres. Some of this spoil was removed during a restoration project undertaken by Palm Beach County when surface elevations were lowered to support red mangroves. In general, the trend of the park's topography will be affected by general sea level rise, northeastern winter storms and hurricanes.

Geology

Dominant geographic features along much of Florida's coastline are its many barrier islands. Shaped by past geological changes, wind, waves and tidal action barrier islands often occur in long chains, separated from the mainland by estuaries and salt-water wetlands.

The formation of Singer Island took place as part of the series of events, which shaped Florida. This peninsula began with sediment deposition in northern Florida from rivers draining the Appalachian Mountains and in places south of this area from sediments of marine carbonates, shell fragments and microscopic organisms being deposited under a shallow sea. During the Pleistocene epoch, four great ice ages brought peninsular exposure with the glacial advances, and flooding during each retreat. Each cycle was marked by a different thickness and composition of sediments lay down during inundation and the subsequent consolidation during regression. During several events in the Pleistocene, the consolidated coquina limestone of the Anastasia Formation was formed as the base rock. The Pamlico Sand, surface formation of the island, merely represents the latest of the marine repository episodes. Thus, the sands of this area are covering the Anastasia Formation.

This rock formation is found along the east coast of Florida from its type locality on Anastasia Island to Broward County, where it merges with the Miami Limestone. The lithology of this unit varies from coarse rock composed of whole coquina shells and quartz sands, to a sandstone composed of carbonate and quartz sand particles. The cementing agents can be calcium carbonate or iron oxide.

With the beginning of the Wisconsin Ice Age, the final Ice Age of the Pleistocene epoch, the ice increased, and sea level steadily fell until about 20,000 years ago. Then, the sea reached a low point close to 300 feet below the present level. At the time, the climate was windy, cool, and dry—conducive to forming large dune formations along the coast.

From about 15,000 to 6,000 years ago, Singer Island became more than just a large sandbar. Sea level rose relatively rapid at more than three feet per century. Near the end of this period, modern vegetation and climate became better established, and the rise in sea level slowed.

In the future, rising sea levels and the continuous movement of beach sand will perpetually change the shoreline. In addition, severe northeast storms and hurricanes will also inflict dramatic landform changes to the barrier island. Geologically, the island is a continuously changing landform, responding to the effects of both anthropogenic events and natural forces.

Soils

For many years, biologists and soil scientists have recognized the relationship that exists between soil types and plant distribution, and often vegetation can provide clues regarding dominant soil types. A complete description of the seven soil types found in John D. MacArthur Beach State Park is contained in Addendum 4. The Soils Map illustrates the distribution of the soils throughout the park. Information for these seven soil series was obtained from the United States Department of Agriculture, Natural Resources Conservation Services.

The soils of the park are geologically immature because of the relatively recent formation of the barrier island and the action of wind and rainfall on the soils. They are primarily composed of sand, quartz, and shell fragments. The soil associations of the park and barrier island are classified to be nearly level to gently sloping, poorly to excessively drained, with a mixture of carbonate sand and shell fragments.

Kesson mucky sand, tidal, is the predominant soil type found in the park consisting of 125.1 acres or 23.5 percent of the total soil composition for the park. The park contains 26.5 percent of the total of this soil type for all of Palm Beach County. Formerly mapped as tidal swamp, this soil is found along the shoreline of the Lake Worth Lagoon, the Lake Worth Cove and the mangrove areas of the park. It is subject to tidal flooding creating a high salinity environment and is often exposed during periods of low tide.

Canaveral-Urban land complex is the second most abundant soil type comprising 90.9 acres or 17.1 percent of the total soil composition for the park. Sand is the dominant component of this soil and is found throughout the typical profile. Because the fresh water lens is found close to the surface, this soil type is able to support a more diverse plant community and is usually found in association with the maritime hammock.

Cocoa-Urban land complex is found in association with upland coastal ridges at the park. This soil type is similar to Canaveral and Palm Beach soils where sand is the dominant component. This soil type is found in a small segment of maritime hammock in the northern section of the park and a small area along the southern boundary. The Cocoa-Urban land complex comprises 33.2 acres or 6.2 percent of the total soil composition for the park.

Palm Beach-Urban land complex is found in the upper beaches and dunes of the park where drainage is excessive, and the available water capacity is very low. The Palm Beach-Urban land complex comprises 32.9 acres or 6.2 percent of the total soil composition for the park.

Quartzipsamments, shaped, represent material dredged from the ICW and consists of thick deposits of sand and shell materials. This soil type is located on Munyon Island and has been altered, or shaped, from its original deposition during a

restoration project to improve natural habitats in the park. Quartzipsamments comprise 21.9 acres or 4.1 percent of the total soil composition for the park.

Beaches form a narrow strip along the Atlantic shoreline that is periodically flooded by tides and wave action. It is composed of quartz sand and calcium carbonate particles derived from fragments of marine animals and plants. Beaches also include some small areas of low dunes that receive less flooding and can support salt tolerant plants. Natural vegetation is scarce and confined to the low dune areas because of the constantly shifting sand and periodic flooding. Beaches comprise 11.9 acres or 2.2 percent of the total soil composition for the park.

Arents-Urban land complex is the smallest soil component within the park consisting of 1.4 acres or 0.3 percent of the total soil composition. It is located on the northern boundary and is associated with an unimproved road used by park staff for beach access.

Conservation of soil resources in the park is achieved by following best management practices to prevent soil erosion. Although a certain level of soil erosion is naturally associated with barrier islands, anthropogenic influences can seriously exacerbate the situation. On the northern and southern boundaries, seawalls are used to protect private property. During strong storms, wind driven waves erode the dunes and beaches in front of these walls. Although some erosion does occur on park beaches, it is not amplified due to the lack of coastal armoring. The DRP utilizes various methods to minimize soil erosion by minimizing visitor impacts to the natural resources and planting native vegetation. For example, dune erosion resulting from human foot traffic was minimized by a series of three dune crossovers. In areas of excessive soil erosion where off-trail usage has occurred, rails or barriers are constructed to prevent visitors from leaving designated trails. In addition, native vegetation has been planted to stabilize soils in eroded areas along the beach and encourage dune formation.

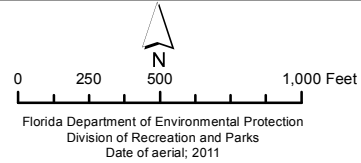


Legend

- 04 - Arents-Urban land complex, 0 to 5 percent slopes
- 09 - Beaches
- 11 - Canaveral-Urban land complex, 0 to 5 percent slopes
- 13 - Cocoa-Urban land complex, 0 to 5 percent slopes
- 27 - Palm Beach-Urban land complex, 0 to 8 percent slopes
- 35 - Quartzipsamments, shaped, 0 to 5 percent slopes
- 44 - Kesson mucky sand, tidal
- 99 - Water

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JOHN D. MACARTHUR BEACH
STATE PARK



SOILS MAP

Minerals

There are no known mineral deposits of commercial value located within John D. MacArthur Beach State Park.

Hydrology

The hydrological resources of John D. MacArthur Beach State Park are divided into two broad categories: surface and ground water. All surface waters within the park are classified as Outstanding Florida Waters in accordance with Chapter 27, Section 403.061 of the Florida Statutes and 62-302.700, Florida Administrative Code. This designation is intended to protect and maintain existing acceptable water quality standards of the park's hydrological systems and prevent further degradation of the water quality of that system. The park's hydrological surface features include the near shore waters of the Atlantic Ocean, the northern section of the Lake Worth Lagoon where the Intracoastal Waterway (ICW) is located, Lake Worth Cove, Little Lake Worth Cove and all associated mangrove wetlands. The ground water resources include the Floridan Aquifer and the Surficial Aquifer. Since the park's largest hydrological features: the Atlantic Ocean, the Lake Worth Lagoon, and both aquifers extend far beyond the boundaries of the park, management of these systems is complex.

Surface water in the park is mostly influenced by the Atlantic Ocean and the Lake Worth Lagoon. Drainage in the park is westward into the Lake Worth Cove and Little Lake Worth Cove. The mean range of the semi-diurnal tide along the beach is about 3 feet, 9 inches (Van de Kreeke and Wang 1978). Because of the low topography of the barrier island, flooding can be a problem that affects the park. A combination of high spring tides and strong easterly winds can "stack up" water along the seashore and the Intracoastal Waterway resulting in localized flooding.

In general, there is good tidal exchange surrounding the park, but both Lake Worth Cove and Little Lake Worth Cove have reduced tidal exchange because of restricted flow at Burnt Bridge on A-1-A regarding the former, and through culverts at the latter.

Originally, the Lake Worth Lagoon was an isolated freshwater lagoon. Beginning in the late 19th century, canals were dredged to connect the coastal lagoons and create the ICW for navigational purposes. Over time, inlets were dredged to improve water circulation in the canal/estuary system and provide access to the Atlantic Ocean. These alterations permanently changed the natural dynamics of Lake Worth Lagoon resulting in the biodiversity found today.

This park does not use the Floridan aquifer because of the depth of the water table and the high level of dissolved solids. Presently, the park and other nearby residents use potable water from utilities that have well fields on the mainland that draw from the surficial aquifer. Increasing demand for water from the surficial aquifer system in the highly populated coastal area of Palm Beach County, Fla., has prompted a need to find supplemental sources of available water for both public

and agricultural use. The virtually untapped Floridan aquifer system can be used to assist in this need. Because of the brackish nature of this groundwater resource, two alternative methods of use are currently expanding: the reverse-osmosis method, and the aquifer storage and recovery (ASR) method.

Within the park, the surficial aquifer is present near the land surface and functions as a freshwater lens. Freshwater being less dense than saltwater is suspended on top of the salt water forming a lens that plants utilize. The survival of barrier island vegetation other than halophytic species is entirely dependent on precipitation and the re-charging of the freshwater lens. Most of the recharge to the surficial aquifer is supplied by rainfall that percolates downward into the aquifer and then moves laterally through the system until it discharges to a surface-water body or to the ocean. Rainfall is abundant in the southeastern portion of the state during the wet season (May to September). During this period, precipitation occurs almost daily due to convective heat and differences between the land and sea. However, the park receives slightly less rainfall than the inland Palm Beach County because of the prevailing southeast winds that carry the rain clouds further inland during the rainy season. Much of the rainfall in the park infiltrates into the shallow unconfined aquifer, yet a large amount runs off or remains at the surface where it is returned to the atmosphere by evapotranspiration. The runoff flows into mangrove wetlands, coves and lagoons within the park.

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, 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 dependant 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.

The park contains five distinct natural communities as well as altered landcover types (see Natural Communities Map). A list of known plants and animals occurring in the park is contained in Addendum 5.

BEACH DUNE

Desired Future Condition: Beach dune is a coastal mound or ridge of unconsolidated sediments found along shorelines with high energy waves. Vegetation will consist of herbaceous dune forming grass species such as sea oats (*Uniola paniculata*) and sand cordgrass (*Spartina alterniflora*). Other typical species may include sea rocket (*Cakile* spp.), railroad vine (*Ipomea pes-caprae*), seashore paspalum (*Paspalum vaginatum*), beach morning glory (*Ipomea imperati*), and beach sunflower (*Helianthus debilis*) along the Atlantic coast. Occasionally shrubs such as seagrape (*Coccoloba uvifera*) may be scattered within the herbaceous vegetation.

Description and assessment: The beach dune community is in good (northern) to excellent (southern) condition and is the only natural community found in management zone MB-07 (Management Zones Map). This community is narrower, steeper at the north end of the park, wider, and flatter at the southern end. The tall, extensive dunes represent one of the best examples of this community in south Florida. The dunes range from a few feet above sea level to 20 feet tall. The best examples of these tall dunes can be seen north of the main crossover. In 2012, Tropical Storm Sandy had eroded some of the larger dunes immediately south of the park's north boundary. The southern portion of the beach dune community is colonized by scattered populations of sea oats, beach spurge (*Chamaesyce* sp.) and railroad vine. The beach dune community is continuously decolonized by plants, since storm waves or high tides disturb it periodically. Beyond the limit of yearly wave action, wind-blown sand can accumulate around plants as they grow upward to form the foredune. Since a supply of loose sand is always present, sand burial is a constant factor on the foredune, its rate dependent on the force and direction of the winds and the mobility of the sand grains (Meyers and Ewel 1990).

Past hurricanes and strong winter storms have caused noticeable erosion along the park's northern beach. This section of the beach dune community becomes narrower and is slower to recover from these storm events than the southern beach. There are several reasons for the differences in the beach width, but the most obvious is the lack of any foredune system on the northern stretch of beach. Along the southern beach, vegetation has established itself and foredunes are forming around these pioneer plants. Foredunes are usually built by grasses whose upward growth keeps pace with sand burial and whose lateral growth helps build a continuous dune ridge (Meyers and Ewel 1990).

The beach community serves as an important nesting habitat for imperiled sea turtles. Florida beaches are one of the three major nesting areas in the world for loggerhead turtles (*Caretta caretta*). Other imperiled sea turtles that use the park for nesting are the leatherback turtles (*Dermochelys coriacea*) and green turtles (*Chelonia mydas*).

General management measures: The principle threat to the beach dune community that includes the park's sandy beaches is erosion caused by natural storm events. Periodic large-scale beach nourishment projects are regularly used in other areas to counteract the effects of erosion. However, with potential impacts to the submerged resources of the park and the temporary loss of nesting habitat for imperiled sea

turtles, careful planning and deliberation must be applied before using this alternative approach. Please refer to the Coastal/Beach Management section for more discussion concerning erosion and beach nourishment issues.

The park will continue to implement management activities to minimize erosion such as the planting of native dune building vegetation, removal of exotic vegetation and establishing designated access trails as needed.

The park will continue to participate in statewide monitoring programs for nesting sea turtles and assist in the recovery efforts for these imperiled species. These programs and efforts are discussed in the Resource Management Program section.

MARITIME HAMMOCK

Desired Future Condition: Maritime hammock is a coastal evergreen hardwood forest occurring in narrow bands along stabilized coastal dunes. Canopy species will typically consist of live oak (*Quercus virginiana*), red bay (*Persea borbonia*), and cabbage palm (*Sabal palmetto*). The canopy will typically be dense and often salt-spray pruned. Understory species may consist of yaupon holly (*Ilex vomitoria*), saw palmetto (*Serenoa repens*), and/or wax myrtle (*Myrica cerifera*). Herbaceous groundcover will be very sparse or absent. Variation in species composition exists along the coast - heading southward, tropical species become more prevalent.

Description and assessment: The tropical maritime hammock at John D. MacArthur Beach State Park represents one of the best examples of this community in Palm Beach County. The hammock has a diverse assemblage of tropical trees and understory making it an ideal stop over for many migratory bird species. The maritime hammock is in excellent condition and is found in management zones MB-04, MB-05, MB-06 and MB-09. The maritime hammock includes a thin, intermittent strip of vegetation behind the beach dune and a mature hammock between A-1-A and Lake Worth Cove. The main portion of the hammock includes many large tropical trees like mastic (*Sideroxylon foetidissimum*) and some temperate species like live oak. There are also some large satin leaf (*Chrysophyllum oliviforme*) trees, a small fresh water depression with pond apple (*Annona glabra*) and a few scattered remnant slash pines (*Pinus elliottii*). The hammock contains several species of exotic invasive plants, with Brazilian pepper being the most significant threat. Through a joint restoration project on Munyon Island, an area of restored maritime hammock was established. Much of the native vegetation had survived the harsh conditions and have grown into a functioning hammock community. However, several species of exotic plants: Jacob's ladder (*Pedilanthus tithymaloides* var *smallii*) and bowstring hemp (*Sansevieria hyacinthoides*), have established sizeable populations.

General management measures: Invasive exotics located in the hammock areas that are accessible by foot are in a maintenance stage. Many of the larger, seed bearing plants have been removed. Park staff will continue to monitor and treat the remaining small patches of herbaceous exotic vegetation where possible. Access to some areas is limited. As Munyon Island is only accessible by boat, removing exotic vegetation from the island requires more planning and effort. The long-term

maintenance of previous exotic removal projects will require periodic treatment to remove any new seedlings or saplings present. The park has a productive greenhouse staffed by volunteers. Many of the native species of plants raised in the greenhouse are used throughout the park on restoration projects.

MANGROVE SWAMP

Desired Future Condition: Mangrove swamp is typically characterized as a dense forest occurring along relatively flat, low wave energy, marine and estuarine shorelines. The dominant overstory will include red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), white mangrove (*Laguncularia racemosa*), and buttonwood (*Conocarpus erectus*). These four species may occur either 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 mangrove in the intermediate zone, and white mangroves and buttonwood 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 salt marsh species predominate. When present, shrub species can include seaside oxeye (*Borrchia arborescens*, *B. frutescens*), and vines including gray nicker (*Caesalpinia bonduc*), coinvine (*Dalbergia ecastaphyllum*), rubbervine (*Rhabdadenia biflora*), and herbaceous species such as saltwort (*Batis maritime*), shoregrass (*Monanthocloe littoralis*), perennial glasswort (*Sarcocornia perennis*), and giant leather fern (*Acrostichum danaeifolium*). Soils will generally be anaerobic and are saturated with brackish water at all times, becoming inundated at high tides. Mangrove swamps will occur on a wide variety of soils, ranging from sands and mud to solid limestone rock. Soils in South Florida are primarily calcareous marl muds or calcareous sands and along Central Florida coastlines, siliceous sands. 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 swamp community represents the largest of the floral-based communities at John D. MacArthur Beach State Park. It is in excellent condition and represents one of the largest remnants of undeveloped, mangrove shorelines remaining in the Lake Worth Lagoon. Over 55% of Lake Worth Lagoon's mangrove habitats are within the park boundaries. This is an assemblage of the three species of mangroves (red, black and white) along with a full complement of halophytic herbs and shrubs. This community is found along the relatively low energy intertidal and supratidal shorelines of the Lake Worth Lagoon, the Lake Worth Cove, and Little Lake Worth Cove located in management zones MB-01, MB-02, MB-03, MB-04, MB-05, MB-06, MB-08 and MB-09.

Unlike most vascular plants, mangroves have managed to adapt to a harsh environment characterized by sustainable, anaerobic sediments, fluctuating water levels and waters with high concentrations of salt. They have accomplished this through evolutionary adaptations of their root systems, morphological and physiological mechanisms for maintaining salt balance, and reproductive dispersal strategies (Meyers and Ewel 1990). The oxygen-poor soil limits root growth to

within a few feet of the surface. Mangroves do not have a deep taproot to anchor them during storm events, but they produce extensive, interlaced, horizontal roots that keep them anchored and help to minimize erosion. Some species, such as the red mangrove, have developed prop roots that extend into the soil bracing the tree during storm events.

Mangroves play an important role in the marine and estuarine ecosystems of the park. They are the primary producers establishing the microbial food web that sustains a wide variety of species. Over 220 fish species have been recorded utilizing the mangrove swamp community at some point during their lifecycle. Important commercial and recreational marine species find food and shelter in the mangrove swamp. The shallow waters, entanglement of roots, and abundant food make this an ideal nursery for fish and invertebrate species such as the spiny lobster (*Panularis argus*), snook (*Centropomus undecimalis*), and mangrove snapper (*Lutjanus apodus*). A wide variety of birds, including the endangered wood stork (*Mycteria Americana*), the double-crested cormorant (*Phalacrocorax auritus*), and the brown pelican (*Pelicanus occidentalis*), use mangroves for nesting, roosting, and protection from predators and the elements. Sessile invertebrates, such as oysters and barnacles, use the network of roots and tree trunks as points of attachment whenever these surfaces are void of macroalgae. Together with the macroalgae, these invertebrates have been documented to filter large volumes of water thereby maintaining water quality within the mangrove community. During periods of tropical storms and hurricanes, mangroves have been shown to baffle storm and wave energy and create an extensive root system that helps to stabilize the shoreline.

Because of the health of this natural community and the scarcity of mangroves in the Lake Worth Lagoon, these mangroves function as a seed source for this section of the lagoon. Palm Beach County biologists have also collected seeds from the park's red mangroves to be grown into saplings that are used for restoration projects in the southern portion of the Lake Worth Lagoon. DRP biologists are careful to permit a limited number of seeds to be removed from the park so that recruitment of saplings within the park boundaries is not disrupted.

General management measures: The major threat to this community is erosion from the high volume of vessel traffic in the ICW. This area of the ICW does not have designated speed zones to help moderate vessel speed. Instead the shallow grass beds and sand bars reduce wave action from vessel wakes. DRP will continue to work with and support efforts by the FFWCC to regulate vessel speed in the Lake Worth Lagoon.

Another potential impact is the degradation of the water quality by point and non-point pollution sources. Storm water runoff from the urbanized areas surrounding the park and the freshwater discharge from drainage canals entering the Lake Worth Lagoon have the potential to adversely impact water quality. Large volumes of surface water high in nutrients such as nitrogen and phosphorous flowing into the estuarine system of the park could alter this system by causing eutrophication and a change in species composition.

The park will also continue to utilize and enforce state and federal regulations and designations to protect these valuable natural resources. Mangroves are designated as essential fish habitat and habitat areas of particular concern (HAPC) by the South Atlantic Fishery Management Council. HAPCs are rare, particularly susceptible to human-induced degradation, ecologically important, and most often found in an environmentally stressed area.

MARINE UNCONSOLIDATED SUBSTRATE

Desired Future Condition: Marine unconsolidated substrate will consist of expansive unvegetated, open areas of mineral based substrate composed of shell, coral gal, marl, mud, and/or sand (sand beaches). The presence of natural marine debris, or wrack, is considered desirable as it greatly enhances nutrient cycling and the food web. Desired conditions include preventing soil compaction, dredging activities, and disturbances such as the accumulation of pollutants.

Description and assessment: The marine unconsolidated substrate is in excellent condition and is located entirely in management zone MB-07. This is a highly variable community covering several different habitats along the high-energy beach from the supratidal zone to the intertidal zone. Sediment is also variable from coarse sand and shell to fine mud. Species composition usually includes those organisms especially adapted for a highly variable community with burrowing abilities or attachment capabilities. In the supratidal zone, such species include common mole crab (*Emerita talpoida*) and variable coquina clam (*Donax variabilis*). Infaunal organisms found here help to support migrating and resident shorebirds.

General management measures: The marine unconsolidated substrate is in the desired future condition. Natural erosion from storms and wave action are to be expected, but the natural process of sand transport and deposition tends to replace the sand on the beach and minimizes any impacts to this community.

ESTUARINE SEAGRASS BED

Desired Future Condition: Estuarine seagrass beds are typically characterized as expansive stands of vascular plants and are one of the most productive communities in the world. Seagrass beds will occur in clear, coastal waters where wave energy is moderate. The three most common species of seagrasses in Florida are turtle grass, (*Thalassia testudinum*), manatee grass, (*Syringodium filiforme*), and shoal weed (*Halodule wrightii*). Other seagrasses of the genus *Halophila* may also occur but will be considerably less common. Seagrass beds require unconsolidated substrate in order to establish their underground biomass root structure. They will typically be found in waters ranging from 20° to 30°C (68° to 86°F) and require clear water for photosynthesis. Seagrass beds will not thrive where nutrient levels are high because of increased turbidity and competition of undesirable algal species.

Description and assessment: Estuarine seagrass beds are located within Lake Worth Cove, Little Lake Worth Cove and along the eastern shore of Lake Worth Lagoon. Like mangroves, they are a "new" community that appeared after the historical

salinity changes of Lake Worth. The seagrass beds can be found in management zones MB-01, MB-03, MB-04 and MB-08.

An ongoing seagrass monitoring program was established in 2010 in partnership with a variety of stakeholders including faculty and undergraduate research assistants from Palm Beach Atlantic University, park staff, scientists and volunteers. All seven of Florida's seagrass species were found in the Cove, including the federally threatened species *Halophila johnsonii* (Johnson's seagrass) as well as *Ruppia maritima* (widgeongrass), a species which has never been documented within the Cove and rarely documented within the lagoon remote from freshwater sources. (Chesnes, et al, 2011). Lake Worth Cove has the highest seagrass diversity of any area in Lake Worth Lagoon and, along with the Indian River Lagoon, has the greatest seagrass diversity of any estuary in the Western Hemisphere (Chesnes, et al, 2011).

Seagrasses are the only flowering vascular plant that lives in the marine environment. Together with a vast assemblage of macroalgae, the seagrass beds at the park are a highly productive benthic community providing food and shelter for a variety of economically important recreational and commercial vertebrate and invertebrate species. In addition, Seagrasses serve as a filter for nutrients thus improving water quality and helps to baffle wave energy, reducing erosion and turbidity. Seagrass also acts as a substrate for epiphytic algae and sessile invertebrates while functioning as a base for detrital food webs.

Several imperiled species utilize the estuarine seagrass beds at the park. In 1998, Johnson's seagrass became the first and only seagrass listed as threatened under the Endangered Species Act. Juvenile green turtles are often observed feeding on submerged aquatic vegetation within Lake Worth Lagoon. The Florida manatee (*Trichechus manatus latirostris*), a subspecies of the West Indian manatee (*Trichechus manatus*), is often observed foraging and cavorting in the shallow seagrass beds.

The park's seagrass monitoring program has identified a significant decline in the abundance and distribution seagrass. Biannual surveys are conducted in Lake Worth Cove. Since 2014, there has been a decrease in the coverage of seagrass within the Cove. This is disturbing since the park once had some of the largest contiguous seagrass beds in Lake Worth Lagoon. What is occurring at the park is indicative of the seagrass community throughout Lake Worth Lagoon. Seagrasses are an important indicator of the environmental health of a water body. According to the Palm Beach County Lake Worth Lagoon Monitoring Project Final Report, (DEP Agreement no. WAP028, PBC no. R2001-0401) revised, November 2003, "untreated stormwater and other non-point source discharges are now considered one of the greatest threats to the health of surface waters and, thus, to seagrasses. Stormwater enters the lagoon through three major drainage canals and hundreds of stormwater outfalls which discharge directly to the lagoon. The sediments contained in stormwater damage seagrass by the formation of a muck layer which, in some areas, may be thick enough to physically prevent the establishment of seagrasses. In addition, wind, wave action and boat wakes re-suspend the top of the muck

layer, clouding the water column which reduces light penetration, reduces the depth of the photic zone, and hence, affects the health and distribution of seagrasses.”

Another area of the park experiencing a decrease in the coverage of seagrass is the western side of Munyon Island. In May 2011, a floating dock was built on the island. The installation of this docking facility has caused both direct and indirect impacts to the nearshore benthic communities as well as Munyon Island itself. Concerns of this dock being constructed along a heavily travelled section of the Intracoastal Waterway prompted designs that would dissipate wave attenuation thereby making the floating docks safer and more accessible. The final design required placing boulders underneath the dock in prefabricated cribs along its entire length. Although this design accomplished its goal of disrupting the wakes from passing boats, the entire structure now exhibits characteristics of a groin. There is minimal flushing and the water is calm behind the dock. This has resulted in an accumulation of a thick sediment composed mostly of silt and mud. This unconsolidated substrate appears to prevent the growth of seagrass.

General management measures: John D. MacArthur Beach State Park has managed Lake Worth Cove as a 'Motor Exclusion Zone' since the park was acquired. Recently, the 'Motor Exclusion Zone' designation was expanded to include additional submerged grass beds located immediately south and adjacent to the Cove. This management strategy effectively reduces the threat of future impacts to these grass beds from boat groundings.

The seagrass monitoring program will continue and may be expanded to include areas that are outside of current park boundaries but lie within the optimal boundary of the park. DRP staff will continue to assist biologists with the Palm Beach County Environmental Resource Management (ERM) Division during the county's seagrass surveys of Lake Worth Lagoon.

The park will continue to be an active partner in supporting Palm Beach County's efforts to improve water quality within Lake Worth Lagoon by reducing freshwater discharge and sediment deposition.

The DRP will examine alternative designs for the docking facility at Munyon Island that will enhance the seagrass community, prevent further erosion of the island and provide public safety.

DEVELOPED

Desired Future Condition: The developed areas within the park will be managed to minimize the effect of the developed areas on adjacent natural areas. Priority invasive plant species (FLEPPC Category I and II species) will be removed from all developed areas. Other management measures include proper stormwater management and development guidelines that are compatible with prescribed fire management in adjacent natural areas.

Description and assessment: Developed areas are found in the following management zones: MB-01, MB-02, MB-04, MB-05, MB-06, MB-08 and MB-09. These areas include residences, a workshop, administrative offices, visitors' parking area, education center, the boardwalk across Lake Worth Cove, two bathhouses, three dune crossovers, pavilions and a floating boat dock on Munyon Island. An aggressive exotic removal program has helped to minimize the spread of invasive exotics. Also, staff are encouraged to plant only native vegetation around buildings and residences for decorative purposes.

General management measures: Control of FLEPPC Category I and II species in this area remains a priority to prevent their spread into the natural communities of the park.

The raised boardwalk and associated pavilions on Munyon Island are being threatened by erosion that was exacerbated by the installation of a docking facility on the island. The DRP will examine alternative designs for the docking facility at Munyon Island that will prevent further erosion of the island and provide public safety.

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.

John D. MacArthur Beach State Park is an active participant in the statewide marine turtle-monitoring program. The park provides critical nesting habitat for three species of sea turtles: loggerhead (*Caretta caretta*), green (*Chelonia mydas*), and leatherback (*Dermochelys coriacea*). In addition, the park serves as a state index and survey beach for nesting sea turtles. During the nesting season, park staff conducts daily surveys of the beach recording the previous night's activities including number of crawls, false crawls, species identification and number of nests. The data collected from the park, in addition to data gathered from around the state, is used by government agencies to formulate policies on nesting sea turtles.

The park utilizes a combination of management strategies that are essential for the recovery of marine turtles. They include the continued support of the marine turtle monitoring program, educational programs on the importance of marine turtles and protection measures such as nesting surveys, light management, and predation control.

The park is permitted under FWC guidelines to offer turtle walks to its visitors. This interpretive program educates the public on the biology, ecology and threats confronting marine turtles. Following a comprehensive classroom presentation, the group is taken to the beach where many people will observe for the first time a female turtle laying her eggs.

The population of nesting marine turtles is stable but tends to follow statewide trends. For example, if the population of nesting loggerhead turtles is in decline around the state, this trend is also reflected in the regional population nesting at the park. The major threats to nesting sea turtles, their nests and turtle hatchlings include predation from natural and introduced animals, disorientation from artificial lighting, habitat loss and impediments to nesting from structures and escarpments.

John D. MacArthur Beach State Park is bordered by affluent residences, many of which use coastal armament as a means of shoreline protection. Seawalls often result in a false crawl where the female turtle cannot access prime nesting beach and she returns to the ocean without nesting. Another consequence of seawalls results in the female turtle nesting low on the beach in an area prone to flooding. This wash over is harmful to the eggs and usually results in a high mortality rate.

The large metropolitan areas of Palm Beach County produce enough artificial lighting to illuminate the western night sky beyond the park. Under these conditions, disorientation of hatchlings would seem to be significantly high. However at the park, disorientation seldom occurs. The tall dunes and associated trees may help diffuse the light. Analysis of the 2013 nesting data seems to confirm these field observations. The report shows that the northern beach which is narrow but has the tallest dunes attracts significantly more loggerhead and green turtles than the southern beach which is broader but has shorter dunes. In fact there is about 3 times as many nests on the north end compared to the south end. The number and frequency of nests decreases where the dune drops lower and the beach gets wider. The 1.8 miles of park beaches receive in excess of 1,500 nests per year; so lighting does not seem to be an issue with female turtles or their young.

The predominant threat to marine turtles and their nests at the Park is predation. Coyotes (*Canis latrans*) and raccoons (*Procyon lotor*) destroy more marine turtle eggs in the park than any other predator. However, a host of predators benefit from the nesting season including ghost crabs (*Ocypode quadrata*), American crows (*Corvus brachyrhynchos*) and spotted skunks (*Spilogale putorius*). Even snakes such as the Eastern coachwhip (*Masticophis flagellum*) have been observed removing hatchlings from a nest.

Park staff has located and monitors known gopher tortoise (*Gopherus polyphemus*) burrow sites. No additional protection measures are required at the time of this writing.

The Florida Manatee (*Trichechus manatus latirostris*) inhabits the waters of Palm Beach County year-round. The park supports the continued designation of manatee protection zones in the ICW and surrounding waters and the posting of manatee warning signs informing boaters that this species may be present. The park is frequently used by FWC and other agencies as an area for rehabilitated manatees to be released back into the wild. Whenever this species is observed by park visitors at John D. MacArthur Beach State Park, staff members provide immediate interpretation.

Many of the listed wading birds such as herons, egrets, roseate spoonbills and woodstorks (*Mycteria americana*) utilize the seagrass beds, sand flats, and mangroves for foraging areas. Although some of the imperiled bird species are not residents of the park, they have been observed using the natural resources of the park. The tropical maritime hammock serves as an important stop over during migration for neotropical migrants such as the worm-eating warbler (*Helmitheros vermivorus*) and the American redstart (*Setophaga ruticilla*). Piping plovers (*Charadrius melodus*) are a winter resident that have been observed foraging and roosting along the beach and grass flats within the park.

Least terns (*Sterna antillarum*) and black skimmers (*Rynchops niger*) forage in marine and estuarine waters surrounding the park. Least terns also loaf on the sandy spit of Munyon Island. Signage and other public information are used to advise park visitors of the need to prevent undue disturbances of loafing terns.

Annual bird census are conducted by DRP biologists and non-governmental organizations, such as Audubon, that help document species and size of populations. In addition, the park will continue to implement a systems management approach that involves managing the resources as a complete ecosystem. This strategy will provide for the resources needed to assist in the recovery and stabilization of the imperiled bird species that use the park.

The DRP will seek a balanced approach to minimize visitor impacts to shorebirds and the park's sensitive coastal habitats, while managing resource-based recreational activities. In collaboration with FWC, other government agencies, local non-governmental organizations, and volunteers, DRP staff will identify and delineate habitats and educate the public about shorebird protection.

Management decisions will be informed by analysis of data on habitat use in the park during prior nesting seasons. This analysis will suggest areas of importance where focused management actions are needed. These actions will typically include:

- Demarcating potential shorebird habitat by enclosing the perimeter of the habitat and buffer area with appropriate fencing and signage.
- Encouraging and focusing visitor activities into areas less suitable for shorebird nesting habitat.
- Monitoring during the nesting season to identify and protect new breeding sites.
- Providing interpretive and educational outreach to the public prior to and during the nesting season to encourage visitor use that protects shorebirds and their habitat.
- When the same breeding sites are used year after year, posting the protected area will occur prior to the season (pre-posting).
- When new breeding sites are indicated, appropriate measures will be implemented, including demarcating new protected areas and expanding or initiating interpretive programs.
- Coordinating with FWC and local law enforcement agencies to ensure compliance with park rules and shorebird protection, as needed.

When it is necessary to limit recreational activities or visitor access to protect nesting habitat, DRP staff or volunteers will provide onsite interpretation to educate visitors about the management of imperiled shorebird habitat and identify suitable recreational areas. These outreach programs will commence prior to nesting seasons and prior to placing limits on access to recreational areas. Pre-posting the identified habitat areas combined with early public notification regarding the park's shorebird protection program will improve visitor compliance with park rules and promote broad-based public stewardship of shorebird nesting, resting, and foraging habitats in the park.

There are six imperiled plants found at John D. MacArthur Beach State Park. Two of the plants are being monitored through designed programs while the other four will be monitored using a more passive observation documentation approach in which the presence of the plant will be documented through casual/passive observation during routine park activities.

The royal palm (*Roystonea regia*) is one of the largest native palms in Florida reaching heights up to 100 feet with a trunk diameter of 20 inches. Historically, the species was once thought to range as far north as Volusia County, but it is now restricted to south Florida. There are only a small number of individuals at the park growing in the maritime hammock. Currently, there are no threats to this species at the park and the population appears to be stable. Although a comprehensive monitoring program is not scheduled for this species, park staff will continue to monitor the royal palm through passive observation and documentation.

The golden leather fern (*Acrostichum aureum*) is a large herbaceous fern that is fast growing and very robust. This species is found in the intermediate estuarine zone in the high intertidal region. At the park, the golden leather fern is restricted to the mangrove systems, however, it can grow in other areas such as fresh water environments and salt marshes. This is a species that is opportunistic and colonizes disturbed areas. Currently, there are no threats to this species at the park and the population appears to be stable. Although a comprehensive monitoring program is not scheduled for this species, park staff will continue to monitor the golden leather fern through passive observation and documentation.

In 2011 and 2014, park staff conducted a project to locate and record the existing sea lavender (*Argusia gnaphalodes*). Sea lavender is native to Southeast Florida and functions as a shoreline erosion control plant. It helps to trap sand and stabilize the dunes on which other plants can become established. Eleven specimens of sea lavender were recorded in 2011; six specimens were recorded in 2014. The difference in recorded specimens is a direct result of Tropical Storm Sandy which caused extensive shoreline erosion. This data will serve as a baseline for a monitoring project to determine the growth and health of this imperiled plant.

Johnson's seagrass (*Halophila johnsonii*) is found in shallow waters that experience minimal disturbance from visitors or vessel traffic. Of the seven species of seagrasses found in Florida, Johnson's seagrass is the only federally threatened species and the only seagrass known to reproduce asexually. Johnson's seagrass

plays a major role in the health of benthic resources as a shelter and nursery habitat. It has been documented as a food source for endangered manatees and threatened green sea turtles. Johnson's seagrass is the rarest species of its genus. It has a limited distribution, limited ability to disperse and colonize habitats because of its asexual reproduction and is dependent on substrate stability. Johnson's seagrass is the least abundant seagrass within its range. It has a disjunct and patchy distribution along the east coast of Florida from central Biscayne Bay to Sebastian Inlet. The largest patches have been documented inside the Lake Worth Inlet. Threats to this imperiled plant include degraded water quality, pollution, storm action and sedimentation, and dredging. It has been documented in the estuarine seagrass bed in Lake Worth Cove and the shallow waters of Lake Worth Lagoon. DRP staff will continue to conduct seagrass surveys within the Cove as part of the seagrass monitoring program at the park.

There are no known seed banks; and although experiments have shown that vegetative fragments survive when transplanted into the field, there is only circumstantial evidence for unassisted recruitment by naturally produced fragments. Thus, the plant has a reduced capacity to repopulate an area if lost due to human or environmental perturbations. The apparent lack of sexual reproduction suggests this species may have limited genetic diversity. Because of its small size and minimal stored reserves, local populations may decline during periods of unfavorable conditions, be out-competed by larger seagrasses, or become overgrown by macroalgae. *Halophila johnsonii* is particularly vulnerable to sediment disturbances, trampling, and prop scarring due to its fragile nature and predominantly shallow growth habit; and, for these reasons, it will have a limited recovery potential (NOAA, 2002, Final Recovery Plan for Johnson's Seagrass (*Halophila johnsonii* Eiseman)).

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.

Table 2. Imperiled Species Inventory

Common and Scientific Name	Imperiled Species Status				Management Actions	Monitoring Level
	FWC	USFWS	FDACS	FNAI		
PLANTS						
Golden leather fern <i>Acrostichum aureum</i>			LT		10	Tier 1
Sea lavender <i>Argusia gnaphalodes</i>				G4, S3	2, 10	Tier 2, Tier 3
Johnson's seagrass <i>Halophila johnsonii</i>		LT	LT	G2, S2	10, 13	Tier 2, Tier 3
Burrowing four-o'clock <i>Okenia hypogaea</i>				G3, S2		
Hand Fern <i>Ophioglossum palmatum</i>				G4, S2		
Florida royal palm <i>Roystonea regia</i>				G2, S2	2, 10	Tier 1
BIRDS						
Piping plover <i>Charadrius melodus</i>		LT			9, 10, 13	Tier 2, Tier 3
Little blue heron <i>Egretta caerulea</i>	SSC			G5, S4		Tier 1
Reddish egret <i>Egretta rufescens</i>	SSC			G4, S2		Tier 1
Snowy egret <i>Egretta thula</i>	SSC			G5, S3		Tier 1
Tricolored heron <i>Egretta tricolor</i>	SSC			G5, S4		Tier 1
Swallow-tailed kite <i>Elanoides forficatus</i>				G5, S2		Tier 1
White ibis <i>Eudocimus albus</i>	SSC			G5, S5		Tier 1
Merlin <i>Falco columbarius</i>				G4, S2		Tier 1
Peregrine falcon <i>Falco peregrinus</i>				G4, S2		Tier 1
Southern bald eagle <i>Haliaeetus leucocephalus</i>	LT	LT		G4, S3		Tier 2, Tier 3
Worm-eating warbler <i>Helmitheros vermivorus</i>				G5, S1		Tier 1
Wood stork <i>Mycteria americana</i>	LE	LE		G4, S2		Tier 2, Tier 3

Common and Scientific Name	Imperiled Species Status				Management Actions	Monitoring Level
	FWC	USFWS	FDACS	FNAI		
Osprey <i>Pandion haliaetus</i>	SSC			G5, S3S4		Tier 1
Brown pelican <i>Pelecanus occidentalis</i>	SSC			G4, S3		Tier 2, Tier 3
Black skimmer <i>Rynchops niger</i>	SSC			G5, S3		Tier 2, Tier 3
American redstart <i>Setophaga ruticilla</i>				G5, S2		Tier 2, Tier 3
Least tern <i>Sterna antillarum</i>	LT	LE		G4,S3	10, 13	Tier 2, Tier 3
FISH						
Mangrove rivulus <i>Rivulus marmoratus</i>	SSC					Tier 1
MAMMALS						
Florida manatee <i>Trichechus manatus latirostris</i>	LE	LE		G2, 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.

Detailed management goals, objectives and actions for imperiled species in this park are discussed in the Resource Management Program section of this component and the Implementation Component of this plan.

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.

Detailed management goals, objectives and actions for management of invasive exotic plants and exotic and nuisance animals are discussed in the Resource Management Program section of this component.

Exotic plants will continue to be a resource management issue at the park due to its close proximity to urban landscaping and the size and location of exotic infestations within park boundaries. One of the overall goals for the park is to achieve a maintenance phase for each management zone. Due to the efforts of DRP staff either through funding contractor projects or by conducting in-house treatment of infested areas, the entire park is experiencing a maintenance phase of 83 percent as of this writing. No additional exotic plant surveys are required however staff will note the presence of any exotic vegetation while conducting routine duties.

Several large projects have helped to achieve this successful exotic removal program at the park. Previously, the largest problem was pockets of Brazilian pepper (*Schinus terebinthifolius*) in various parts of the hammock community. In 2006 a contractor project was funded by DEP's Bureau of Invasive Plant Management (BIPM) to remove 5.5 acres of heavily infested Brazilian Pepper in management zone MB-02. The project was in the hammock in the northwest area of the management zone. In 2007 another contractor project was funded by DRP to treat 60 acres of hammock in zone MB-02. Species that were treated included

Brazilian pepper, java plum (*Syzygium cumini*), bishopwood (*Bischofia javanica*), Australian umbrella tree (*Schefflera actinophylla*), carrotwood (*Cupaniopsis anacardioides*), Surinam cherry (*Eugenia uniflora*) and areca palm (*Dyopsis lutescens*). A contractor project in 2009 funded by the DRP targeted 13 acres in management zone MB-05 and 12 acres in zone MB-06. The treatment area was the hammock/beach dune from the top of the dune line west to the mangrove fringe. Species that were treated include Brazilian pepper, beach naupaka (*Scaevola taccada*), carrotwood, bowstring hemp (*Sansevieria hyacinthoides*), rosary pea (*Abrus precatorius*) and Portia tree (*Thespesia populnea*). Principally, maintenance and monitoring of these areas are conducted by DRP staff on regular intervals or as resources allow. However, in 2013 a contractor project funded by the USFWS Coastal Ecosystem Grant through the Treasure Coast Cooperative Invasive Species Management Area group (TC CISMA) provided retreatment of the same areas that were treated in 2009.

One of the major obstacles for the exotic control and removal program at Munyon Island is accessibility which is limited to watercraft. There are additional concerns and issues that must be addressed for all projects since they are limited by logistics, the scope of work and the equipment that can be transported. This often increases the funding that is required for large-scale restoration projects. Once on the island, treating certain exotic infestations can be challenging because some areas of the natural communities are isolated and inaccessible. However, because of the cultural resources and the high costs of previous restoration projects, exotic removal on Munyon Island remains a high priority for the park.

Many invasive exotic plants occur on and adjacent to disturbed land. Threats for new invasions come from several sources: exotics already established in the park, seed dispersal by natural means (birds, wind, water, etc.) and neighboring developments. These areas are a high priority for exotic plant treatment wherever feasible because they threaten rare habitats and function as a seed source.

The red lionfish, *Pterois volitans*, is an Indo-Pacific marine fish that has been recently introduced to the east coast of the United States including coastal Florida, which many believe to be the site where the first lionfish was introduced. Lionfish were first observed in park waters in 2010. They are an ambush predator that prefers the ledges and crevices of the marine consolidated substrate. However, lionfish are able to tolerate salinity differences over a large range from ocean to brackish waters. Consequently, individuals have been removed from the dock at Munyon Island. Lionfish are being found in the mangrove swamps of the Lake Worth Lagoon. This is particularly disturbing since these mangrove swamps serve as a nursery for important commercial and recreational fish species. Currently, DRP staff are able to manage and remove the small numbers of lionfish that have been found in the park. The majority of removals have occurred on the near shore reef, but one lionfish was removed from the dock at Munyon Island.

Coyotes (*Canus latrans*) have established a population of unknown size in natural areas north of the park. They travel south along county beaches destroying marine turtle nests and feeding on turtle eggs. Coyotes have been photographed on the

park beach using motion sensitive cameras. Staff have observed a coyote feeding on emerging hatchlings. In addition to the threat posed to imperiled marine turtles, coyotes can spread disease such as distemper, parvo virus, hepatitis, mange and rabies. Coyotes can also carry parasites like fleas, ticks, mites and worms. Coyotes are now the predominant predator at the park and depredate more turtle nests per year than all other predators.

Raccoons (*Procyon lotor*) are an abundant native species that impact sea turtle conservation at many Florida beaches through nest depredation (Stancyk, 1982). Compounding the problem, raccoon populations flourish in association with humans because they often receive artificial support through refuse or direct feeding (Smith and Engeman, 2002). They are one of the top predators on marine turtle nests at John D. MacArthur Beach State Park preying on eggs and hatchlings. Like coyotes, raccoons can spread disease such as distemper, parvo virus, hepatitis, mange and rabies, and carry the same parasites.

Monitoring of nest predation is noted during daily nesting surveys. In an effort to reduce predation rates and help in the recovery of the three listed species of sea turtle, a trap and removal program has been implemented at the park (see Goals and Objectives). All predators trapped under this program are removed according to the protocols set forth in the Florida Park Service Operations Manual. Predator removal programs have proven very successful. A study was conducted on The Hobe Sound National Wildlife Refuge (HSNWR), which forms the southern boundary of the St Lucie Inlet Preserve State Park. Prior to a predator control program, historical nest predation at HSNWR was 95%. Consequently, predator control was identified as the most important conservation tool at HSNWR, and predator removal program was implemented in the early 2000's. Predator control optimized by predator monitoring led to highly successful results whereby predation had been reduced to low levels (7–13.5% of monitored nests) in 2002 and 2003 (Engeman and Smith, 2006).

Table 3 contains a list of the Florida Exotic Pest Plant Council (FLEPPC) Category I and II invasive, exotic plant species found within the park (FLEPPC, 2011). 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.

Table 3. Inventory of FLEPPC Category I and II Exotic Plant Species			
Common and Scientific Name	FLEPPC Category	Distribution	Management Zone (s)
PLANTS			
<i>Abrus precatorius</i> rosary pea	I	2	MB-02, MB-08, MB-09
<i>Bischofia javanica</i> bishopwood	I	2	MB-02, MB-05
<i>Casuarina equisetifolia</i> Australian-pine	I	1	MB-09, MB-08
		2	MB-05, MB-02
<i>Cupaniopsis anacardioides</i> carrotwood	I	2	MB-02, MB-05, MB-06, MB-08, MB-01, MB-09
<i>Jasminum dichotomum</i> Gold Coast jasmine	I	3	MB-09
<i>Scaevola taccada</i> beach naupaka	I	2	MB-01, MB-08, MB-05
<i>Schefflera actinophylla</i> schefflera	I	2	MB-05, MB-02, MB-08, MB-06
<i>Schinus terebinthifolius</i> Brazilian pepper	I	2	MB-09
		3	MB-05, MB-08, MB-06, MB-02, MB-01
<i>Syngonium podophyllum</i> arrowhead vine	I	2	MB-02
<i>Syzygium cumini</i> Java plum	I	2	MB-08, MB-02
<i>Thespesia populnea</i> seaside mahoe	I	2	MB-05, MB-01, MB-08, MB-06
<i>Antigonon leptopus</i> coral vine	II	2	MB-09
<i>Cocos nucifera</i> coconut palm	II	2	MB-09, MB-06, MB-05, MB-01
<i>Epipremnum pinnatum</i> pothos	II	2	MB-02
<i>Sansevieria hyacinthoides</i> bowstring hemp	II	2	MB-01, MB-06
		3	MB-09, MB-08, MB-02

Common and Scientific Name	FLEPPC Category	Distribution	Management Zone (s)
<i>Sphagneticola trilobata</i> <i>wedelia</i>	II	2	MB-01, MB-02, MB-08
<i>Syagrus romanzoffianum</i> <i>queen palm</i>	II	2	MB-02
<i>Vitex trifolia</i> <i>simple-leaf chaste tree</i>	II	2	MB-01

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.

Special Natural Features

The tropical maritime hammock at John D. MacArthur Beach State Park represents one of the best examples of this community in Palm Beach County. The hammock has a diverse assemblage of tropical trees and understory making it an ideal stop over for many migratory bird species. This community is listed by FNAI as imperiled in Florida with fewer than 253 recorded locations (FNAI, 1999). Generally, because of the cooler weather, tropical species rapidly decline from Palm Beach County northward along the coast to Cape Canaveral. At the park, the vegetation is primarily tropical (mastic and pigeon plum) with some temperate (live oak and red bay) plants. Commercial and residential development along the southeast coast of Florida have greatly reduced and fragmented this community. The examples seen in south Florida today represent remnants of a once extensive system. Because of the desirability for development of the remaining coastal property in south Florida, it is certain that the remaining examples of this community will become even more endangered outside of protected areas.

A patchy reef system comprised of exposed limestone from the Anastasia formation runs parallel to the shore and is accessible from the beach. Many park visitors take the opportunity to explore this near shore reef by snorkel. Over 90 species of fish have been identified using the rocky outcrops for shelter, food and resting. Marine turtles are also seen resting and foraging along the reef.

Aggregations of worm reefs can also be found on the near shore reef. Worm reefs are listed as an imperiled natural community both globally and statewide. They are constructed by a tropical marine worm (*Phragmatopoma lapidosa*) that cements

together grains of sand with a protein to form narrow tubes. These reefs grow as larvae build on the existing tubes. The worm reefs in the park are small in comparison to other areas but are in excellent condition.

The beach provides critical nesting habitat for three imperiled marine turtle species: the threatened loggerhead sea turtle, *Caretta caretta*, the endangered green sea turtle, *Chelonia mydas*, and the endangered leatherback sea turtle, *Dermochelys coreacea*. John D. MacArthur Beach State Park averages a higher nesting rate than any other Florida State Park and serves as the primary nesting beach in southeast Florida.

The park also contains one of the best examples of a mangrove fringed shoreline and mangrove swamp in Palm Beach County. The park has one of the longest mangrove fringed shorelines in the Lake Worth Lagoon. In general, red mangroves are typically found in the intertidal zone, while black mangroves are dominant in the upper portion of the intertidal zone (Odum and McIvor, 1990). White mangroves are usually found in patches near a natural disturbance and occur in less frequently flooded areas of the mangrove community. This ecosystem serves as an important nursery for fishes and invertebrates as well as offering protection to uplands by suppressing storm surges. In addition, the mangrove community is an important nesting and roosting site for many wading birds.

The seagrass beds found in the calm waters of Lake Worth Cove, are one of the most productive and diverse natural communities at the park providing food and shelter for a variety of economically important recreational and commercial vertebrate and invertebrate species.

All seven of Florida's seagrass species were found in the Cove, including the federally threatened species *Halophila johnsonii* (Johnson's seagrass) as well as *Ruppia maritima* (wigeongrass), a species which has never been documented within the Cove and rarely documented within Lagoon remote from freshwater sources. (Chesnes, et al, 2011). Lake Worth Cove has the highest seagrass diversity of any area in Lake Worth Lagoon and, along with the Indian River Lagoon, has the greatest seagrass diversity of any estuary in the Western Hemisphere (Chesnes, et al, 2011).

Several imperiled species utilize the estuarine seagrass beds at the park. In 1998, Johnson's seagrass became the first and only seagrass listed as threatened under the Endangered Species Act. Juvenile green turtles are often observed feeding on submerged aquatic vegetation within Lake Worth Lagoon. The Florida manatee (*Trichechus manatus latirostris*), a subspecies of the West Indian manatee (*Trichechus manatus*), is often observed foraging and cavorting in the shallow seagrass beds.

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 at the end of this section.

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: The park lies within the Circum-Glades archeological region of Florida. Proximity to the ocean, estuarine and freshwater environments, made the coastal zone an important region during much of the prehistoric period supplying many necessary resources such as food, water and tools. The aboriginal populations living in the vicinity of the park were the Ais and Jaega. Both of these small groups inhabited the lagoons and inlets of the south Atlantic during the time when the Spanish were increasing their explorations of Florida. Repeated conflicts with the Europeans and exposure to foreign diseases resulted in their decimation and dispersal by the mid eighteenth century.

Although Spanish explorers came to the area in the sixteenth century, Palm Beach County was not settled until somewhat late in the nineteenth century when permanent homesteads were established. Within the park, the most notable homestead was located on Munyon Island.

Munyon Island was once referred to by the Seminoles as "Nuactsahoo" meaning "pelican." This was the largest colonial water bird rookery in the area. In 1874, plume hunters killed or frightened the birds away and they never returned.

Munyon Island was acquired from the State in 1889 by a couple named Pitts and was renamed Pitts Island. The Pitts built a large house at the south end of the island and planted many exotic, ornamental shrubs and fruit trees. The island was the subject of many articles in national magazines and reported to be "the most picturesque spot" in Florida.

In 1901, Dr. James M. Munyon acquired the island from the Pitts. Dr. Munyon had made his fortune selling patent medicines in the northeast. He added to the landscaping, put in shell roads and enlarged the Pitts' house to five stories renaming it the "Hygeia Hotel." He catered to many ailing, wealthy northerners, who came for the scenery, healthful sulfur water, and fermented papaya juice called "Munyon Paw-Paw" tonic.

The hotel and some of the grounds burned in 1915. The island then remained largely uninhabited, and the ornamental garden and shrubs languished from storms and neglect. In 1936, and again in 1959-60, spoil material dredged from Lake Worth was placed along the western edge of the island almost tripling its original size.

The next owner of the island and the remainder of the park property was John D. MacArthur, for whom the park is named. He was a billionaire when he passed away in 1978. MacArthur made his fortune in insurance and real estate, and passed on the bulk of his fortune to the John D. and Catherine T. MacArthur Foundation, from which the state received the park property in 1981.

The Florida Master Site File lists four historic archeological sites within the boundaries of John D. MacArthur Beach State Park.

The largest site encompasses all of Munyon Island (PB00079) and is listed as a historic refuse site that contains remnants of the Hygeia Hotel. The hotel was operated by Dr. Munyon as a health resort during the 1890's. The only remains of the hotel are some of the foundation stones and a small section of seawall made from native rock. These remains are located on the south end of the island. The seawall and old dock alignment are exposed to wave action and are threatened by erosion. In addition to the hotel site, subsequent surveys have identified an old homestead site dating from the mid 1800's and an Indian midden.

The next site (PB00214) was uncovered during the 1984 preconstruction survey and is described as an aboriginal midden located in the primary dune system. This is a fairly large midden that extends for over 100 feet along the dune and has had several pieces of Glades Plain pottery recovered, as well as fish and turtles bones. This site was further studied in 1988 and given a date of Glades III. This is a significant site merely from its location on the ecotone between a once fresh water lake (Lake Worth Cove) and the salt water/beach environment. It could potentially provide useful information on prehistoric food gathering and dietary habits in these environments. The site appears to have been utilized for a long period and might reveal how adaptive changes occurred through time.

The Singer Island Midden 3 (PB06298) is located along the shore of the Lake Worth Lagoon in the vicinity of the park shop compound. It appears to be a relatively large shell midden. This area is listed as partially disturbed, but with large undisturbed areas. It is thought that this midden dates to the same period as PB00214. It is believed that this site was used for the collection of oysters in Lake Worth while PB00214 was used for harvesting marine turtles, marine foods, and materials from ship wrecks. This site produced St. Johns Check Stamped sherds and large amount of oysters.

Another site (PB00215) that is listed as a historic refuse site is located on the edge of A1A in a small grove of palm trees. This site is marked by a broken concrete slab and fragments of 19th century bottle glass and ceramics. It is believed this site was associated with Munyon Island.

A predictive model for John D. MacArthur Beach State Park was completed in 2013. Although the majority of the park (43.19%) was delineated as having lower sensitivity valuation, a new archeological site was recorded to the FMSF. Site 8Pb16069, an unspecified structure ruin comprised of a small rectangular concrete and mortar foundational wall feature (measuring approximately 6 x 6 ft., was recorded using GPS point data and photographs. The site is at the northern end of the park and in the general vicinity of the prehistoric site 8Pb6298.

Condition Assessment: The Singer Island Midden 3 (PB06298) and site PB00215 are in good condition and are located in areas where there is minimal activity or erosion. In addition, the Singer Island Midden 3 is afforded additional protection from vandalism due to its close proximity to the park residences and the shop compound.

The aboriginal midden, Singer Island Midden II (PB00214), on the west face of the primary dune is threatened by the seasonal beach erosion of the primary dune system. The condition of this site is fair. The site has been significantly damaged by hurricanes and in some areas the layers of midden are exposed. Every year, the pattern of winter and tropical storms relentlessly strike the Florida coast. The park beach erodes and accretes with this cyclic pattern. DRP has planted the area in front of Singer Island Midden II with native beach vegetation in an effort to create a buffer of dunes.

The majority of Munyon Island (PB00079) is in good condition. The seawall at Munyon is exposed to wave action passing boats and threatened by erosion. Munyon Island is located along the ICW in an area that experiences a high volume of vessel traffic. The development of dock facilities on the island have exacerbated erosion along the western side including seawall.

General Management Measures: It is the assessment of DRP that neither of the two threatened sites: Singer Island Midden II (PB00214) and Munyon Island (PB00079), will be able to attain a good desired future condition. Both sites are affected by environmental conditions that are beyond the scope of management for the park. Hurricanes, tropical storms and strong winter storms impact the park every year. It is impossible to predict with certainty when and where these destructive natural forces will strike and imprudent to believe that available management measures will withstand these forces. In addition to the erosion caused by storms, Munyon Island also experiences erosion from the wave action caused by water craft of varying size from jet skis to large yachts.

The location of the park also makes it difficult to implement management strategies for achieving a good desired future condition. The park is situated on a barrier island surrounded by two bodies of water: the Atlantic Ocean and the Lake Worth Lagoon, that extend far beyond the boundaries of the park. Management of these systems is complex.

The park will consider all options to determine which, if any, management strategy will be successful without further impacting the natural resources. To stabilize the beach, the park will continue to plant native vegetation in an effort to promote the formation of dunes. The park will also consider other measures such as installing small wooden picket fences to promote dune formation. The park will continue to support efforts to regulate the speed of vessels in this area of the ICW. Currently, the recommend treatment for all 4 archeological sites in the park is preservation. In addition all of the sites will be monitored, any stabilization issues addressed, and additional information or data relative to any of the sites submitted to DHR/FMSF.

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: No historical structures are located on John D. MacArthur Beach State Park.

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. Table 4 contains the name, reference number, culture or period, and brief description of all the cultural sites within the park that are listed in the Florida Master Site File. The table also summarizes each site's level of significance, existing condition and recommended management treatment. An explanation of the codes is provided following the table.

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.

Currently, there are no collections at John D. MacArthur Beach State Park

Table 4. Cultural Sites Listed in the Florida Master Site File					
Site Name and FMSF #	Culture/Period	Description	Significance	Condition	Treatment
PB06298 Singer Island Midden 3	Historic/Unspecified	Archaeological Site	NE	G	P
PB00215 MacArthur Beach Recreation Area	Historic/Unspecified	Archaeological Site	NE	G	P
PB00214 Singer Island Midden 2	Historic/Unspecified	Archaeological Site	NE	G	ST, P
PB00079 Munyon Island	Historic/Unspecified	Archaeological Site	NE	G	ST, P
PB16069 Singer Island	Historic/Unspecified	Archaeological Site	NE	G	P

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

Resource Management Program

Management Goals, Objectives and Actions

Measurable objectives and actions have been identified for each of the DRP's management goals for John D. MacArthur Beach 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.

Natural Resource Management

Hydrological Management

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.

There are no hydrological restoration needs at John D. MacArthur Beach State Park. Although no specific hydrological management is necessary at the park, staff will comply with best management practices to prevent further degradation of the hydrological resources or other impacts to water resources offsite.

Action 1 Monitor water quality at the park

John D. MacArthur Beach State Park is surrounded by tidal wetlands (mangroves), estuarine open water and marine systems. Water is perhaps the most important influence on the uniqueness of a barrier island. Anything that degrades water quality can affect the natural environment and visitors to the park.

The issue of maintaining good surface water quality in John D. MacArthur Beach State Park extends beyond the park's wetlands. Point sources and non-point sources of surface water pollution coming into the park should be identified and proposed to regulating agencies for remediation. Every effort should be made to support acquisition programs for preservation of all wetlands within the unit's drainage basin.

DRP staff will continue to monitor the hydrological resources and continue its tradition of close cooperation with state and federal agencies and independent researchers engaged in estuarine research and monitoring programs in the area. The Division will rely on agencies such as the SFWMD, FWC, and FDEP to keep it apprised of any local declines in surface water quality or increases in saltwater intrusion. Biological staff in District 5 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 will promote protection of the park's hydrological resources.

Action 2 Address a small outflow from affluent property to the North of the park

The Lost Tree Village community is situated along the northern boundary of the park. A small outflow from the community's retention pond drains into the mangrove swamp that, in turn, drains into Lake Worth Cove. DRP biologists will collect water samples from the drainage for analysis. If results indicate that the outflow is adversely impacting the natural resources of the park, state and county

regulatory agencies will be notified of the violation and enforcement proceedings will be undertaken.

Natural Communities Management

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 0 acres of the park maintained within the optimum fire return interval.

Prescribed burning has not been conducted at John D. MacArthur Beach State Park. There are no fire dependent natural communities and no natural communities that will accept fire except for the maritime hammock. Natural fires in maritime hammock probably occur no more often than once every 26 to 100-year period; consequently, prescribed fire is not planned for the unit. Since no communities will be managed through prescribed burning, no annual burn plan is required.

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.

Objective B: Conduct habitat/natural community restoration activities on 1 acre of beach natural community

- Action 1 Develop/update site specific restoration plan
- Action 2 Implement restoration plan

A boat dock facility was completed in 2012 on Munyon Island as part of a statewide program to increase boater access on public lands. The entire structure is an L-shaped concrete pier extending from the beach on Munyon Island with 20 floating boat slips on the inside. The proximity of Munyon Island to the ICW was a concern for the engineers. There is a high volume of vessel traffic creating numerous boat wakes. In an effort to reduce wave attenuation to attain calm conditions at the floating boat slips, boulders were placed under the L-shaped pier. Although the placement of these boulders effectively reduced wave action from the boating activity in the ICW, they have also exacerbated erosion of the island's beach. The boat dock has taken on the characteristics of a groin where sediment accretes at the base of the structure while the beach erodes on either side. The erosion has begun to threaten structures on the island forcing the park to close a beach access and over 500 feet of visitor service boardwalk, as well as the Park Service dock.

District and park staff will work with DRP engineers to develop a restoration plan that will ultimately restore the beach to preconstruction condition. Both biologists and engineers will study the feasibility of altering the dock structure to reduce the rate of erosion and define a mechanism that will allow sand to accumulate on the beach. Developing a restoration plan that will involve this type of skilled labor is beyond the scope of this document. Regardless of the type of restoration plan to be developed and implemented, there will be an associated monitoring component with protocols to help determine the success of the project.

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 park.

Objective C: Conduct natural community/habitat improvement activities on 0 acres of natural communities

No natural community improvements are planned for this park.

Imperiled Species Management

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 animal

Objective B: Monitor and document 3 selected imperiled animal species in the park.

- Action 1 Implement monitoring protocols for 3 imperiled animal species including marine turtles.

John D. MacArthur Beach State Park is an active participant in the statewide marine turtle monitoring program. Monitoring protocols have been established by the Florida Fish and Wildlife Conservation Commission (FWC). Three species of marine turtles--loggerhead, green, and leatherback--use the beach for nesting. The park serves as a state index and survey beach for nesting marine turtles. During the nesting season, DRP staff conduct daily surveys of the beach recording the previous night's activities including the number of crawls, false crawls, species identification and the number of nests. A representative sample of nests are designated for nest productivity analysis to help determine the number of hatchlings produced from the park. In addition to the daily surveys, the park also participates in the state's marine turtle stranding and salvage program that collects data on stranded, injured or dead marine turtles. The data collected from the park are used by state and federal agencies to formulate policy on nesting marine turtles.

Objective C: Maintain predation levels of marine turtle nests at or below ten percent.

- Action 1 Implement predator removal program to reduce predation levels on imperiled marine turtles.

Predation from natural and introduced animal species is one of the major threats to marine turtle nests and hatchlings. Raccoons and coyotes are the primary predators in the park. Depredation is a part of the natural system and, to a certain extent, compensated by the high reproductive output of sea turtles. However, predators will sometimes become so proficient at finding and destroying nests that they may threaten all the nests on a beach. Resource managers may sometimes control predators such as raccoons by trapping and removing nuisance animals from the beach. DRP staff use a predator trap and removal program to maintain predation levels at or below the required ten percent that was established by the FWC. Raccoons are opportunistic predators that have adapted well to coexist in the urban developments throughout Florida. Scientific documentation indicates that certain behavior is learned and passed on from adult raccoons to their offspring. During the marine turtle nesting season, the population of raccoons raiding nests on the beach increases. For these reasons, the screening does not always prevent nest depredation by raccoons, so it becomes necessary to remove the nuisance predator from the park. The predator removal program is an effective means of controlling nest depredation and is administered by the United States Department of Agriculture.

Objective D: Minimize coastal armament and other impediments to nesting by working closely with regulatory and coastal engineering agencies.

- Action 1 The DRP will work closely with other agencies and contractors to minimize impacts to nesting turtles by continuing to conduct nesting surveys to ensure work is restricted to non-nesting season.

Beach nourishment projects alter the physiology and topography of the beach and pose another threat to nesting marine turtles. Following beach nourishment, a certain amount of scarping will take place along the mean high-water line where the waves continuously erode the recently deposited beach sand. Over time, the height and severity of the escarpments will decrease to form a more gradual slope. Depending upon the severity, these escarpments can be a hindrance to nesting marine turtles by preventing their access to the beach. Immediately following a beach nourishment project, nesting frequencies drastically decrease. It may take as long as three years for nesting frequencies to return to levels experienced prior to beach nourishment.

Objective E: Monitor and document 2 selected imperiled plant species in the park.

- Action 1 Implement monitoring protocols for 2 imperiled plant species including Johnsons' seagrass and sea lavender.

The current seagrass monitoring program at the park was implemented in 2010 and has established protocols for identifying the species and abundance of all seagrasses in Lake Worth Cove including Johnson's seagrass. The park has partnered with a variety of stakeholders including faculty and undergraduate research assistants from Palm Beach Atlantic University, DRP staff, scientists and volunteers. Monitoring takes place biannually; during the winter to capture the dormant season and at the end of summer to capture the growing season.

The population of sea lavender appears to be doing well in isolated pockets at the base of the dunes. The population is susceptible to impacts from periodic tropical storms. Park staff implemented a monitoring program for sea lavender in 2010 but was unable to continue the program because of a lack of resources. However, in 2014, the park established baseline data recording the location of all individual colonies, the height and width of the colony and the current health. Monitoring will be conducted biannually and following any tropical storm.

Exotic Species Management

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 3 acres of exotic plant species in the park.

- Action 1 Annually develop/update exotic plant management work plan.
- Action 2 Implement annual work plan by treating 3 acres in park, annually, and continuing maintenance and follow-up treatments, as needed.

The DRP defines the acreage of exotic plants proposed for treatment as an infested area. An infested area is the approximate area of land (in acres) covered by the invasive plants if the plants were accumulated into one area. This distinction more accurately estimates the actual quantity of plants removed. DRP staff will conduct exotic removal treatment at the park for Category I and II invasive exotics. The park will annually identify areas where exotic treatment will take place during the course of the year. The goal will be to treat exotic species that either have re-sprouted or have recruited into natural communities following previous exotic removal treatments. All communities, including developed, will be targeted. Continuous monitoring and maintenance activities to control re-growth and new infestations will be implemented by DRP staff. Vegetative surveys will continue to be conducted to ascertain the presence of new exotic species.

Objective B: Implement control measures on 1 exotic animal species in the park.

- Action 1 Conduct biannual lionfish surveys

Lionfish were first sighted in park waters in 2009. DRP biologists have organized lionfish surveys with park staff and biologists from other divisions and agencies to locate and remove all fish that are found. These surveys are conducted periodically, and they have maintained the lionfish population in the park at manageable levels. Fortunately, the park has not experienced the great numbers of these fish that other areas have seen. The DRP follows policies and guidelines for managing this invasive exotic established by FWC.

Cultural Resource Management

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 John D. MacArthur Beach State Park.

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

The management of cultural resources is often complicated because these resources are irreplaceable and extremely vulnerable to disturbances. The advice of historical and archaeological experts is required in this effort. All activities related to land clearing, ground disturbing activities, major repairs or additions to historic structures listed or eligible for listing in the National Register of Historic Places must be submitted to the 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 5 of 5 recorded cultural resources in the park.

Action 1 Complete 5 assessments/evaluations of archaeological sites.

Park staff will complete assessments of all 5 known archaeological sites in the park. Of these sites, 3 are in areas that limit threats to the current condition of the site. The treatment plan calls for preservation. The remaining 2 sites have a treatment plan that calls for preservation but also includes stabilization. The Singer Island Midden located at the base of the dunes on the beach is subject to erosion from seasonal storms. The Munyon Island seawall and old dock alignment are exposed to wave action and are threatened by erosion. Photo points will be a useful tool to compare the current condition of the 5 sites with previous evaluations. Park staff will work closely with state archeologists to implement strategies to stabilize those sites that are immediately threatened.

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

Action 1 Ensure all known sites are recorded or updated in the Florida Master Site File.

Beginning in 1984, there have been eight archaeological surveys of varying intensity and scope within areas covered by the current park boundary. These projects range from monitoring, to resource surveys by DHR archaeologists, to CRAS projects and a Phase I Historical and Archaeological assessment involving the Munyon Island and Hygeia Hotel vicinity of the park. In addition, a predictive model was completed in 2013 that revealed a new archeological site that has since been recorded in the Florida Master Site File (FMSF). The present model was created for terrestrial site sensitivity only. The predictive model concludes that all of the archaeological sites previously recorded with the FMSF, fall within high or medium sensitivity areas for this park. The report also delineates some 43.19% of the park areas as having lower sensitivity valuation.

Objective C: Bring 1 of 5 recorded cultural resources into good condition.

- Action 1 Design and implement regular monitoring programs for 5 cultural sites.
- Action 2 Create and implement a cyclical maintenance program for 1 cultural resource.

The park will work with state archeologists to design a monitoring program that will enable staff to conduct annual monitoring of the 5 archeological sites located within the park. Monitoring will also take place following episodic events such as tropical storms/hurricanes to ascertain the damage to the site and what immediate action, if any, is required to stabilize the site. The park acknowledges the historical importance of these sites and the need for a monitoring program to determine each sites' current condition and to monitor improvements or deterioration of that current condition. The monitoring program will also identify possible threats to the site such as erosion and the management strategies required for the possible stabilization and preservation of this archeological site. Such strategies would include the planting of native vegetation to help promote dune formation.

A maintenance program will be implemented for 1 archeological site. The Singer Island Midden is located on the beach at the base of the dunes and is susceptible to erosion from tropical storms. This site is particularly significant because it is located on an ecotone between a former freshwater lake (Lake Worth Cove) and the saltwater/beach environment immediately to the east. It could potentially provide useful information about prehistoric food gathering and dietary habits in these environments. The site appears to have been occupied for an extended period and might reveal how adaptive changes occurred through time. However, the location of this site makes preservation and stabilization a challenge. Once implemented, the monitoring program should help to guide the maintenance program. For example, since this site is susceptible to erosion, monitoring the site after a tropical storm, would identify the impacts to the site and the management strategies required for stabilization. In this case, planting an assemblage of native vegetation to help promote dune formation would be an appropriate strategy.

Special Management Considerations

Timber Management Analysis

Chapters 253 and 259, Florida Statutes, require an assessment of the feasibility of managing timber in land management plans for parcels greater than 1,000 acres if the lead agency determines that timber management is not in conflict with the primary management objectives of the land. The feasibility of harvesting timber at this park during the period covered by this plan was considered in context of the DRP's statutory responsibilities and an analysis of 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, with the exception of those communities specifically managed as early successional.

A timber management analysis was not conducted for this park since its total acreage is below the 1,000-acre threshold established by statute. Timber management will be re-evaluated during the next revision of this management plan.

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.

John D. MacArthur Beach State Park is located on Singer Island and has 1.8 miles of beach. According to the DEP Bureau of Beaches and Coastal Systems, the beach within the park is designated as a noncritically eroded area. For an erosion problem area to be critical, there must exist a threat to or loss of one of four specific interests – upland development, recreation, wildlife habitat, or important cultural resources. Many areas have significant historic or contemporary erosion conditions, yet the erosion processes do not currently threaten public or private interests. These areas are therefore designated as non-critically eroded areas and require close monitoring in case conditions become critical.

Although the beach is subjected to the seasonal erosion caused by summer tropical storms and winter nor'easters, the park historically has not had to pursue beach nourishment. Since the park is not located adjacent to an inlet, jetties or other coastal armaments that disrupt the sediment transport system, the park relies on the natural process of sand accretion to nourish its beach.

Three sea turtles: the threatened loggerhead sea turtle (*Caretta caretta*), endangered green sea turtle (*Chelonia mydas*), and endangered leatherback sea turtle (*Dermochelys coreacea*) use the park's beach as nesting habitat to deposit their eggs. The beach serves as habitat that is critical to the recovery of these imperiled species. The park beaches also record numerous migratory bird species that benefit from the undisturbed natural communities of the park that support foraging, roosting, and sheltering, and the physical features necessary for maintaining the natural processes that support these critical habitats.

The Anastasia formation is exposed along much of the park's shoreline forming a nearshore hardbottom habitat that is beneficial to the park and offers additional recreational activities to park visitors. Biodiversity is much greater on hardbottom habitats than on sandy bottom. The exposed rock provides a stable substrate for epifauna such as macroalgae, soft corals and sponges. These heterotrophs, through photosynthesis and filter and suspension feeding, provide basic organic material on which much of the reef's food web is based. Another sessile organism, sabellariid worms form a unique reef type known as "worm reef". These reefs are most often formed in high energy surf zones and provide shoreline protection by reducing wave energy on the beach. Such reefs are composed of loosely cemented sand particles which are held together by a mucus secreted by the worms when building their casing. Sabellariid worm colonies provide habitat for over 325 species of invertebrates (Nelson 1989). The nearshore hardbottom is also used by adult sea turtles for foraging, resting and mating and by turtle hatchlings for refuge from predators when they first enter the ocean after emergence from nest cavities. In addition, the hardbottom community is utilized by numerous recreational and commercial fish species, such as tarpon and snapper, lobsters and a variety of tropical fish.

In an effort to provide additional protection for this important natural community, the park has established a 400 ft. sovereign submerged management area that extends along the entire beach. Management activities conducted within this 400 ft. zone are designed to enhance the recovery of imperiled marine turtles, increase the biological diversity of the park, increase shoreline protection, increase recreational opportunities and enhance visitor experience to the park.

Public access to the beach is provided by the park via four dune crossovers. However, many visitors access the beach by simply walking from the neighboring beach or by anchoring their boats and swimming ashore. This is one of the few undisturbed, natural beaches remaining in Palm Beach County and it has become a very popular destination. Although the visitation rate is high, park staff have been diligent in protecting beach vegetation by using signs and barriers to limit access to designated foot paths. Whenever plants become available and as required, the park, with the help of volunteers, for installation of native vegetation to help protect sensitive cultural areas and promote the formation of dunes.

Systematic review of the DRP's recreation and imperiled species policies as they apply to beach management will assist in better understanding cumulative impacts. Site-specific analysis and implementation of conservation measures should be a high priority for John D. MacArthur Beach State Park. For example, the impacts from disturbance may be lessened by restricting access to roosting and foraging areas and enforcing the no-pet rule on the beach. In addition, educational materials such as signs and brochures can provide valuable information, so the public understands the need for conservation measures.

Arthropod Control Plan

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

There is no arthropod control plan established for the John D. MacArthur Beach State Park.

Sea Level Rise

Potential effects of sea level rise are 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 DRP’s adaptive management response to future conditions, including the effects of sea level rise, as they develop. Additional concepts for addressing impacts of sea level rise are briefly described under the Resiliency Planning section of the Land Use Component (see page 72).

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.

John D. MacArthur Beach State Park was subject to a land management review on April 17, 1998. 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

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

John D. MacArthur Beach State Park is in North Palm Beach within Palm Beach County about 5 miles east of Palm Beach Gardens, 10 miles south of Jupiter, and 10 miles north of West Palm Beach in the southeast part of the state. Approximately 1.4 million people live within 30 miles of the park (U.S. Census 2016).

The population of Palm Beach County is diverse in terms of demographic characteristics. According to the U.S. Census Data (2016), approximately 46% of residents in the county identify as black, Hispanic or Latino, or another minority group. Approximately 42% of residents can be described as youth or seniors (U.S. Census 2016). Persons of the working age (16 to 65 years old) make up 62% of the population (U.S. Census 2016). Palm Beach County's per capita personal income at \$34,846 is below the statewide average of \$41,497 (U.S. Bureau of Economic Analysis 2016).

A significant amount of resource-based recreation opportunities are within 15 miles of John D. MacArthur Beach State Park. Jonathan Dickinson State Park offers biking, camping, paddling, fishing, hiking, swimming, cabins, horse trails, and wildlife viewing. Hobe Sound National Wildlife Refuge, a 1,035-acre refuge, offers opportunities for public recreation, including nature trails and wildlife observation, surf fishing, and beach use. Managed by the Florida Fish and Wildlife Conservation Commission (FWC), the John C. and Mariana Jones/Hungryland Wildlife and Environmental Area (WEA), Pal-Mar East, and Loxahatchee Slough Natural Area provide biking, boating, camping, paddling, hiking, and hunting opportunities.

Several parks and preserves managed by Palm Beach County are located in the vicinity of the park. Palm Beach County is responsible for the management of Pine Glades, Cypress Creek, Winding Waters, Frenchman's Forest, Lake Park Scrub, Snook Islands, and Juno Dunes Natural Areas. All properties offer opportunities for biking, hiking, fishing, and paddling. The Jupiter Inlet Lighthouse Outstanding Natural Area hosts nature trails, observation platforms, and hiking trails. The South Florida Water Management District (SFWMD) allows paddling, boating, hunting, fishing, and hiking through the Loxahatchee River/Cypress Creek Management Area, and J.W. Corbett Wildlife Management Area. Okeeheelee Park in West Palm Beach has equestrian and nature trails, fishing piers, bike paths, and rental concessions for the public.

The park is located in the Southeast Vacation Region, which includes Broward, Miami-Dade, Monroe, and Palm Beach counties (Visit Florida 2013). According to the 2013 Florida Visitor Survey, approximately 17.3% of domestic visitors to Florida visited this region. Roughly 87% visitors to the region traveled to the Southeast for leisure purposes. The top activities for domestic visitors were beach/waterfront and culinary/dining experiences. Summer was the most popular travel season, but visitation was generally spread throughout the year. Most visitors traveled by air (60%), reporting an average of 4.4 nights and spending an average of \$186 per person per day (Visit Florida 2013).

Florida's Statewide Comprehensive Outdoor Recreation Plan (SCORP) indicates that participation rates in this region for saltwater beach activities, visiting archaeological and historic sites, nature study, picnicking, and bicycle riding are

higher than the state average with demand for additional facilities increasing through 2020 (FDEP 2013).

The table below identifies significant resource-based recreation opportunities within 15 miles of John. D. Macarthur State Park.

Name	Biking	Hiking	Swim/ Beach Access	Boating/ Paddling	Fishing	Wildlife Viewing	Overnight Stay	Hunting	Equestrian Facilities
Pine Glades Natural Area		✓		✓	✓	✓			
Cypress Creek Natural Area	✓	✓				✓			✓
Winding Waters Natural Area		✓		✓		✓			
Frenchman's Forest Natural Area		✓				✓			
Lake Park Scrub Natural Area		✓							
Snook Islands Natural Area		✓		✓	✓	✓			
Juno Dunes Natural Area		✓		✓		✓			
Juniper Inlet Lighthouse Outstanding Natural Area		✓				✓			
Loxahatchee Slough Natural Area	✓	✓		✓		✓			✓
Grassy Waters Preserve	✓	✓		✓		✓			
Jonathan Dickinson State Park	✓	✓		✓	✓	✓	✓		✓
J.W. Corbett Wildlife Management Area	✓	✓			✓	✓	✓	✓	✓
Okeehetee Park	✓	✓			✓	✓			✓

Existing Use of Adjacent Lands

John D. MacArthur Beach State Park is bordered entirely by single-family residential development. The park is bound to the east by the Atlantic Ocean and to the west by the Intracoastal Waterway (Lake Worth). A1A runs along the western border. The Intracoastal Waterway carries an abundance of cargo daily

and supports a variety of commercial and recreational activities. Recreation is the main use of the waterway, including personal boats, water taxis, and tour boats. To the west of the Intracoastal Waterway is Palm Beach Gardens. Along the northern park border situated in residential development is a golf course community, and a church is situated at the park entrance road.

Surrounding lands in the Village of North Palm Beach are largely residential and commercial. Among the many winding neighborhoods in the village are commercial developments including country clubs and restaurants. Recreational spaces are not in short supply in the area which has many local parks and natural areas.

Impacts of the adjacent residential areas to the park are minimal, as the John D. MacArthur Beach State Park Greenline Overlay substantially reduces potential impact from surrounding lands. The park also enjoys relative seclusion from contaminants as the only directly adjacent parcels to the park exist on narrow northern and southern boundaries.

Planned Use of Adjacent Lands

Surrounding properties directly to the north are designated for residential low-density development, which continues inland on land in Palm Beach Gardens. An institutional district is identified for the church property also on the northern park boundary. To the south, land is designated for conservation purposes. There are also high-rise residential complexes as you travel south on A1A from the park. The Village of North Palm Beach has designated the future land use for much of the land near the park as either high or low density residential, with dispersed pockets of commercial and mixed-use parcels. All parcels surrounding the park are unlikely to see significant change in the future in regard to land use given that much of the area has seemingly reached maximum buildout.

The northern boundary of the park abuts the John D. MacArthur Beach State Park Greenline Overlay, which is intended to protect park resources from impacts caused by activities on adjacent lands. The overlay creates a buffer from surface water runoff and groundwater contamination, potential incompatible land use, and protects critical wildlife habitats (Palm Beach County 2014).

Palm Beach County is a member of the Treasure Coast Regional Planning Council (TCRPC), which also includes St. Lucie, Martin, and Indian River Counties. The council and county are committed to maintaining a balanced, orderly sustainable economic growth (TCRPC 2012). Growth is being directed to the east of the county to prevent sprawl from harming coastal resources. Coastal communities are identified by the council for revitalization and redevelopment programs. The council is cognizant of the rapid growth in the area and incorporates solutions into its work to counter negative impacts of rapid growth. TCRPC and the South Florida Regional Planning Council (SFRPC)

are collaborating on a long-range economic development plan for the six million residents in South Florida.

Florida Greenways and Trails System (FGTS)

The Florida Greenways and Trails System (FGTS) is made up of existing, planned and conceptual non-motorized trails, and ecological greenways that form a connected, integrated statewide network. The FGTS serves as a green infrastructure plan for Florida, tying together the greenways and trails plans and planning activities of communities, agencies and non-profit organizations throughout Florida. Trails include paddling, hiking, biking, multi-use and equestrian trails. The Office of Greenways and Trails maintains a priority trails map and gap analysis for the FGTS to focus attention and resources on closing key gaps in the system.

In some cases, existing or planned priority trails run through or are adjacent to state parks, or they may be in close proximity and can be connected by a spur trail. State parks can often serve as trailheads, points-of-interest, and offer amenities such as camping, showers and laundry, providing valuable services for trail users while increasing state park visitation.

The Florida Circumnavigational Saltwater Paddling Trail, or the CT, spans 1,515 miles along Florida's coast, from Pensacola to Fort Clinch. This trail is a strategic long-term priority that will require the involvement of state and local agencies alongside local stakeholders. Segment 19, a 29-mile link from Lake Worth to Jonathan Dickinson State Park runs past the park through Lake Worth Lagoon. Paddlers on the trail can utilize the park's facilities and enjoy a number of accessible recreational opportunities.

The park is also intersected by the East Coast Greenway, the longest biking and walking route in the nation. An on-road routing portion of the East Coast Greenway runs through the property and continues along A1A.

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

Across the park's 440 acres, remarkable resources are preserved including mangrove, estuarine grass bed, worm reef, and 121 acres of maritime hammock. The combination of natural communities makes the park a robust and vital component of the region. The maritime hammock in the park is a rarity in SE Florida and has been identified as an exemplary site by the Florida Natural Areas Inventory.

Water Area

The park is bounded on both its east and west sides by Lake Worth Lagoon and the Atlantic Ocean and contains the entirety Lake Worth Cove. Visitors paddle across Lake Worth Lagoon to access Munnyon Island and explore the scenic mangrove swamps throughout the park. The adjacent Atlantic beach affords high quality aquatic opportunities. Other small navigable water bodies within the park offer additional interpretation and recreation.

Shoreline

The park's lagoon and cove shorelines are characterized by extensive mangrove swamp which support abundant wildlife. Boaters and paddlers along the mangroves enjoy a number of interpretive and recreational activities. The Florida Circumnavigational Trail extends past the park through the intercoastal waterway attracting paddlers into the park. One of the primary draws of the park is its 1.5-mile Atlantic shoreline. Clear waters and a shallow reef feature make this popular for swimming and snorkeling

Natural Scenery

The park interior contains scenic canopied use areas contrasting with the open vistas from the boardwalks across Lake Worth Cove and the Atlantic Beach. Parkwide, the scenery is characteristic of the Atlantic Coastal Ridge region.

Significant Habitat

Set in a highly urbanized area, the park protects and interprets a variety of terrestrial and marine wildlife. The beach provides significant habitat for nesting sea turtles and shorebirds. The calm waters of the lagoon as well as cove provide refuge for manatees and expansive seagrass beds. The hammock provides resting habitat for neotropical-migratory bird species.

Natural Features

The park facilitates access to three distinct natural features including Lake Worth Cove, Munyon Island, and the Atlantic Beach, each offering unique recreational experiences. Visitors traverse dense maritime hammock on both the mainland and Munyon Island. The beach is popular for walking, shelling, and swimming.

Archaeological and Historical Features

The cultural resources of the park tell a complex story of southeast Florida history spanning centuries. Serving as a place for prehistoric sustenance, cultural ceremonies, war, trade, commerce, and recreation- the park has been a site of interest across the generations. Evidence of prehistoric use has been identified by the shell middens in the park and the most tangible remnants of historical occupation are on Munyon Island, which hosts the remains of the Hygeia Hotel.

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

Modern use of the property began in the 1880s by homesteaders and horticulturalists who began enticing northern visitors with the unique subtropical setting and beach landscape. In 1901 the property was acquired by Dr. James M. Munyon who sequentially developed the Hygeia Hotel as a place of healing. The hotel was situated amongst lush scenery and what the doctor believed to be a fountain of youth brimming with healthful sulfuric waters. The Hygeia Hotel operated until 1917 and the property largely remained dormant until John D. Macarthur purchased the land in 1955.

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 Palm Beach County Future Land Use designation for the park is Parks and Recreation. These areas are designated to reflect developed or planned sites owned by a governmental entity that provide the public an opportunity to partake in a variety of recreational activities that may be active, passive, or special in nature in a safe and convenient manner that is compatible with its environs. The area surrounding the park has been designated as a Greenline Overlay area by Palm Beach County. This designation is intended to protect resources within park boundaries, such as water, wildlife populations, and the aesthetic quality of recreation in this park, from impacts caused by activities on adjacent land (Palm Beach County 2016).

The Village of North Palm Beach zones the park as Conservation and Open Space (C-OS). The intent of this classification is to provide for land uses and activities for the primary purpose of conserving or protecting natural resources of environmental quality. This designation does not allow any building or structures except those for normal operation and management including single-family residential dwellings. The minimum lot size for each dwelling shall be at least one acre of upland area (Village of North Palm Beach 2016). Existing land use and zoning designations are consistent with current and projected future uses of the park.

Current Recreational Use and Visitor Programs

Approximately 6,000 feet of shoreline on the Atlantic Ocean at John D. MacArthur Beach State Park allow general beach recreation activities, including walking, sunbathing, swimming, shoreline fishing, snorkeling and scuba diving. Park facilities developed in the late 1980s provide safe, low-impact access to this beach for thousands of visitors each year. Nature trails, picnicking facilities, and the interpretive center provide visitors with a range of recreational, interpretive and environmental education programs in the maritime hammock area. The interpretive center features an exhibit area regarding coastal and marine ecosystems, aquarium displays, audio-visual presentation room, outdoor amphitheater, and restrooms. Since the park opened in 1989, an ambitious environmental education program has evolved in response to the unique character and quality of the natural systems and resources of the state park. The park's citizen support organization outfits visitors with kayaks to explore the estuary.

John D. MacArthur Beach State Park recorded 149,982 visitors in FY 2018/2019. By DRP estimates, the FY 2018/2019 visitors contributed \$13.3 million in direct economic impact, the equivalent of adding 187 jobs to the local economy (FDEP 2019).

Other Uses

Munyon Island was used by the Army Corps of Engineers as a spoil site for construction and maintenance of the Intracoastal Waterway. Spoil deposition and staging of projects is now discounted. The park mainland includes a segment of right-of-way for State Road A1A. No other non-park uses are permitted.

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 John D. MacArthur Beach State Park, all wetlands and floodplain 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

Picnicking facilities are available at the picnic area, visitor center, and Munyon Island. Paddling facilities are located at the visitor center and Munyon Island. Several boardwalks provide visitors with access to the beach. Several short nature trails provide visitors access to the park's natural communities. Support facilities include a ranger station, shop and residence areas (see Base Map).

Recreation Facilities

Park Entrance

- Ranger Station
- Park road (0.5 mi.)

Main Day Use Area

- Interpretive center
- Picnic shelter (2)
- Kayak rental/launch
- Boardwalk (1600 ft.)
- Parking (548 spaces)

Atlantic Beach Access

- Dune Boardwalks (4)
- Backdune Nature Trail (.3 mi.)
- Restrooms (2)

Satinleaf Picnic Area

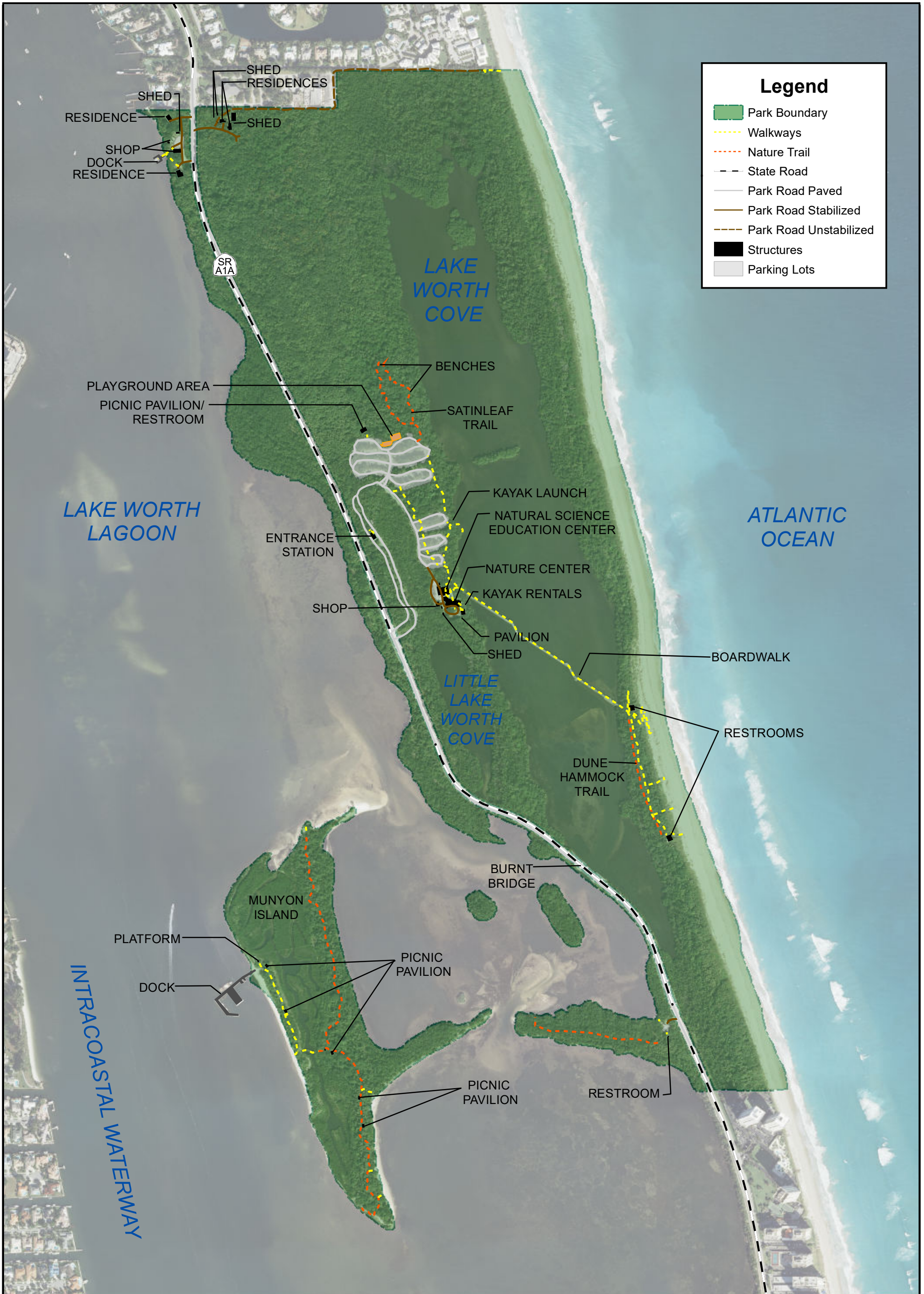
- Large shelter
- Restrooms
- Scattered picnic tables
- Playground equipment
- Satinleaf Nature Trail (0.1 mi)

Munyon Island

- Small picnic shelters (5)
- Temporary restroom
- Nature trail (0.2 mi.)
- Canoe/kayak launch
- Dock (28 boat capacity)

Support Facilities

- Tram maintenance building
- Volunteer office
- Plant nursery
- Shop
- Flammable storage
- Staff residences (4)
- Support docks
- Parking areas (548 spaces)
- Employee owned trailer site (1)



Legend

- Park Boundary
- Walkways
- Nature Trail
- State Road
- Park Road Paved
- Park Road Stabilized
- Park Road Unstabilized
- Structures
- Parking Lots

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 access points and recreational uses.

Resource-based recreation activities including beach access, picnicking, paddling, and interpretation of natural and cultural resources are the most popular activities at the park that accommodates visitors with a range of interests. Aside from what visitors experience on their own or in small groups, there is also an impressive offering of regularly scheduled interpretive programs largely supported by the park's Citizen Support Organization (CSO). Daily nature walks, birding programs, butterfly tours, and snorkeling education are just a few of the opportunities readily available at the park. Several relatively simple renovations around the park are proposed for the next ten years. These enhancements to existing facilities such as improved walkways to the beach will serve to better the visitor experience.

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

The park provides ample opportunities for interpretation and education on the park's natural and cultural resources as well as recreational programs. The CSO, Friends of MacArthur Beach State Park is a particularly active group of dedicated volunteers that are critical to providing many of these programs. On-going programs offered through the CSO include nature walks, tours on the park's bird species and butterfly species, talks at the nature center on marine animals and snakes, a course for paddling beginners, bi-monthly bluegrass concerts, monthly car shows, and yearly nature scrape events.

In 2011, the Pew Family Natural Science Education Center opened in the park to help promote natural science education and research. Serving both visitors and staff, this nature center includes a classroom for students to have a chance to dive deeper into their park discoveries, a research library to further the center's educational component, a discovery lab so that staff can nurture animals, and an education gallery for viewing of interpretive displays.

These programs along with the nature center equip visitors with a better understanding of their natural surroundings, the protection they require, and how they can be better stewards of the land. The park will continue to work collaboratively with their CSO in providing these programs over the coming 10 years.

Objective: Develop 1 new educational program.

The Friends of MacArthur Beach State Park have been working diligently with the park to create a Citizen Science Marine Debris Program. The CSO is also working in conjunction with The Community Foundation for Palm Beach and Martin Counties. This program will invite visitors and the surrounding community to participate in fighting against marine debris. This program centers around offering an outlet for those who wish to take action in making their environments more sustainable. The work of volunteers to remove marine debris and the collection of data by park staff will directly feed into the academic efforts of those with the Solid Waste Authority and National Oceanic Atmospheric Administration. In the initial rollout of the program so far, Citizen Scientists have already collected 1,500 pounds of marine debris from the park's beach.

Proposed Facilities

Capital Facilities and Infrastructure

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

John D. MacArthur Beach State Park has and continues to provide exceptional opportunities for recreation and education that are truly unique to the park system. The development of the park has been considerate and appropriate to the needs and trends of recreation and resource management. The following proposals seek to enhance the current qualities of the park and improve upon existing infrastructure for reasons including environmental sensitivity, evolving recreation trends, creating truly accessible facilities, and a need to reinvest in the park's aging infrastructure.

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 John D. MacArthur Beach 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 8 existing facilities and 0.3 miles of trail

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.

A1A Park Entrance

The park's entrance off A1A follows along a quiet portion of this road surrounded on both sides by lush hammock and mangrove. The entrance serves the park well but could be improved in terms of visibility. In its current state, it is easy to miss the park entrance. Landscaping improvements or additional signage to make the entrance more visible should be considered. The ranger station at the entrance is in good condition, however the plumbing system should be connected to the central sewer system of the county.

Satinleaf Picnic Area

This picnic area is a popular place for small events and casual gatherings. The restrooms attached to the pavilion are in good condition but the frames and doors to the restrooms should be replaced as well as the pavilion's plumbing should be connected to the central sewer system of the county.

Main Day Use Area

Majority of the park's interpretation is based in the Lake Worth Day Use Area. The area includes the Natural Science Education Center, paddling rentals, pavilions, and trams to take people to and from the beach. The actual layout of this area should be made more pedestrian friendly and provide for a better sense of arrival. Specific improvements include adding crosswalk markings from parking areas onto the path and boardwalk that lead to nature center and adding wayfinding signage to easily orient visitors from the parking area to the day use areas. Landscaping improvements should also be ongoing in the small green spaces interwoven in the parking area. The pavilion in this area also requires some updates including a new roof and a centralized line to the county sewer system.

North Paddling Launch

The north paddling launch offers visitors access onto Lake Worth Cove just north of the Main Day Use Area. The launch is in good condition but will be made more accessible with the addition of a Mobi-mat. Due to its situation among mangroves, the launch should also be stabilized with crushed shell to facilitate easy access for visitors. An implementation plan should be in place and carried out by park staff to control and monitor erosion at the launch site.

South Paddling Launch

This paddling launch currently provides visitors access onto Lake Worth Lagoon. Paddling is a relatively popular activity at the park, but this could be further capitalized on with a few improvements. Given that it is relatively separated from other use areas of the park, the launch area currently lacks accommodations like those offered throughout the rest of the park. This area would benefit from the addition of potable water, electric, and a hookup to sewer if possible. To enhance the access of this area, Mobi-mat should also be added. The construction of a small concessionaire building adjacent to the parking area could facilitate paddling vessel rentals and other small purchases by visitors. The parking area would consist of 10 to 15 parking spots, and if needed, further stabilized with gravel.

Munyon Island

The current visitor use of Munyon Island is relatively low compared to other areas in the park. There is significant damage to the two main boardwalks on the island and repair or complete replacement is required.

One of the main features of Munyon Island is a large dock structure which contains prefabricated cribbing below the structure to keep it in place. Observations indicate that the below riprap cribbing has resulted in an eddy circulating in the area, the underlying cribbing has prevented a natural flow of water and the constant circulating water has eroded parts of the shoreline. The erosion of the shoreline has caused a loss of mangroves on the island.

Further hydrological studies would need to be conducted in collaboration with DRP and other DEP divisions to evaluate the on-going water flow and all future options to address the issues. Possible solutions include beach nourishment along the island to restore the shoreline, and removal or reduction of the amount of cribbing. This removal will likely result in the cessation of the eddy and allow the return of natural waterflow to the area.

The main walkway along the Intracoastal Waterway needs complete re-decking simply due to age, and possibly due to the eddy and the ongoing erosion, the underlying structural support has diminished. Additionally, the other boardwalk

that leads to the Island Trail needs to be assessed for structural support and damage.

Additionally, the floating dock needs to be replaced as it incurred damages throughout the years, and more recently from Hurricane Irma in 2017.

Other proposed additions to the facilities of Munyon Island include a paddling rack, potable water line, and an observation deck overlooking the Intracoastal Waterway, similar in style to observation platforms on the main boardwalk that crosses Lake Worth Lagoon. The observation deck option would be contingent on the restoration of the shoreline and replaced boardwalk. These new improvements will better cater to existing and new user groups.

Atlantic Beach Access Area

This area refers to the beach access point as well as the connected Lagoon Boardwalk that transports visitors from the foliage-filled entrance area to the expansive beach views. The boardwalk itself is an impressive structure that allows for a multitude of varied viewsheds and interpretive opportunities. To maintain the high volume of visitors utilizing this access, the boardwalk requires the addition of structural support beams and re-decking for the entire boardwalk, as needed.

The restroom facilities along this access require termite treatment, and the extent of damaged assessed prior to treatment may require a full replacement of the restrooms. In the case that the termites can be successfully treated without full replacement of the restrooms, the facilities will also need to be freshly painted and all the interior fixtures replaced including new floor drains. To increase accessibility to the beach area, a Mobi-mat should be added near the main dune crossover and only to be used during non-turtle nesting season.

Like the work that has already been done on the Satinleaf Trail, the beach access trails that run perpendicular to the boardwalk should be stabilized with crushed shell.







Support Area

The parks 3-Bay shop needs total replacement. The current one has suffered significant termite damage over the years. A new shop is to be constructed in the existing footprint of the current one.

The other support facilities at the park are generally in good condition.



Legend

-  Proposed Facilities
-  Trails
-  Park Boundary
-  Lake Worth Cove
-  Lagoon Boardwalk
-  Main Park Road

Support Areas
New Bay Shop

Satinleaf Picnic Area
Restroom improvements
Connect to central sewer

Volunteer Camping Area
Construct Volunteer Sites

Entrance Station
Landscape Improvements
Connect to central sewer

Main Day Use Area
Landscaping improvements
Pavilion improvements
Connect to central sewer

Munyon Island
Repair/renovate dock
Add new clivus restroom
Add paddling vessel rack
Provide potable water
Redeck boardwalk

South Paddling Launch
Add concessionaire building
Provide utility access
Add mobi-mat
Stabilize parking

North Paddling Launch
Add mobi-mat
Stabilize launch

Redeck Entire Boardwalk

Atlantic Beach Access
Renovate restrooms
Stabilize/reconstruct dune crossovers

Objective: Construct 1 new facility

Volunteer Camping Area

The park has a very active CSO and volunteer base, and the addition of volunteer sites in a disturbed area just to the west of the parking adjacent to the Satinleaf Picnic Area will help to continue and enhance volunteerism in the park. Hookups to utilities are already available for this site underneath the hammock canopy. In the future, this site could also serve as an area for employee owned trailer sites as well.

Facilities Development

Preliminary cost estimates for these recommended facilities and improvements are provided in the Ten-Year Implementation Schedule and Cost Estimates (Table 5) 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

A1A Park Entrance

- Improve landscaping
- Connect Ranger Station to central sewer

Main Day Use Area

- Improve landscaping
- Pavilion improvements
- Connect to central sewer

Atlantic Beach Access- Lagoon Boardwalk

- Renovation of bathrooms
- Stabilization and reconstruction of Dune crossovers
- Redeck Lagoon Boardwalk

Satinleaf Picnic Area

- Replace doors & frames to restrooms
- Connect sewer to county line

Support Area

- Replace Shop

North Paddling Launch

- Add Mobi-mat
- Stabilize Launch

Munyon Island

- Repair & renovate existing dock
- Add new clivus restroom
- Add paddling vessel rack
- Provide potable water
- Redeck Boardwalks

South Paddling Launch

- Add small concessionaire facility
- Provide utility access
- Add Mobi-mat
- Stabilize existing parking

Volunteer Camping Area

- Construct volunteer sites

Resiliency Planning

Specific effects of sea level rise at this park are not yet known, however, general changes to the park's natural and built landscapes are predictable. Parkwide, the maritime hammock may potentially become increasingly wet such that public and staff access along trails and management roads will be impeded. Given the significance of access to this park's resources, long term solutions to wet or inundated sites may require installation of boardwalks and off-grade buildings. The existing environmental education center is already designed as off grade however, extensions of the off-grade structures may need to be considered.

Paddling launches may require setbacks to adjust for rise in mean high water and the extent of paddling access to submerged areas may increase.

At this stage in the resiliency planning process, no specific developments, renovations, landscape alterations, or augmentations are proposed.

Visitor Use Management

The DRP manages visitor use to sustain the quality of park resources and the visitor experience, consistent with the purposes of the park. The dynamic nature of visitor use requires a deliberate and adaptive approach to managing resource impacts from recreational activity.

To manage visitor use, the DRP will rely on a variety of management tools and strategies, potentially including modes of access and limits on the number of people within certain areas of the park. Achieving balance between resource protection and public access is fundamental to the provision of resource-based recreation and interpretation. The premise of a visitor use management strategy is to protect the park's significant natural and cultural resources. A strategy may include site-specific indicators and thresholds selected to monitor resource conditions and visitor experience. By monitoring conditions over time and clearly documenting when conditions become problematic, the DRP can implement actions to prevent unacceptable resource conditions.

Levels of visitation, patterns of recreational use, and varieties of available recreational activities are routinely monitored parkwide. Indicators have shown that this park is operating sustainably for its resources and offers high quality experiences for its visitors.

Resource indicators to be considered during the next ten-year planning period include:

- Erosion along trails through maritime hammock and other sensitive natural communities
- Trampling of dune vegetation, formations, and wildlife landward of the beach wrack line
- Deterioration of the worm reef or other significant submerged resources along the park beach
- Erosion or disturbance of vegetation along the shorelines of Lake Worth Lagoon and Munyon Island

Quality of visitor experience indicators to be considered during the next ten-year planning period include:

- Congestion of day use areas by visitors at one time
- Insufficient visitor amenities to safely and comfortably support the intended activities of a use area
- Obstruction of viewsheds through scenic areas of the park
- Interruption of serenity in areas intended for passive interpretive experience

Thresholds are defined as the minimally acceptable conditions for each indicator and represent the point at which resource impacts will require a change in management strategy or actions to improve resource conditions. Thresholds are assigned based on the desired resource conditions, the data on existing conditions, relevant research studies, management experience, and current visitor use patterns. It is important to note that identified thresholds still represent acceptable resource conditions and not degraded or impaired conditions. Management actions may also be taken prior to reaching the thresholds.

Specific thresholds for resource conditions and experiential quality have not yet been established for John D. MacArthur Beach State Park. As monitoring continues, collected data may be used to determine baseline and desired conditions, thereby establishing thresholds.

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.

The optimum boundary for this park consists of the aquatic submerged lands surrounding the park's eastern boundary along the Atlantic Ocean. This 400-foot wide strip is known to contain a significant amount of worm reef, which aid in shoreline protection by reducing wave energy to the adjacent shoreline. Acquiring this area would allow for resource management on these worm reefs, as well aid in the recovery of imperiled marine turtles and increase shoreline protection. Additional recreational and interpretive opportunities in this acquired area would enhance the overall visitor experience.



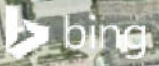
Legend

- Park Boundary
- Acquisition

LAKE
WORTH
LAGOON

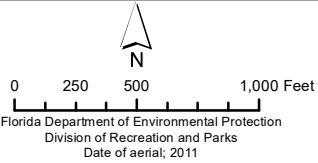
400'

LITTLE
MUNYON
ISLAND



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JOHN D. MACARTHUR BEACH
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 John D. MacArthur Beach State Park in 2005, 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.

Park Administration and Operations

- Total volunteer hours for 2018-2019 at John D. MacArthur Beach State Park was 22,451 hours.
- One additional resident staff location, an employee-owned trailer site, has been established next to the existing resident ranger sites.
- Temporary intern housing is now available to resident interns. The Friends of MacArthur Beach State Park purchased a travel trailer to house education program interns. Naturalist Interns, a post-graduate internship program was established. Naturalist Interns assist in Natural Science Education Programs and are trained in animal care, facilitating adult nature Park programs and exotic plant removal.
- 2018 Florida State Parks Foundation Short Project of the year awarded for the Citizen Science Marine Debris Program
- 2018 Florida State Parks Foundation Youth Volunteer of the Year awarded to volunteer Twain Glas
- 2017 Volunteer Janet Heaton was awarded 25-year service award
- 2016 Park Ranger Rob Matriscino and Park Service Specialist Art Carton, and Veronica Frehm (CSO), received the prestigious Florida State Park Award of Valor for selflessly risking their lives to save two drowning visitors caught in a rip current at MacArthur Beach State Park

- Education program has won the 2014 Pine Jog Environmental Education “Environmental Education Program of the Year” award.
- The education program volunteers received the 2014 FPS “Volunteer Team of the Year” award.
- The Friends of MacArthur Beach State Park won the 2010 FPS “CSO of the Year” award.
- The park continues to benefit from an outstanding volunteer team. Volunteers serve as Nature Center docents, nature walk guides, tram drivers, reef guides, turtle walk guides, gift store assistance, and native plant nursery help.

Resource Management

Natural Resources

- Marine turtle surveys are conducted annually in accordance with protocols established by the FFWCC. The data gathered on nesting leatherback, loggerhead and green turtles is used to help formulate state and federal policies for the management of these imperiled marine turtles. The park has been conducting daily marine turtle nest surveys since 1982.
- The Park Service implemented a predator control and monitoring program at the park that removes predators of marine turtle nests from the nesting beach. Historically, up to 95% of turtle nests were lost to predation. Because of the predator removal program, predation levels on marine turtle nests have been reduced to levels of less than 5%.
- A Citizen Science program was established at the park to assist staff with collecting important data from ongoing monitoring and research programs. Currently, the citizen scientists (volunteers) are conducting nest excavations to determine nest productivity of imperiled marine turtles. This data will be used to measure the number of hatchlings that are produced at the park.
- Fish population censuring is conducted annually in conjunction with the Great Annual Fish Count. The Florida Park Service partners with other agencies and volunteers to gather data on fish species and abundance.
- Lionfish eradication is a part of the invasive exotic control program at the park since the fish was first observed in park waters in 2012. DRP staff conduct lionfish surveys on a regular basis. All lionfish are removed under protocols established by FFWCC. Due to these efforts, population is under control and new sightings are rare.
- In 2010 a seagrass monitoring program was implemented to gather baseline data on the estuarine seagrass community of the park including species diversity, species abundance, health and changes over time. Biannual

surveys are conducted in the Lake Worth Cove to capture the growing season. This program was established in partnership with Palm Beach Atlantic University research professor Dr. Tom Chesnes.

- A seagrass monitoring program implemented at the park revealed that all 7 species of seagrass found in Florida are growing in Lake Worth Cove. Included are several large areas of the federally listed species Johnson's seagrass (*Halophila johnsonii*) and Widgeon grass (*Ruppia maritima*). The park is the only known place in the entire Lake Worth Lagoon where this species is known to grow.
- A research project to determine the bat species utilizing the park was conducted by research professor Dr. Maurice Thomas of Palm Beach Atlantic University. Mist nets were placed throughout the park which yielded two new bat species.
- A Munyon Island Internal Combustion Exclusion Zone was established in 2010. The zone protects sensitive seagrass beds east of Munyon Island by restricting boat traffic to non-combustion propulsion only. These seagrass beds provide food and shelter to commercial and recreational marine species as well as juvenile imperiled green marine turtles.
- Palm Beach County Environmental Resource Management (ERM) conducted a catch and release project of marine turtles in the Lake Worth Lagoon. The northern section of the Lagoon, much of which is located within the boundaries of the park, functions as important developmental habitat for juvenile green marine turtles. A related project by ERM in the nearshore ocean habitats showed significantly more marine turtles in park waters than the surrounding areas.
- Additional research projects were conducted by students at Palm Beach Atlantic University, Broward College and Florida Atlantic University. All the projects contributed to the species inventories and increased the number of species known to occur in the park. These projects include the following:
 - a. Research the species composition of drift algae found in Lake Worth Cove. Varying size mats of drift algae are observed in the estuarine seagrass beds where they tumble and sometimes gather in natural depressions.
 - b. The biodiversity of mollusks found in the seagrass beds in the Lake Worth Cove.
 - c. Determine if red mangroves, *Rhizophora mangle*, that are stressed from being cut and maintained at 1.8 meters allow more isopods, *Sphaeroma terebrans*, to bore into the prop roots thus weakening the mangrove.
 - d. Determine species of reptiles found within the Park by setting up a pitfall array herpetology study in management zone 2.
 - e. Recording the coordinates of all known specimens of rosary pea, bowstring hemp and dragon fruit cactus on Munyon Island.

- f. Recording the coordinates of all known specimens of the invasive exotic species, Santa Maria tree, *Callophyllum antollanum* within the Park boundaries.
 - g. Determining factors that affect oyster spat recruitment.
 - h. Surveying oyster distribution and health in the Park's estuary.
- Park staff and volunteers has recorded the coordinates of all known specimens of sea lavender, *Argusia gnaphalodes*, and burrowing four o'clock, *Okenia hypogaea* in the park. This information will be used to implement a monitoring program that will track changes to the plants' health and size over time.
 - District biologists and park staff perform periodic removal and treatment of invasive plants in the park. Cooperative workdays with staff biologists from other agencies are also used to periodically remove and treat invasive plants.
 - District biologists routinely seek additional funding to remove larger areas of invasive exotics. Several large projects include the following:
 1. 2006: contractor project funded by DEPs Bureau of Invasive Plant Management to remove 5.5 acres of heavily infested Brazilian pepper in the maritime hammock.
 2. 2007: contractor project funded by the Division of Rec and Parks to treat 60 acres of maritime hammock. Species that were treated included Brazilian pepper, java plum, bishopwood, umbrellas tree, carrotwood, Surinam cherry and areca palm.
 3. 2009: contractor project funded by the Division of Recreation and Parks to treat 13 acres in the hammock/strand ecotone from the top of the dune line west to the mangrove edge. Species that were treated include Brazilian pepper, beach naupaka, carrotwood, bowstring hemp, rosary pea and Portia tree.
 4. 2013: contractor project funded by the Division of Recreation and Parks to treat 12.7 acres in the hammock/strand ecotone from the top of the dune line west to the mangrove edge. Species that were treated include Brazilian pepper, beach naupaka, carrotwood.
 5. 2017: contractor project funded by the Division of Recreation and Parks to treat 35 acres in the maritime hammock. Species that were treated include Brazilian pepper, carrotwood, bishopwood, schefflera, rosary pea, bowstring hemp and various exotic palms.
 6. 2018/2019: contractor project funded by the Division of Recreation and Parks to treat 80 acres in the maritime hammock and on Munyon Island. Species that were treated include Brazilian pepper, carrotwood, winged yam, Australian pine, rosary pea, balsampear, areca palm, oyster plant, bowstring hemp.
 - Friends secured Exotic Removal grant, \$10,000 annually for 3 years
 1. Independent Contractors assisted PSS in removal
 2. Purchase of an all-terrain vehicle for exotic removal
 3. Building new shade house for the growth of replacement plants

- The new Citizen Science Marine Debris Program was created for all Park visitors to participate in. A Citizen Science Marine Debris Program Area was installed where visitors can learn and then participate in the program by collecting marine debris from the beach and then weigh/report how much was collected. This information is being reported to several agencies.
- Summer Camp students have been participating in a Citizen Science Program with REEF Fish Counts since 2012. Data can be used by researchers/scientists to see trends of fish populations based on summer camper citizen scientist observations and data input.

Cultural Resources

- Plant native vegetation to promote dune formation and reduce the threat of erosion.
- Remove and treat exotic plants in and around archeological sites to prevent damage from vegetative growth.

Recreation and Visitor Services

- The Munyon Island Public Boat Docking Facility was opened to the public in 2011. The facility is designed to accommodate 20 boats for day-use mooring and access to Munyon Island trails, beaches, and picnic pavilions.
- An interpretive kiosk has been placed on Munyon Island explaining the island's rich cultural history. The kiosk also points out the various partners involved in the island's restoration.
- As a result of a local Boy Scout's Eagle Scout project, a set of stairs has been installed to better enable kayakers to access Munyon Island near the existing boardwalk.
- The park's existing Nature Center, which also housed the Friends of MacArthur Beach gift shop, has been completely renovated. The new interpretive displays incorporate many tactile and interactive features to better engage visitors.
- A new 1500-gallon central aquarium depicting the park's estuary simulates natural habitat of the mangrove shoreline for many aquatic species.
- The center's existing reef and sea turtle tanks were removed and refurbished to provide a better visitor experience and to better reflect the park's habitats.
- The gift shop was moved to a new location making room for a Welcome Center and cultural history interpretive displays.

- The park's Natural Science Education Program now provides both classroom and field experiences to over 5000 Palm Beach County students per school year with 71% of students attending Title 1 schools. The program meets all requirements for the Next Generation Sunshine State Standards (NGSSS) for science as set forth by the Florida State Board of Education which includes Making Stem Connections.
- MacBeach Explorations - Each year since 2001, up to 20 Title I teachers within a 25 mile radius are part of a grant, – bringing them into a 3-5 day training workshop over the summer, certifying them in Project Learning Tree and Project WILD; the teachers then get to bring their students back to the Park in the academic year for an extended Field Experience.
- Students throughout the county and beyond were able to take advantage of monthly Vodcasts (Video on Demand) in which students and teachers can interact from their classrooms with park and education staff. Vodcast participation for each academic year is approximately 10,000 students each academic year.
- Summer Science Camp is offered in 6, one-week sessions, all-day experiences for campers. The different groups participate and learn in age-appropriate activities: Sunshine Explorers, ages 6-8; Junior Rangers, ages 9-10; Marine Biologists, ages 11-14; and Marine Champions, ages 12-14. There is also a Counselor-In-Training program which students 15-17 can assist with programing.
- Junior Friends of MacArthur Beach State Park is a volunteer group that performs community service projects for the Park. Middle and High school aged students participate in Citizen Science projects, beach re-nourishments plantings, exotic plant removals, and beach/mangrove cleanups etc.
- Summer camp is now offered to 3 age groups and has been expanded to an all-day experience for campers.
- The park continues to develop new programming. The more recent additions include a Butterfly Walk, Introduction to Surfing, Introduction to Snorkeling, Introduction to Kayaking, Live Snake Talks, Weekly Fish Feeding, Birding by Kayak, Reef Program, Monthly Beach Cleanups, Citizen Science Programs, Moonlight Concert Series, and a Guest Speaker Series.
- An emergency response UTV has been built to provide access to the beach in emergency situations when park visitors or staff are in need.
- An emergency access has been built in place of a dune crossover to provide quick access to the beach in emergency situations,

Park Facilities

- As part of a \$2.1 million Partnership in Parks (PIP) project, the Friends of MacArthur Beach provided funding and support for renovation of the existing Nature Center and construction of a new Education Center Complex; The Pew Family Natural Science Education Center.
- A new state of the art theater system replaced the existing system. The new system enables visitors to select from a variety of videos focusing on the park and the area's natural resources.
- The Education Center Complex was opened to the public in 2012. The facility contains a state-of-the-art classroom, staff lab, library, offices, and the Friend's-operated gift shop. A new 1200 gallon educational sea turtle tank has also been installed on the front deck of the facility.

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 7**) 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 5** may need to be adjusted during the ten-year management planning cycle.

Addendum 1-7



Addendum 1—Acquisition History

LAND ACQUISITION HISTORY REPORT

Park Name	John D. MacArthur Beach State Park
Date Updated	9/21/2017
County	Palm Beach County
Trustees Lease Number	Trustees Lease No. 3205
Current Park Size	436.39 acres
Purpose of Acquisition	The Board of Trustees of the Internal Improvement Trust Fund of the State of Florida has acquired John D. MacArthur Beach State Park to manage the property solely for environmental preservation, park, and public recreation.

Acquisition History (Includes only acquisition of a parcel or parcels with areas of 10 acres or more)

Parcel Name or Parcel DM-ID	Date Acquired	Initial Seller	Initial Purchaser	Size in acres	Instrument Type
DMID6976	7/7/1981	Palm Beach County	The Board of Trustees of the Internal Improvement Trust Fund of the State of Florida (Trustees)	206.604	County Deed
DMID2451	4/16/1996	Palm Beach County	Trustees	13.346	County Deed

John D. MacArthur Beach Park Acquisition History

Management Lease					
Parcel Name or Lease Number	Date Leased	Initial Lessor	Initial Lessee	Current Term	Expiration Date
Lease No. 3205	3/22/1982	The Board of Trustees of the Internal Improvement Trust Fund of the State of Florida	The State of Florida Department of Natural Resources for the use and benefit of the Division of Recreation and Parks	50 (fifty) years	3/21/2032
Outstanding Issue	Type of Instrument	Brief Description of the Outstanding Issue		Term of the Outstanding Issue	
The property shall be used to foster, preserve and enhance the existing ecological relationships with terrestrial and aquatic animal species	Conservation Easement	<i>The property Shall be used to foster, preserve and enhance the existing ecological relationships with terrestrial and aquatic animal species including birds, by regulating public recreational usage not incompatible with the presently existing environment.</i>		Perpetual	
The property shall be used solely for environmental preservation, park, and recreation purposes.	County Deed	By accepting this county deed, the Board of Trustee of the Internal Improvement Trust Fund of the State of Florida covenants and agrees that it shall use the subject property solely for environmental preservation, park, and recreation purposes.		Perpetual	

John D. MacArthur Beach Park Acquisition History

Addendum 2—Advisory Group Members and Report

**John D. MacArthur Beach State Park
Advisory Group Members and Report**

List

**John D. MacArthur Beach State Park
Advisory Group Members and Report**

Report

Addendum 3—References Cited

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Addendum 4—Soil Descriptions

John D. MacArthur Beach State Park Soil Descriptions

4 – Arents - Urban land complex, 0 to 5 percent slopes - Arents consist of nearly level, heterogeneous soil material. This material has been excavated, reworked, and reshaped by earthmoving equipment. Arents are near urban centers, phosphate-mining operations, major highways and sanitary landfills.

Arents do not have an orderly sequence of soil layers. This map unit is not associated with or confined to a particular kind of soil. Arents are variable and contain discontinuous lenses, pockets, or streaks of black, gray, grayish brown, brown, or yellowish brown sandy or loamy fill material. The thickness of the fill material ranges from 30 to 80 inches or more. Also included are small areas of soil that has slope that ranges from 0 to 5 percent.

Most soil properties are variable. The depth to the seasonal high water table varies with the amount of fill material and artificial drainage. Permeability and the available water capacity vary widely from one area to another.

9 - Beaches - This soil type occurs on narrow strips of tide washed sand along the Atlantic Coastline. They range from less than 100 feet to more than 500 feet wide, with an average width of 250 feet. As much as half of the beach may be covered with water at daily high tides, and all may be covered during storm events. Most beaches have a uniform, gentle slope up to the edge of the ocean.

The beaches are frequently mixed and reworked by waves. They are firm or compact near the water's edge; the drier sands further up the beach are loose. They consist of pale brown to light gray sand grains, which are a mixture of quartz sand and fragments of seashells. The entire beach is subject to wind and tides. Rock outcrops are scattered throughout.

11 – Canaveral-Urban land complex, 0 to 5 percent slopes – This soil type consists of very deep, somewhat poorly to moderately well drained, very rapidly permeable soils on side slopes of dune-like ridges bordering depressions and sloughs along the coast in lower Coastal Plain of peninsular Florida. They formed in thick marine deposits of sand and shell fragments. Canaveral soils have a water table within 10 to 40 inches of the surface for 2 to 6 months or more in an average year. They can recede to a depth of 50 inches or more during dry periods. Internal drainage is impeded by this shallow water table.

John D. MacArthur Beach State Park Soil Descriptions

The surface layer is a dark grayish brown sand mixed with shell fragments, about 8 inches thick. The next layer is pale brown to very pale brown mixed sand and shell fragments, extending to 65 inches or more.

These soils were formerly part of the Palm Beach series and are geographically associated with Anclote, Delray, Palm Beach, Paola, Pompano, St Lucie and Welaka soil series. Most areas of the Canaveral soils remain in their natural state and function as wildlife habitat and recreation. The native vegetation supported by this soil type includes cabbage palm, scattered saw palmetto, magnolias, bays, and slash pine with an understory of gallberry and pineland threeawn.

13 – Cocoa-Urban land complex, 0 to 5 percent slopes - This salicieous, hyperthermic soil type consists of moderately deep, well drained, rapidly permeable soils on upland coastal ridges near the Atlantic Ocean. Slopes range from 0 to 8 percent. They formed in thin regolith of sandy marine and eolian sandy sediments over porous, coquina limestone. Permeability is rapid in all layers above the limestone. Available water levels in the upper sandy layers are very low, and low in the subsoil.

The upper layer consists of 3 inches of very dark grayish brown sand. The next 5 inches are composed of dark red sand. The next layer is loose yellowish red sand 14 inches thick. The subsoil is yellowish red, friable sand about 8 inches thick. There is a hard coquina limestone layer below the subsoil.

Cocoa soils are geographically associated with Astatula, Canaveral, Orsino, Palm Beach, Paola, Parkwood, Pomello, and St Lucie soil series. Most areas throughout the range of Cocoa soils are cultivated with citrus being the principal crop. The native vegetation supported by this soil type includes scattered live oak and laurel oak, cabbage palmetto, magnolia, and pineland threeawn.

27 – Palm Beach-Urban land complex, 0 to 8 percent slopes - This soil type consists of very deep, well to excessively drained, very rapidly permeable soils on dune-like ridges that are generally parallel to the Atlantic and Gulf Coastal Plain, principally in peninsular Florida. They formed in regolith that is a marine deposit of thick beds of sand and shell fragments.

Palm Beach soils are geographically associated with Anclote, Basinger, Canaveral, Paola, Immokalee, Myakka, Pomello, Welaka and St. Lucie

John D. MacArthur Beach State Park Soil Descriptions

soil series. They are similar to Canaveral soils, but have a water table deeper than 6 feet. The Palm Beach soils consist of nearly level to sloping, well drained, deep sandy soils.

The surface layer is dark grayish brown sand and shell fragments about 6 inches thick. The next layer is pale brown sand and shell fragments about 34 inches thick. The next layer consists of light yellowish brown sand and shell fragments, extending to a depth up to 80 inches or more.

Native vegetation supported by this soil type includes cabbage palm, running oak, saw palmetto, common seagrape, sea oats, bays and oaks.

35 – Quartzipsammments, shaped, 0 to 5 percent slopes - This soil type consists of well drained, deep, sandy soils in areas where natural soils have been altered by cutting down ridges and spreading the soil material over adjacent lower soils. This is done when low areas are filled above natural ground level, and by filling and shaping soil material (i.e. to form golf courses). The sandy fill material may be hauled in from a distant location, but is usually obtained onsite by dredging nearby water areas, or by excavating to create new water areas.

Permeability is very rapid, and available water capture is low.

There is not a standard soil layer pattern for this soil type. The most common example has a surface layer of dark grayish brown sand about 6 inches thick. Next are stratified layers of gray, grayish brown, light gray, light brownish gray, and white sand in any sequence and variable thickness. The depth range of this strata is 6 to 32 inches. Below this layer is a strong brown sand 10 inches thick with some dark reddish brown fragments of weakly cemented sand. The next layer is a grayish brown sand 18 inches thick. The last layer is about 80 inches of white sand.

44 – Kesson mucky sand, tidal – This soil type consists of deep, very poorly drained, rapid to moderately permeable soils that formed in thick marine deposits of sand and shell fragments in tidal swamps and marshes along the Gulf Coast and Southeast Coast of Peninsular Florida. Slopes range from 0 to 1 percent.

Kesson soils are in tidal swamps and marshes that are flooded during normal high tides. The color, texture, and thickness of the layers of this soil vary from area to another. A common profile has the soil's surface

John D. MacArthur Beach State Park Soil Descriptions

layer of black, very dark gray, or very dark grayish brown and is 10 inches or more thick. It is a mucky sand or a mucky loamy sand. The surface layer is fibrous muck 4 to 6 inches thick. The next layer is black, very dark gray, very dark grayish brown, dark gray, gray, grayish brown, or brown sand, fine sand, or loamy sand.

Kesson soils are geographically associated with Captiva, Myakka, and Wulfert soil series. Kesson soils were formerly mapped as tidal swamp and are function mainly for wildlife habitat. Native vegetation supported by this soil type includes red, black and white mangroves, oxeye daisy, and batis.

Addendum 5—Plant and Animal List

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PTERIDOPHYTES

Golden leather fern.....	<i>Acrostichum aureum</i>	MS
Giant leather fern.....	<i>Acrostichum danaeifolium</i>	
Swamp fern.....	<i>Blechnum serrulatum</i>	
Asian sword fern.....	<i>Nephrolepis brownii</i> *	
Tuberous sword fern.....	<i>Nephrolepis cordifolia</i> *	
Wild Boston fern.....	<i>Nephrolepis exaltata</i>	
Old World climbing fern.....	<i>Lygodium microphyllum</i>	
Hand Fern.....	<i>Ophioglossum palmatum</i>	D
Golden polypody.....	<i>Phlebodium aureum</i>	
Resurrection fern.....	<i>Pleopeltis polypodioides</i> var. <i>michauxiana</i>	
Whisk fern.....	<i>Psilotum nudum</i>	
Lacey bracken fern.....	<i>Pteridium aquilinum</i> var. <i>caudatum</i>	
Tailed bracken fern.....	<i>Pteridium aquilinum</i> var. <i>pseudocaudatum</i>	
Shoestring fern.....	<i>Vittaria lineata</i>	

GYMNOSPERMS

Slash pine.....	<i>Pinus ellioti</i>
Coontie.....	<i>Zamia integrifolia</i>

ANGIOSPERMS

Monocots

False-sisal.....	<i>Agave decipiens</i>
Southern sandbur.....	<i>Cenchrus echinatus</i>
Coastal sandbur.....	<i>Cenchrus incertus</i>
Sanddune sandbur.....	<i>Cenchrus tribuloides</i>
Areca palm.....	<i>Chrysalidocarpus lutescens</i> *
Jamaican swamp sawgrass ..	<i>Cladium jamaicense</i>
Coconut palm.....	<i>Cocos nucifera</i> *
Common dayflower.....	<i>Commelina diffusa</i>
Whitemouth dayflower.....	<i>Commelina erecta</i>
Bermuda grass.....	<i>Cynodon dactylon</i> *
Baldwin's flatsedge.....	<i>Cyperus croceus</i>
Swamp flatsedge.....	<i>Cyperus ligularis</i>
Beach star.....	<i>Cyperus pedunculatus</i>
Flatleaf flatsedge.....	<i>Cyperus planifolius</i>
Manyspike flatsedge.....	<i>Cyperus polystachyos</i>
Nut-grass.....	<i>Cyperus rotundus</i> *
Tropical flatsedge.....	<i>Cyperus surinamensis</i>
Crow's-foot grass.....	<i>Dactyloctenium aegyptium</i> *
Variable witchgrass.....	<i>Dichantherium commutatum</i>
Southern crabgrass.....	<i>Digitaria ciliaris</i>
Pangola grass.....	<i>Digitaria pentzii</i> *
Air-potato.....	<i>Dioscorea alata</i>
Indian goose grass.....	<i>Eleusine indica</i> *

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Florida butterfly orchid.....	<i>Encyclia tampensis</i>	
Gophertail love grass	<i>Eragrostis ciliaris</i> *	
Common fingergrass	<i>Eustachys petraea</i>	
Hurricane sedge	<i>Fimbristylis cymosa</i> *	
Toothpetal false reinorchid ..	<i>Habenaria floribunda</i>	
Mangrove spider lily	<i>Hymenocallis latifolia</i>	
Woods grass	<i>Oplismenus hirtellus</i>	
Beach grass.....	<i>Panicum amarum</i>	
Torpedo grass	<i>Panicum repens</i> *	
Knot grass	<i>Paspalum distichum</i>	
Bahia grass	<i>Paspalum notatum</i> *	
Thin paspalum.....	<i>Paspalum setaceum</i>	
Seashore paspalum.....	<i>Paspalum vaginatum</i>	
Senegal date palm.....	<i>Phoenix reclinata</i> *	
Florida royal palm.....	<i>Roystonea regia</i>	MAH, DV
Cabbage palm.....	<i>Sabal palmetto</i>	
Bowstring hemp.....	<i>Sansevieria hyacinthoides</i> *	
Baldwin's nutrush.....	<i>Scleria baldwinii</i>	
Saw palmetto.....	<i>Serenoa repens</i>	
Coastal foxtail	<i>Setaria macrosperma</i>	
Knotroot foxtail	<i>Setaria parviflora</i>	
Earleaf greenbrier	<i>Smilax auriculata</i>	
Saw greenbrier	<i>Smilax bona-nox</i>	
Laurel greenbrier	<i>Smilax laurifolia</i>	
Smooth cordgrass	<i>Spartina alterniflora</i> var <i>glabra</i>	
Saltmeadow cordgrass.....	<i>Spartina patens</i>	
Coral dropseed grass	<i>Sporobolus domingensis</i>	
Smut grass	<i>Sporobolus indicus</i> *	
Seashore dropseed	<i>Sporobolus virginicus</i>	
St. Augustine grass.....	<i>Stenotaphrum secundatum</i> *	
Queen palm.....	<i>Syagrus romanzoffianum</i> *	
Stiff-leaved wild pine.....	<i>Tillandsia fasciculata</i> var <i>densispica</i>	
Ball moss	<i>Tillandsia recurvata</i>	
Spanish-moss	<i>Tillandsia usneoides</i>	
Giant wild pine	<i>Tillandsia utriculata</i>	
Sea oats	<i>Uniola paniculata</i>	
Paragrass	<i>Urochloa mutica</i> *	
Signal grass.....	<i>Urochloa subquadripa</i> *	
Spanish bayonet	<i>Yucca aloifolia</i>	

Dicots

Rosary pea.....	<i>Abrus precatorius</i> *	
Barbwire cactus	<i>Acanthocereus tetragonus</i>	
Hammock snakeroot	<i>Ageratina jucunda</i>	
Yellow joyweed	<i>Alternanthera flavescens</i>	
Seaside joyweed	<i>Alternanthera maritima</i>	
Purple amaranth.....	<i>Amaranthus blitum</i> *	
Common ragweed	<i>Ambrosia artemisiifolia</i>	

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Peppervine	<i>Ampelopsis arborea</i>	
Black-calabash	<i>Amphitecna latifolia</i>	
Sea torchwood	<i>Amyris elemifera</i>	
Pond apple	<i>Annona glabra</i>	
Coral vine.....	<i>Antigonon leptopus*</i>	
Marlberry.....	<i>Ardisia escallonioides</i>	
Sea lavender.....	<i>Argusia gnaphalodes.....</i>	BD
Chinese violet.....	<i>Asystasia gangetica*</i>	
Black mangrove	<i>Avicennia germinans</i>	
Salt bush.....	<i>Baccharis halimifolia</i>	
Spanish needle.....	<i>Bidens alba var. radiata</i>	
Bishopwood.....	<i>Bischofia javanica *</i>	
Samphire	<i>Blutaparon vermiculare</i>	
Red spiderling	<i>Boerhavia diffusa</i>	
Green sea-oxeye-daisy	<i>Borrchia arborescens</i>	
Silver sea-oxeye-daisy	<i>Borrchia frutescens</i>	
Gumbo-limbo.....	<i>Bursera simaruba</i>	
Gray nicker-bean	<i>Caesalpinia bonduc</i>	
Coastal searocket.....	<i>Cakile lanceolata</i>	
American beautyberry.....	<i>Callicarpa americana</i>	
Bay-bean.....	<i>Canavalia rosea</i>	
Jamaica caper-tree	<i>Capparis cynophallophora</i>	
Limber caper	<i>Capparis flexuosa</i>	
Papaya.....	<i>Carica papaya</i>	
Sevenyear apple	<i>Casasia clusiifolia</i>	
Love vine.....	<i>Cassytha filiformis</i>	
Australian pine	<i>Casuarina equisetifolia*</i>	
Madagascar periwinkle	<i>Catharanthus roseus*</i>	
Coinwort.....	<i>Centella asiatica</i>	
Hairy sensitive-pea.....	<i>Chaemecrista nictitans var. aspera</i>	
Limestone sandmat	<i>Chamaesyce blodgettii</i>	
Sand dune spurge	<i>Chamaesyce bombensis</i>	
Hairy spurge.....	<i>Chamaesyce hirta</i>	
Eyebane.....	<i>Chamaesyce hypericifolia</i>	
Seaside spurge	<i>Chamaesyce mesembryanthemifolia</i>	
Florida hammock sandmat ...	<i>Chamaesyce ophthalmica</i>	
Mexican tea	<i>Chenopodium ambrosioides*</i>	
Common snowberry	<i>Chiococca alba</i>	
Jack-in-the-bush	<i>Chromolaena odorata</i>	
Coco-plum	<i>Chrysobalanus icaco</i>	
Satinleaf	<i>Chrysophyllum oliviforme</i>	
Florida fiddlewood	<i>Citharexylum spinosum</i>	
Stinging nettle	<i>Cnidoscolus stimulosus</i>	
Pigeon plum.....	<i>Coccoloba diversifolia</i>	
Sea plum	<i>Coccoloba diversifolia x uvifera</i>	
Seagrape	<i>Coccoloba uvifera</i>	
Latherleaf.....	<i>Colubrina asiatica*</i>	
Buttonwood	<i>Conocarpus erecta</i>	

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Dwarf Canadian horseweed ..	<i>Conyza canadensis var. pusilla</i>
Florida vente conmingo	<i>Croton glandulosus var. floridanus</i>
Vente conmingo	<i>Croton glandulosus</i>
Gulf croton	<i>Croton punctatus</i>
Carrotwood	<i>Cupaniopsis anacardioides*</i>
Coin vine	<i>Dalbergia ecastophyllum</i>
Royal poinciana	<i>Delonix regia*</i>
Beggar-weed	<i>Desmodium incanum</i>
Dixie ticktrefoil	<i>Desmodium tortuosum*</i>
Threeflower ticktrefoil	<i>Desmodium triflorum*</i>
Pony-foot	<i>Dichondra carolinensis</i>
Persimmon	<i>Diospyros virginiana</i>
Guiana plum	<i>Drypetes lateriflora</i>
Devil's potato	<i>Echites umbellata</i>
False daisy	<i>Eclipta prostrata</i>
Florida tasselflower	<i>Emilia fosbergii*</i>
Lilac tasselflower	<i>Emilia sonchifolia*</i>
Pothos	<i>Epipremnum pinnatum*</i>
Loquat	<i>Eriobotrya japonica*</i>
Coral bean	<i>Erythrina herbacea</i>
White stopper	<i>Eugenia axillaris</i>
Spanish stopper	<i>Eugenia foetida</i>
Surinam cherry	<i>Eugenia uniflora*</i>
Dog fennel	<i>Eupatorium capillifolium</i>
Inkwood	<i>Exothea paniculata</i>
Hairy crabweed	<i>Fatoua villosa*</i>
Strangler fig	<i>Ficus aurea</i>
Laurel fig	<i>Ficus microcarpa*</i>
Florida privet	<i>Foresteria segregata</i>
Downy milkpea	<i>Galactia volubilis</i>
Coastal bedstraw	<i>Galium hispidulum</i>
Purple cudweed	<i>Gamochaeta purpurea</i>
Southern gaura	<i>Gaura angustifolia</i>
Rabbit tobacco	<i>Gnaphalium obtusifolium</i>
Blolly	<i>Guapira discolor</i>
Firebush, scarletbush	<i>Hamelia patens</i>
Flattop mille grains	<i>Hedyotis corymbosa*</i>
Pinebarren frostweed	<i>Helianthemum corymbosum</i>
Beach sunflower	<i>Helianthus debilis</i>
Scorpion tail	<i>Heliotropium angiospermum</i>
Pineland heliotrope	<i>Heliotropium polyphyllum</i>
Nightblooming cereus	<i>Hylocereus undatus*</i>
St Peter's wort	<i>Hypericum crux-andreae</i>
St. Andrew's cross	<i>Hypericum hypericoides</i>
Creeping indigo	<i>Indigofera spicata*</i>
Moon-flower	<i>Ipomoea alba</i>
Morning glory	<i>Ipomoea indica var. acuminata</i>
Railroad vine	<i>Ipomoea pes-caprae ssp. brasiliensis</i>

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Bloodleaf.....	<i>Iresine diffusa</i>	
Beach elder	<i>Iva imbricata</i>	
Gold Coast jasmine	<i>Jasminum dichotomum*</i>	
Devil's backbone	<i>Kalanchoe daigremontiana*</i>	
Common liveleaf	<i>Kalanchoe pinnata*</i>	
Virginia saltmarsh mallow ...	<i>Kosteletzkya virginica</i>	
Black ironwood	<i>Krugiodendron ferreum</i>	
Grassleaf lettuce.....	<i>Lactuca graminifolia</i>	
White mangrove	<i>Languncularia racemosa</i>	
Shrubverbena.....	<i>Lantana camara*</i>	
Wild sage	<i>Lantana involucrata</i>	
Poor-man's-pepper.....	<i>Lepidium virginicum</i>	
Canada toadflax	<i>Linaria canadensis</i>	
Fetterbush	<i>Lyonia lucida</i>	
Sapodilla	<i>Manilkara zapota*</i>	
Snow squarestem.....	<i>Melanthera nivea</i>	
Pineland blackanthers	<i>Melanthera parvifolia</i>	
Chinaberrytree	<i>Melia azedarach*</i>	
Spanish lime	<i>Melicoccus bijugatus*</i>	
Creeping cucumber	<i>Melothria pendula</i>	
Poor man's patch.....	<i>Mentzelia floridana</i>	
Noyau vine.....	<i>Merremia dissecta</i>	
Poisonwood.....	<i>Metopium toxiferum</i>	
Florida Keys hempvine	<i>Mikania cordifolia</i>	
Wild balsam apple.....	<i>Momordica charantia*</i>	
Red mulberry	<i>Morus rubra</i>	
Wax myrtle.....	<i>Myrica cerifera</i>	
Myrsine	<i>Myrsine cubana</i>	
Oleander.....	<i>Nerium oleander*</i>	
Elliptic yellowwood	<i>Ochrosia elliptica*</i>	
Lancewood.....	<i>Ocotea coriacea</i>	
Monk orchid	<i>Oeceoclades maculate*</i>	
Seaside evening primrose.....	<i>Oenothera humifusa</i>	
Burrowing four-o'clock	<i>Okenia hypogaea</i>	BD
Prickly pear cactus	<i>Opuntia humifusa</i>	
Erect prickly pear cactus	<i>Opuntia stricta</i>	
Lady's sorrel	<i>Oxalis corniculata</i>	
Florida pellitory	<i>Parietaria floridana</i>	
Virginia creeper	<i>Parthenocissus quinquefolia</i>	
Corky-stemmed passionflower.....	<i>Passiflora suberosa</i>	
Jacob's ladder.....	<i>Pedilanthus tithymaloides var smallii*</i>	
Redbay	<i>Persea borbonia</i>	
Swamp bay.....	<i>Persea palustris</i>	
Guinea-hen weed	<i>Petiveria alliacea</i>	
Frogfruit	<i>Phyla nodiflora</i>	
Drummond's leafflower	<i>Phyllanthus abnormis</i>	
Gale-of-wind	<i>Phyllanthus amarus*</i>	
Mascarene Island leafflower.....	<i>Phyllanthus tenellus*</i>	

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Chamber bitter	<i>Phyllanthus urinaria</i> *
Walter's ground cherry	<i>Physalis walteri</i>
American pokeweed	<i>Phytolacca americana</i>
Artillery plant	<i>Pilea microphylla</i>
Devil's claw	<i>Pisonia aculeata</i>
Florida Keys blackbead	<i>Pithecellobium keyense</i>
Wild plumbago	<i>Plumbago zeylanica</i>
Frangipani	<i>Plumeria alba</i> *
Painted leaf	<i>Poinsettia cyathophora</i>
Candyweed.....	<i>Polygala grandiflora</i>
Mild water pepper.....	<i>Polygonum hydropiperoides</i>
Rustweed	<i>Polypremum procumbens</i>
Paraguayan purslane	<i>Portulaca amilis</i> *
Purslane.....	<i>Portulaca oleracea</i>
Pink purslane	<i>Portulaca pilosa</i>
Rabbit's tobacco	<i>Pseudognaphalium obtusifolium</i>
Guava	<i>Psidium guajava</i> *
Shiny-leaved wild coffee.....	<i>Psychotria nervosa</i>
Shortleaf wild coffee.....	<i>Psychotria sulzneri</i>
Mock bishopweed	<i>Ptilimnium capillaceum</i>
Laurel oak	<i>Quercus laurifolia</i>
Virginia live oak	<i>Quercus virginiana</i>
White indigo-berry	<i>Randia aculeata</i>
Red mangrove	<i>Rhizophora mangle</i>
Brown haired snoutbean.....	<i>Rhynchosia cinerea</i>
Rougeberry.....	<i>Rivina humilis</i>
Green shrimpplant	<i>Ruellia blechum</i> *
Perennial glasswort.....	<i>Salicornia perennis</i>
Prickly Russian thistle	<i>Salsola kali</i> ssp. <i>pontica</i> *
Southern elderberry.....	<i>Sambucus canadensis</i>
Milkweed vine	<i>Sarcostemma clausum</i> *
Inkberry	<i>Scaevola plumieri</i>
Beach naupaka.....	<i>Scaevola taccada</i> *
Umbrella tree	<i>Schefflera actinophylla</i> *
Brazilian pepper	<i>Schinus terebinthifolius</i> *
Gulf graytwig	<i>Schoepfia chrysophylloides</i>
Sea purslane.....	<i>Sesuvium portulacastrum</i>
Common wire weed	<i>Sida acuta</i>
Lima.....	<i>Sida cordifolia</i> *
Indian hemp.....	<i>Sida rhombifolia</i>
Wild mastic.....	<i>Sideroxylon foetidissimum</i>
Tough Florida bully.....	<i>Sideroxylon salicifolium</i>
Tough buckhorn.....	<i>Sideroxylon tenax</i>
Paradise tree	<i>Simarouba glauca</i>
Bahama nightshade	<i>Solanum bahamense</i>
Chapman's goldenrod	<i>Solidago chapmanii</i>
Narrow-leaved goldenrod	<i>Solidago stricta</i>
Yellow necklace-pod	<i>Sophora tomentosa</i> var <i>truncata</i>

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- Woodland false buttonweed .*Spermacoce assurgens*
Shrubby false buttonweed ... *Spermacoce verticillata*
Sea blite*Suaeda linearis*
Bay cedar*Suriana maritima*
Arrowhead vine..... *Syngodium podophyllum**
Java plum *Syzygium cumini**
Seaside mahoe *Thespesia populnea**
Eastern poison ivy*Toxicodendron radicans*
Oyster plant *Tradescantia spathacea**
Puncture weed*Tribulus cistoides**
Forked bluecurls.....*Trichostema dichotomum*
Brittleweed.....*Tridax procumbens**
Caesar's weed.....*Urena lobata**
Frostweed.....*Verbesina virginica*
Cow-pea..... *Vigna luteola*
Lilac chaste tree*Vitex agnus-castus**
Simple-leaf chaste tree *Vitex trifolia**
Florida grape*Vitis cinerea* var. *floridana*
Muscadine grape..... *Vitis rotundifolia*
Calusa grape.....*Vitis shuttleworthii*
Creeping wedelia *Wedelia trilobata**
Hog-plum.....*Ximenia americana*
Rocketweed *Youngia japonica**
Hercules' club..... *Zanthoxylum clava-herculis*
Wild lime*Zanthoxylum fagara*

MARINE PLANTS

Seagrass

- Shoal grass *Halodule wrightii*
Paddle grass.....*Halophila dicipiens*
Engelman's seagrass..... *Halophila engelmannii*
Johnson's seagrass*Halophila johnsonii* ESGB
Widgeon grass.....*Ruppia maritima*
Manatee grass*Syringodium filiforme*
Turtle Grass.....*Thalassia testudinum*

Macroalgae

Chlorophyta (Green Algae)

- Mermaid's wine glass*Acetabularia crenulata*
Paddle blade alga *Avrainvillea longicaulis*
Flat green feather alga*Caulerpa mexicana*
Oval-blade alga..... *Caulerpa prolifera*
Green feather alga *Caulerpa sertularioides*
Spaghetti Algae *Chaetomorpha* sp.
..... *Cladophora albida*
Dead man's fingers *Codium decorticatum*
Stalked lettuce leaf alga..... *Halimeda tuna*

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Scalloped disk alga *Halimeda tuna* f. *platydisca*
Mermaid's shaving brush *Penicillus capitatus*
Mermaid's fans..... *Udotea* spp.

Phaeophyta (Brown Algae)

Y-branched alga..... *Dictyota menstrualis*
Y-branched alga..... *Dictyota pulchella*
Scroll alga..... *Padina sanctae-crucis*

Rhodophyta (Red Algae)

Spiny seaweed..... *Acanthophora spicifera*
.....*Centroceras minutum*
..... *Ceramium* spp
.....*Gracilaria cervicornis*
..... *Gracilaria* cf. *damaecornis*
..... *Gracilaria tikvahiae*
..... *Hypnea cornuta*
Hooked red weed.....*Hypnea cervicornis*
..... *Hypnea spinella*
.....*Polysiphonia denudata*
..... *Spyridia clavata*
Red bush alga *Laurencia poiteaui*

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INVERTEBRATES

PORIFERA
(Sponges)

Red boring sponge.....	<i>Cliona deletrix</i>	MCNS
Orange boring sponge	<i>Cliona lampa</i>	MCNS
Red sponge.....	<i>Haliclona rubens</i>	MCNS
Vase sponge	<i>Ircinia campana</i>	MCNS
Stinker sponge	<i>Ircinia felix</i>	MCNS
Black ball sponge.....	<i>Ircinia strobilina</i>	MCNS

CNIDARIANS
(Corals, Anemones, Jellyfish)

Scleractinia (Hard Corals)

Lesser starlet coral	<i>Siderastrea radians</i>	MCNS
Greater starlet coral	<i>Siderastrea siderea</i>	MCNS

Octocoralia (Soft Corals)

White telesto	<i>Carijoa riisei</i>	MCNS
Common sea fan	<i>Gorgonia ventalina</i>	MCNS
Colorful sea whip.....	<i>Leptogorgia virgulata</i>	MCNS

Hydrozoans

Branching fire coral	<i>Millepora alcicornis</i>	MCNS
Portuguese man-of-war	<i>Physalia physalis</i>	MTC
By-the-wind sailor	<i>Velella velella</i>	MTC

Anemones and Zoanthids

Corkscrew anemone	<i>Bartholomea annulata</i>	MCNS
Giant Caribbean anemone.....	<i>Chondylactus gigantea</i>	MCNS
Sun zoanthid.....	<i>Palthoa grandis</i>	MCNS

Jellyfish

Moon jelly	<i>Aurelia aurita</i>	MCNS, MUS
Cannonball jellyfish.....	<i>Stromolophus meleagris</i>	MTC
Mangrove box jellyfish.....	<i>Tripedalia cystophora</i> *	MS, EUS

CTENOPHORES

Sea walnut	<i>Mnemiopsis mccradyi</i>	MCNS, MUS
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POLYCHAETES
(Segmented Worms)

Split-crown feather duster....	<i>Anamobaea orstedii</i>	MCNS
Parchment tube worm	<i>Chaetopterus variopedatus</i>	EUS

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Spaghetti worm.....	<i>Eupolymnia crassicornis</i>	MUS
Worm rock.....	<i>Phragmatopoma caudata</i>	MWR
Magnificent feather duster ...	<i>Sabellastarte magnifica</i>	MCNS

CRUSTACEANS

Speckled swimming crab.....	<i>Arenaeus cribrarius</i>	MUS
Mangrove tree crab	<i>Aratus pisonii</i>	MS
Striped acorn barnacle	<i>Balanus amphitrite</i>	EUS, MS
Ivory barnacle	<i>Balanus eburneus</i>	MCNS
Orange claw hermit crab.....	<i>Calcinus tibicen</i>	MTC
Lesser blue crab.....	<i>Callinectes similis</i>	MTC
Blue crab.....	<i>Callinectes sapidus</i>	MTC
Blue land crab.....	<i>Cardisoma guanhumi</i>	MS, MAH
Thin stripe hermit crab	<i>Clibinarius vittatus</i>	ESGB, EUS
Land hermit crab.....	<i>Coenobita clypeatus</i>	MAH, MS, DV
Blue-legged hermit crab.....	<i>Clibanarius tricolor</i>	ESGB, EUS
Striped hermit crab	<i>Clibanarius vittatus</i>	ESGB, EUS
Say's Mud Crab	<i>Dyspanopeus sayi</i>	EUS, MS, ESGB
Common mole crab	<i>Emerita talpoida</i>	MUS
Mangrove crab.....	<i>Goniopsis cruentata</i>	MS
Wharf roach.....	<i>Ligia exotica</i> *	MS
Horseshoe crab	<i>Limulus polyphemus</i>	EUS
Florida decorator crab.....	<i>Macrocoeloma camptocerum</i>	ESGB, EUS
Channel clinging crab	<i>Mithrax spinosissimus</i>	MCNS
Stone crab.....	<i>Mennipe mercenaria</i>	EUS, MUS
Ghost crab	<i>Ocypode quadrata</i>	BD
Banded dwarf hermit crab....	<i>Pagurus annulipes</i>	ESGB, EUS
Long-clawed hermit crab	<i>Pagurus longicarpus</i>	ESGB, EUS
Daggerblade grass shrimp....	<i>Palaemongruntetes pugio</i>	ESGB
Florida spiny lobster	<i>Panularis argus</i>	MCNS
Spotted spiny lobster.....	<i>Panularis guttatus</i>	MCNS
Pink shrimp.....	<i>Penaeus duorarum</i>	MUS
Nimble spray crab.....	<i>Percnon gibbesi</i>	MCNS
Giant hermit crab	<i>Petrochirus diogenes</i>	EUS, MCNS
Porcelain crab	<i>Petrolisthes armatus</i>	EUS, ESGB, MUS
Marsh crab.....	<i>Sesarma cinereum</i>	MS
Mangrove boring isopod	<i>Sphaeroma terebrans</i> *	MS
Arrow crab.....	<i>Stenorhyncus seticornis</i>	MCNS
Ribbed barnacles	<i>Tetraclita stactifera</i>	MCNS
Atlantic sand fiddler	<i>Uca pugilator</i>	MS
Mudflat fiddler	<i>Uca rapax</i>	MS

MOLLUSKS

Gastropods

Long-spine star shell.....	<i>Astrarium phoebium</i>	MUS
Black horn snail	<i>Batillaria minima</i>	EUS, ESGB

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Variable bittum	<i>Batillaria verium</i>	MTC
Lightening whelk	<i>Busycon contrarium</i>	EUS
West Indian bubble.....	<i>Bulla accidentalis</i>	EUS, ESGB, MS
Common Atlantic bubble	<i>Bulla striata</i>	MUS, ESGB
Florida cerith.....	<i>Cerithium atratum</i>	MTC
Flyspeck cerith.....	<i>Cerithium muscarum</i>	MTC
Apple murex.....	<i>Chicoreus pomum</i>	EUS, ESGB
Flamingo tongue.....	<i>Cyphoma gibbosum</i>	MCNS
Cayenne keyhole limpet.....	<i>Diodora cayenensis</i>	MCNS
Banded tulip conch.....	<i>Fasciolaria hunteria</i>	EUS, ESGB
True tulip conch	<i>Fasciolaria tulipa</i>	EUS, ESGB
Mangrove periwinkle	<i>Littorina angulifera</i>	MS
Crown conch.....	<i>Melongena corona</i>	EUS, MS
Coffee bean marsh snail.....	<i>Melampus coffeus</i>	EUS, ESGB, MS
Buttonsnail	<i>Modulus modulus</i>	EUS, ESGB
Lace murex	<i>Murex florifer</i>	EUS, MUS, ESGB
Bruised nassa.....	<i>Nassarius vibex</i>	MTC
Colorful moonshell	<i>Naticarius canrena</i>	MUS
Antillean nerite	<i>Nerita fulgurans</i>	EUS, ESGB, MS
Florida horse conch.....	<i>Pleuroploca gigantean</i>	MCNS, MUS
Shark's eye	<i>Polinices duplicatus</i>	MCNS, MUS
Coffee bean trivia.....	<i>Pusula pediculus</i>	MUS
Netted olive	<i>Oliva reticularis</i>	MUS, EUS, ESGB
Lettered olives	<i>Oliva sayana</i>	MUS
Florida rock snail	<i>Stramonita haemastoma floridana</i>	MCNS
Brown baby ear	<i>Sinum maculatum</i>	MUS
Florida fighting conch	<i>Strombus alatus</i>	EUS, ESGB
Queen conch	<i>Strombus gigas</i>	EUS, ESGB
Common American auger	<i>Terebra dislocate</i>	MUS

Bivalves

Transverse ark	<i>Anadara transversa</i>	EUS, MUS
Stiff penshell.....	<i>Atrina rigida</i>	EUS, ESGB
Scorched mussel.....	<i>Brachidontes exustus</i>	MS
Scaly scallop	<i>Caribachlamys sentis</i>	MCNS
Cross-barred venus.....	<i>Chione cancellata</i>	EUS, ESGB
Eastern oyster	<i>Crassostrea virginica</i>	MS
Atlantic giant cockle.....	<i>Dinocardium robustum</i>	EUS, MUS
Disc dosinia.....	<i>Dosinia discus</i>	EUS, MUS
Elegant dosinia	<i>Dosinia elegans</i>	EUS, MUS
Variable coquina clam	<i>Donax variabilis</i>	MUS
Ribbed mussel	<i>Geukensia demissa</i>	EUS, MS
Flat tree oyster	<i>Isognomon alatus</i>	MS
Sunray venus	<i>Macrocallista nimbosa</i>	EUS, ESGB
Southern quahog	<i>Mercenaria mercenaria</i>	MUS, ESGB
Atlantic ribbed mussel.....	<i>Modiolus demissus</i>	MS
Favored telling	<i>Tellina fausta</i>	MUS

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Cephalopods

Common octopus	<i>Octopus vulgaris</i>	MCNS
Caribbean reef squid	<i>Sepioteuthis sepiodea</i>	MCNS, MUS

ECHINODERMS

Sea Urchins

Common arbacia urchin	<i>Arabacia punctulata</i>	MCNS
Magnificent urchin	<i>Astropyga magnifica</i>	MCNS
Rock-boring urchin	<i>Echinometre lucunter</i>	MCNS
Slate-pencil sea urchin	<i>Eucidaris tribuloides</i>	MCNS
Variiegated urchin	<i>Lytechinus variegatus</i>	MCNS
Five-keyhole sand dollar	<i>Mellita quinquiesperforata</i>	MUS

Sea Stars

Gray sea star	<i>Luidia clathrata</i>	MUS
Nine arm sea star	<i>Luidea senegalensis</i>	MUS, ESGB
Blunt-spined brittle star	<i>Opheocoma echinata</i>	MUS
Cushion sea star	<i>Oreaster reticulatus</i>	MUS, ESGB

Sea Cucumbers

Florida sea cucumber	<i>Holothuria floridana</i>	MUS
Harlequin sea cucumber	<i>Holothuria grisea</i>	MCNS
Three-rowed sea cucumber ..	<i>Isostichopus badionotus</i>	MUS
Hidden sea cucumber	<i>Pseudothyone belli</i>	MUS
Green sea cucumber	<i>Thyonella gemmate</i>	EUS, ESGB

TUNICATES

Black tunicate	<i>Ascidia nigra</i>	MCNS
Pleated sea squirt	<i>Styela plicata</i>	EUS, MS
Red tunicate	<i>Symplegma rubra</i>	EUS, MS

INSECTS

Dragonflies and Damselflies

Common green darner	<i>Anax junius</i>	DV
Twilight darner	<i>Gynacantha nervosa</i>	MS
Rambur's fork-tail	<i>Ischnura ramburii</i>	BD, MS

Grasshoppers, Crickets and Katydid

Linear-winged grasshopper ..	<i>Aptenopedes sphenarioides</i>	BD
Tropical house cricket	<i>Gryllodes sigillatus*</i>	DV
Spotted-winged grasshopper	<i>Orphulella pelidna</i>	BD
American grasshopper	<i>Schistocerca americana</i>	BD
Seaside grasshopper	<i>Trimerotropis maritima</i>	BD

Stick Insects

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Two-striped walkingstick *Anisomorpha buprestoides* BD, DV

True Bugs, Cicadas and Hoppers

Seaside cicada *Diceroprocta viridifascia* BD, MAH
 Large milkweed bug *Oncopeltus fasciatus* BD

Antlions, Lacewings and Owlflies

Ant lion. *Myrmeleon* sp. BD, DV

Flies

Rugose spiraling whitefly..... *Aleurodicus rugioperculatus** MTC
 Biting midge..... *Culicoides* sp..... MTC
 Black saltmarsh mosquito *Ochlerotatus taeniorhynchus*..... MTC
 Sand fly *Phlebotomus* sp MTC
 Stable flies *Stomoxys calcitrans* MTC

Butterflies and Skippers

Sleepy orange *Abaeis nicippe* BD, MAH, DV
 Gulf fritillary *Agraulis vanillae* BD, MAH, DV
 White peacock..... *Anartia jatrophae* BD, MAH, DV
 Yellow-angled Sulphur *Anteos maerulia*..... MAH
 Statira sulphur *Aphrissa statira* BD, MAH, DV
 Florida white *Appias drusilla*..... BD, MAH, DV
 Monk skipper *Asbolis capucinus* BD, MAH, DV
 Great southern white *Ascia monuste* BD, MAH, DV
 Red-banded hairstreak..... *Calycopis cecrops* BD, MAH, DV
 Soldier *Danaus eresimus* BD, MAH, DV
 Queen *Danaus gilippus* BD, MAH, DV
 Monarch..... *Danaus plexippus* BD, MAH, DV
 Julia heliconian *Dryus iulia* BD, MAH, DV
 Fulvous hairstreak *Electrostrymon angelia*..... BD, MAH, DV
 Silver-spotted skipper..... *Eparagyreus clarus*..... BD, MAH, DV
 Horace's duskywing *Erynnis horatius* BD, MAH, DV
 Little yellow *Eurema lisa*..... BD, MAH, DV
 Zebra heliconian *Heliconius charithonia* BD, MAH, DV
 Ceraunus blue *Hemiargus ceraunus*..... BD, MAH, DV
 Fiery Skipper..... *Hylephila phyleus* BD, MAH, DV
 Mangrove buckeye *Junonia evarete* MS, BD
 Cassius blue..... *Leptotes cassius*..... MAH, DV
 Clouded skipper *Lerema accius*..... BD, MAH, DV
 Eufala skipper *Lerodea eufala*..... BD, DV
 Ruddy daggerwing *Marpesia petreus*..... BD, MAH, DV
 Dainty sulphur *Nathalis iole* MAH, DV
 Twin-spot skipper *Oligoria maculate* BD, MAH, DV
 Ocola skipper *Panoquina ocola* BD, MAH, DV
 Giant swallowtail *Papilio cresphontes* BD, MAH, DV
 Eastern tiger swallowtail *Papilio glaucus* BD, MAH, DV
 Black swallowtail *Papilio polyxenes*..... BD, MAH, DV

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Mangrove skipper	<i>Phocides pigmalion</i>	MS, MAH, BD
Large orange sulphur	<i>Phoebis agarithe</i>	BD, MAH, DV
Orange-barred sulphur	<i>Phoebis philea</i>	BD, MAH, DV
Cloudless sulphur	<i>Phoebis sennae</i>	BD, MAH, DV
Phaon crescent	<i>Phyciodes phaon</i>	BD, MAH, DV
Hammock skipper	<i>Polygonus leo</i>	BD, MAH, DV
Checkered white	<i>Pontia protodice</i>	BD, MAH, DV
Tropical checkered skipper ..	<i>Pyrgus oileus</i>	MAH, DV
Gray hairstreak	<i>Strymon melinus</i>	BD, MAH, DV
Dorantes longtail	<i>Urbanus dorantes</i>	BD, MAH, DV
Red admiral	<i>Vanessa atalanta</i>	BD, MAH, DV
American lady	<i>Vanessa virginiensis</i>	BD, MAH, DV
Southern broken dash.....	<i>Wallegrenia otho</i>	BD, MAH, DV

Moths

Titan sphinx moth.....	<i>Aellopos titan</i>	BD
Black witch moth	<i>Ascalapha odorata</i>	BD, MAH
Florida io moth	<i>Automeris io lilith</i>	BD, MAH
Giant leopard moth	<i>Ecpantheria scribonia</i>	BD, MAH
Mournful sphinx moth.....	<i>Enyo lugubris</i>	BD, MAH
Ello sphinx moth	<i>Erinnyis ello</i>	BD, DV
Gaudy sphinx moth.....	<i>Eumorpha labruscae</i>	BD, MAH
Edwards' wasp moth.....	<i>Lymire edwardsii</i>	BD, DV, MAH
Carolina sphinx moth	<i>Manduca sexta</i>	BD, DV
Puss moth.....	<i>Megalopyge opercularis</i>	BD, DV, MAH
White-tipped black moth	<i>Melanchroia chephise</i>	BD
Fig sphinx moth	<i>Pachylia ficus</i>	BD, DV, MAH
Saddleback caterpillar moth	<i>Sibine stimulea</i>	BD, MAH
Tersa sphinx moth.....	<i>Xylophanes tersa</i>	BD

Ants, Bees and Wasps

Honey bee	<i>Apis mellifera</i> *	MTC
Florida carpenter ant	<i>Camponotus floridanus</i>	MTC
Red imported fire ant	<i>Solenopsis invicta</i> *	MTC

Spiders

Trashline orbweaver	<i>Allocyclosa bifurca</i>	MAH, DV
Silver argiope	<i>Argiope argentata</i>	MAH, MS
Dewdrop spider species	<i>Argyrodes nephilae</i>	MAH
Tropical orb-weaver	<i>Eriophora ravilla</i>	MS, DV, MAH
Spinybacked orbweaver.....	<i>Gasteracantha cancriformis</i>	MS, MAH
Orchard orb-weaver.....	<i>Leucauge venusta</i>	MAH, MS
Golden silk orbweaver.....	<i>Nephila clavipes</i>	MAH
Regal jumping spider	<i>Phidippus regius</i>	MAH

Whipscorpions

Spotted tailless whipscorpion	<i>Phrynos marginemaculata</i>	MAH
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VERTEBRATES

CHONDRICTYES (Sharks, Rays)

Spotted eagle ray	<i>Aetobatus narinari</i>	MCNS, MUS
Spinner shark.....	<i>Carcharhinus brivapinna</i>	MCNS, MUS, EUS
Bull shark.....	<i>Carcharhinus leucas</i>	MCNS, MUS, EUS
Blacktip shark	<i>Carcharhinus limbatus</i>	MCNS, MUS
Southern stingray	<i>Dasyatis americana</i>	MCNS, MUS, EUS
Bluntnose stingray	<i>Dasyatis say</i>	MCNS, MUS, EUS
Nurse shark	<i>Ginglymostoma cirratum</i>	MCNS, MUS
Manta ray.....	<i>Manta birostris</i>	MCNS, MUS
Scalloped hammerhead shark	<i>Sphyma tiburo</i>	
	MCNS, MUS	
Yellow stingray	<i>Urolophus jamaicensis</i>	MCNS, MUS

OSTEICTHYES (Bony Fishes)

Flat needlefish	<i>Ablennes hians</i>	MCNS, MUS
Sergeant major	<i>Abudefduf saxatilis</i>	MCNS
Doctorfish.....	<i>Acanthurus chirurgus</i>	MCNS
Ocean surgeonfish.....	<i>Acanthurus bahianus</i>	MCNS
Blue tang	<i>Acanthurus coeruleus</i>	MCNS
Lined sole.....	<i>Achirus lineatus</i>	ESGB, EUS
Scrawled filefish	<i>Aluterus scriptus</i>	MCNS
Orange filefish	<i>Aluterus schoepfi</i>	MCNS
Bay anchovy.....	<i>Anchoa mitchilli</i>	EUS, ESGB
Black margate	<i>Anisostremus surinamensis</i>	MCNS
Porkfish	<i>Anisostremus virginicus</i>	MCNS
Barred cardinalfish	<i>Apogon binotatus</i>	MCNS
Flamefish.....	<i>Apogon maculates</i>	MCNS
Two-spot cardinalfish	<i>Apogon psuedomaculatus</i>	MCNS
Sheepshead	<i>Archosargus probatocephalus</i>	MCNS, MUS
Sea bream.....	<i>Archosargus rhomboidalis</i>	MCNS, MUS
Lined sole.....	<i>Arcirus lineatus</i>	EUS, ESGB
Hardhead catfish.....	<i>Arius felis</i>	MTC
Trumpetfish	<i>Aulostomus maculatus</i>	MCNS
Striped croaker	<i>Bairdiella sanctaeluciae</i>	MCNS, MUS
Gray triggerfish	<i>Balistes carolinensis</i>	MCNS
Spanish hogfish	<i>Bodianus rufus</i>	MCNS
Peacock flounder.....	<i>Bothus lunatus</i>	MUS
Eyed flounder	<i>Bothus ocellatus</i>	MUS
Sharpnose puffer	<i>Canthigaster rostrata</i>	MCNS, EUS
Saucereye porgy	<i>Calamus calamus</i>	MCNS, MUS
Sheepshead porgy	<i>Calamus penna</i>	MCNS
Whitespotted filefish	<i>Cantherhines macrocerus</i>	MCNS
Orangespotted filefish	<i>Cantherhines pullus</i>	MCNS
Ocean triggerfish	<i>Canthidermis sufflamen</i>	MCNS, MUS

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Yellow jack	<i>Caranx bartholomaei</i>	MCNS, MUS
Blue runner	<i>Caranx crysos</i>	MCNS, MUS
Crevalle jack	<i>Caranx hippos</i>	MCNS, MUS
Horse-eye jack	<i>Caranx latus</i>	MCNS, MUS
Bar jack.....	<i>Caranx rubber</i>	MCNS, MUS
Black jack	<i>Caranx lugubris</i>	MCNS, MUS
Common snook	<i>Centropomus undecimalis</i>	MCNS, MUS
Atlantic spadefish	<i>Chaetodipterus faber</i>	MCNS, MUS
Spotfin butterflyfish	<i>Chaetodon ocellatus</i>	MCNS
Reef butterflyfish.....	<i>Chaetodon sedentarius</i>	MCNS
Banded butterflyfish	<i>Chaetodon striatus</i>	MCNS
Striped burrfish.....	<i>Chilomycterus schoepfi</i>	EUS, ESGB
Atlantic bumper	<i>Chloroscombrus chrysurus</i>	MCNS
Blue chromis	<i>Chromis cyanae</i>	MCNS, MUS
Creole wrasse	<i>Clepticus parrae</i>	MCNS
Colon goby	<i>Coryphopterus dicrus</i>	MCNS, MUS
Bridled goby	<i>Coryphopterus glaucofraenum</i>	MCNS
Masked goby.....	<i>Coryphopterus personatus</i>	MCNS
Emerald goby	<i>Ctenogobius smaragdus</i>	ESGB, EUS
Spotted seatrout	<i>Cynoscion nebulosus</i>	EUS, ESGB
Round scad	<i>Decapterus punctatus</i>	MCNS, MUS
Mackerel scad	<i>Decapterus macarellus</i>	MCNS, MUS
Ballonfish	<i>Diodon holocanthus</i>	MCNS
Sand perch	<i>Diplectrum formosum</i>	MCNS
Silver porgy	<i>Diplodus argenteus</i>	MCNS
Spottail pinfish	<i>Diplodus holbrooki</i>	MCNS
Porcupinefish.....	<i>Diodon hystrix</i>	MCNS
Sharksucker.....	<i>Echeneis naucrates</i>	MCNS
Chain moray	<i>Echidna catenata</i>	MCNS
Ladyfish	<i>Elops saurus</i>	ESGB, EUS
Rock Hind	<i>Epinephalus adscensionis</i>	MCNS
Graysby	<i>Epinephalus cruentatus</i>	MCNS
Highhat.....	<i>Equetus acuminatus</i>	MCNS
Jackknife fish.....	<i>Equetus lanceolatus</i>	MCNS
Spotted drum.....	<i>Equetus punctatus</i>	MCNS
Cubbyu	<i>Equetus umbrosus</i>	MCNS
Spotfin mojarra	<i>Eucinostomus argenteus</i>	MUS
Silver Jenny	<i>Eucinostomus gula</i>	MUS
Slender mojarra	<i>Eucinostomus jonesi</i>	MUS
Mottled mojarra	<i>Eucinostomus lefroyi</i>	MUS
Flagfin mojarra	<i>Eucinostomus melanopterus</i>	MUS
Bluespotted coronetfish.....	<i>Fistularia tabacaria</i>	MCNS
Golden topminnow	<i>Fundulus chrysotus</i>	EUS, MUS
Marsh killifish	<i>Fundulus confluentis</i>	EUS, MUS
Gulf killifish.....	<i>Fundulus grandis</i>	EUS, MUS
Yellowfin mojarra	<i>Gerres cinereus</i>	MCNS, MUS
Goldspot goby.....	<i>Gnatholepis thompsoni</i>	MCNS
Spotlight goby	<i>Gobiosoma louisae</i>	MCNS

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Neon goby	<i>Gobiosoma oceanops</i>	MCNS
Green moray.....	<i>Gymnothorax funebris</i>	MCNS
Spotted moray	<i>Gymnothorax moringa</i>	MCNS
Purplemouth moray	<i>Gymnothorax vicinus</i>	MCNS
White margate.....	<i>Haemulon album</i>	MCNS
Tomtate	<i>Haemulon aurolineatum</i>	MCNS
Caesar grunt	<i>Haemulon carbonarium</i>	MCNS
Smallmouth grunt.....	<i>Haemulon chrysargyreum</i>	MCNS
French grunt.....	<i>Haemulon flavolineatum</i>	MCNS
Spanish grunt	<i>Haemulon macrostomum</i>	MCNS
Cottonwick	<i>Haemulon melanurum</i>	MCNS
White grunt	<i>Haemulon plumieri</i>	MCNS
Sailors choice	<i>Haemulon parra</i>	MCNS
Bluestriped grunt.....	<i>Haemulon sciurus</i>	MCNS
Striped grunt	<i>Haemulon striatum</i>	MCNS
Slippery dick.....	<i>Halichoeres bivittatus</i>	MCNS
Rainbow wrasse	<i>Halichoeres pictus</i>	MCNS
Blackear wrasse	<i>Halichoeres poeyi</i>	MCNS
Puddingwife	<i>Halichoeres radiatus</i>	MCNS
Clown wrasse	<i>Halichoeres maculipinna</i>	MCNS
Scaled sardine.....	<i>Harengula jaguana</i>	EUS, ESGB, MUS
Ballyhoo	<i>Hemiramphus brasiliensis</i>	MCNS
Queen angelfish.....	<i>Holocanthus ciliaris</i>	MCNS
Rock beauty.....	<i>Holocanthus tricolor</i>	MCNS
Squirrelfish.....	<i>Holocentrus ascensionsis</i>	MCNS
Reef squirrelfish	<i>Holocentrus coruscus</i>	MCNS
Dusky squirrelfish.....	<i>Holocentrus vexillarius</i>	MCNS
Lined seahorse	<i>Hyppocampus erectus</i>	ESGB
Bermuda chub.....	<i>Kyphosus sectatrix</i>	MCNS, MUS
Hairy blenny	<i>Labrisomus nuchipinnis</i>	MCNS
Hogfish	<i>Lachnolaimus maximus</i>	MCNS
Scrawled cowfish.....	<i>Lactophrys quadricornis</i>	MCNS
Honeycomb cowfish.....	<i>Lactophrys polygonia</i>	MCNS
Smooth trunkfish.....	<i>Lactophrys triqueter</i>	MCNS
Pinfish	<i>Lagodon rhomboids</i>	MCNS
Mutton snapper	<i>Lutjanus analis</i>	MCNS
Schoolmaster snapper	<i>Lutjanus apodus</i>	MCNS
Gray snapper	<i>Lutjanus griseus</i>	MCNS
Mahogany snapper	<i>Lutjanus mahogoni</i>	MCNS
Lane snapper	<i>Lutjanus synagris</i>	MCNS
Sand tilefish	<i>Malacanthus plumieri</i>	MUS
Saddled blenny	<i>Malacoctenus triangulates</i>	MCNS
Tarpon	<i>Megalops atlanticus</i>	MCNS, MUS
Black durgon	<i>Melchthys niger</i>	MCNS, MUS
Yellowtail damselfish.....	<i>Microspathodon chrysurus</i>	MCNS
Fringed filefish.....	<i>Monacanthus ciliates</i>	ESGB, EUS
Planehead filefish	<i>Monacanthus hispidus</i>	MCNS
Pygmy filefish.....	<i>Monacanthus setifer</i>	MCNS

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Striped mullet	<i>Mugil cephalus</i>	EUS, MUS
White mullet	<i>Mugil curema</i>	EUS, MUS
Yellow goatfish	<i>Mulloidichthys martinicus</i>	MUS
Black grouper	<i>Mycteroperca bonaci</i>	MCNS
Yellowfin grouper	<i>Mycteroperca venenosa</i>	MCNS
Yellowtail snapper	<i>Ocyurus chrysurus</i>	MCNS
Reef croaker	<i>Odontoscion dentex</i>	MCNS
Leatherjacket	<i>Oligoplites saurus</i>	MTC
Redlip blenny.....	<i>Ophioblennius atlanticus</i>	MCNS
Pigfish.....	<i>Orthopristis chrysoptera</i>	MTC
Seaweed blenny	<i>Parablennius marmoratus</i>	MCNS
Gulf flounder	<i>Paralichthys albigutta</i>	MUS, EUS
Southern flounder	<i>Paralichthys lethostigma</i>	MUS, EUS
Glassy sweeper.....	<i>Pempheris schomburgkii</i>	MCNS
Dusky cardinalfish	<i>Phaeoptyx pigmentaria</i>	MCNS
Gray angelfish	<i>Pomacanthus arcuatus</i>	MCNS
French angelfish	<i>Pomacanthus paru</i>	MCNS
Black drum	<i>Pogonias cromis</i>	MCNS
Barbu.....	<i>Polydactylus virginicus</i>	MCNS
Bluefish	<i>Pomatomus saltatrix</i>	MCNS
Bigeye	<i>Priacanthus arenatus</i>	MCNS
Spotted goatfish.....	<i>Psuedopeneus maculatus</i>	MUS
Blue goby	<i>Ptereleotris calliurus</i>	MUS
Red lionfish	<i>Pterois volitans*</i>	MCNS
Atlantic guitarfish	<i>Rhinobatos lentiginosus</i>	EUS, MUS
Mangrove rivulus.....	<i>Rivulus marmoratus</i>	MS, EUS
Whitespotted soapfish.....	<i>Rypticus maculatus</i>	MCNS
Greater soapfish	<i>Rypticus saponaceus</i>	MCNS
Molly miller.....	<i>Scartella cristata</i>	MCNS
Midnight parrotfish.....	<i>Scarus coelestinus</i>	MCNS
Blue parrotfish.....	<i>Scarus coeruleus</i>	MCNS
Striped parrotfish	<i>Scarus iseri</i>	MCNS
Rainbow parrotfish.....	<i>Scarus guacamaia</i>	MCNS
Princess parrotfish	<i>Scarus taeniopterus</i>	MCNS
Queen parrotfish	<i>Scarus vetula</i>	MCNS
Red drum	<i>Sciaenops ocellatus</i>	EUS, ESGB
King mackerel.....	<i>Scomberomorus cavalla</i>	MCNS, MUS
Spanish mackerel.....	<i>Scomberomorus maculatus</i>	MCNS, MUS
Cero mackerel.....	<i>Scomberomorus regalis</i>	MCNS, MUS
Spotted scorpionfish.....	<i>Scorpaena plumieri</i>	MCNS
Spanish sardine	<i>Sardinella aurita</i>	MCNS, MUS
Lookdown	<i>Selene vomer</i>	MCNS
Lantern bass.....	<i>Serranus baldwini</i>	MCNS
Tobaccofish	<i>Serranus tabacarius</i>	MCNS
Harlequin bass.....	<i>Serranus tigrinus</i>	MCNS
Redband parrotfish.....	<i>Sparisoma aurofrenatum</i>	MCNS
Redtail parrotfish.....	<i>Sparisoma chrysopterus</i>	MCNS
Yellowtail (redfin) parrotfish.....	<i>Sparisoma rubripinne</i>	MCNS

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Stoplight parrotfish	<i>Sparisoma viride</i>	MCNS
Bandtail puffer.....	<i>Sphoeroides splengleri</i>	MCNS
Checkered puffer.....	<i>Sphoeroides testudineus</i>	EUS,ESGB
Great barracuda	<i>Sphyraena barracuda</i>	MCNS, MUS
Southern sennet.....	<i>Sphyraena picudilla</i>	MCNS, MUS
Longfin damselfish	<i>Stegastes diencaeus</i>	MCNS
Dusky damselfish	<i>Stegastes adustus</i>	MCNS
Beaugregory	<i>Stegastes leucostictus</i>	MCNS
Bicolor damselfish	<i>Stegastes partitus</i>	MCNS
Threespot damselfish	<i>Stegastes planifrons</i>	MCNS
Cocoa damselfish.....	<i>Stegastes variabilis</i>	MCNS
Atlantic needlefish	<i>Strongylura marina</i>	MUS
Redfin needlefish	<i>Strongylura notate</i>	MUS
Dusky pipefish.....	<i>Syngnathus floridae</i>	ESGB
Chain pipefish.....	<i>Syngnathus louisianae</i>	ESGB
Sargassum pipefish	<i>Syngnathus pelagicus</i>	MCNS
Gulf pipefish	<i>Syngnathus scovelli</i>	ESGB
Inshore lizardfish.....	<i>Synodus foetens</i>	MUS
Sand diver	<i>Synodus intermedius</i>	MUS
Bluehead wrasse	<i>Thalassoma bifasciatum</i>	MCNS
Permit.....	<i>Trachinotus falcatus</i>	MCNS, MUS
Palometa.....	<i>Trachinotus goodie</i>	MCNS, MUS
Houndfish	<i>Tylosurus crocodilus</i>	MCNS, MUS, EUS, ESGB

AMPHIBIANS

Frogs and Toads

Marine toad.....	<i>Bufo marinus</i> *	MAH, DV
Southern toad.....	<i>Bufo terrestris</i>	MAH, DV
Green treefrog	<i>Hyla cinerea</i>	BD, MAH, DV
Squirrel treefrog	<i>Hyla squirella</i>	BD, MAH, DV
Cuban treefrog.....	<i>Osteopilus septentrionalis</i> *	MTC

REPTILES

Crocodilians

American crocodile	<i>Crocodylus acutus</i>	EUS, MS
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Turtles and Tortoises

Loggerhead turtle	<i>Caretta caretta</i>	BD, MUS, MCNS
Green turtle	<i>Chelonia mydas</i>	BD, MUS, MCNS
Leatherback turtle	<i>Dermochelys coriacea</i>	BD, MUS, MCNS
Hawksbill turtle	<i>Eretmochelys imbricate</i>	BD, MUS, MCNS
Gopher tortoise.....	<i>Gopherus polyphemus</i>	MAH, DV

Lizards

Green anole	<i>Anolis carolinensis</i>	BD, DV, MAH
Knight anole	<i>Anolis equestris</i> *	MAH, DV

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Cuban brown anole	<i>Anolis porcatus*</i>	BD, DV, MAH
Brown anole	<i>Anolis sagrei*</i>	MTC
Six-lined racerunner	<i>Cnemidophorus sexlineatus sexlineatus</i>	BD, BD
Southeastern five-lined skink	<i>Eumeces inexpectatus</i>	MAH, DV
Indo-pacific gecko	<i>Hemidactylus garnotii*</i>	DV
Green iguana.....	<i>Iguana iguana*</i>	BD, MS
Curlytail lizard	<i>Leiocephalus carinatus*</i>	DV, MAH
Ground skink.....	<i>Scincella laterale</i>	BD, DV, MAH

Snakes

Southern black racer.....	<i>Coluber constrictor priapus</i>	MAH, DV
Eastern diamondback rattlesnake	<i>Crotalus adamanteus</i>	MAH
Southern ringneck snake.....	<i>Diadophis punctatus punctatus</i>	MTC
Corn snake.....	<i>Elaphe guttata</i>	MAH, DV
Yellow rat snake	<i>Elaphe obsoleta quadrivittata</i>	MAH, DV
Scarlet Kingsnake	<i>Lampropeltis triangulum elapsoides</i> ..	MAH, DV
Eastern coachwhip.....	<i>Masticophis flagellum</i>	BD, MAH
Eastern coral snake	<i>Micrurus fulvius</i>	MAH, DV
Dusky pygmy rattlesnake	<i>Sistrurus miliarius</i>	MAH, DV

BIRDS

Loons

Common loon.....	<i>Gavia immer</i>	MCNS
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Pelicaniformes

Anhinga	<i>Anhinga anhinga</i>	MS, EUS
Magnificent frigate bird	<i>Fregata magnificens</i>	OF
Northern gannet	<i>Morus bassanus</i>	BD, OF
American white pelican.....	<i>Pelecanus erythrorhynchos</i>	MS, MUS, OF
Brown pelican	<i>Pelecanus occidentalis</i>	MS, MUS, OF
Double-crested cormorant ...	<i>Phalacrocorax auritus</i>	EUS, MS, OF

Wading Birds

Roseate spoonbill.....	<i>Ajaia ajaja</i>	EUS, ESGB MS
Great egret.....	<i>Ardea alba</i>	EUS, ESGB, MS
Great blue heron	<i>Ardea herodias</i>	EUS, ESGB, MS
Cattle egret	<i>Bubulcus ibis</i>	MTC
Green heron.....	<i>Butorides virescens</i>	MS
Little blue heron.....	<i>Egretta caerulea</i>	EUS, ESGB, MS
Reddish egret.....	<i>Egretta rufescens</i>	EUS, ESGB, MS
Snowy egret	<i>Egretta thula</i>	EUS, MS
Tricolored heron	<i>Egretta tricolor</i>	EUS, MS
White ibis.....	<i>Eudocimus albus</i>	DV, MS, EUS
Wood stork	<i>Mycteria americana</i>	MS, EUS

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Black-crowned night heron...*Nycticorax nycticorax*..... MS
 Yellow-crowned night heron *Nyctanassa violacea* BD, MS

Ducks

Wood duck..... *Aix sponsa*..... EUS
 Northern pintail *Anas acuta*..... EUS
 American wigeon *Anas Americana*..... EUS
 Green-winged teal *Anas crecca* EUS
 Northern shoveler..... *Anas clypeata*..... EUS
 Blue-winged teal..... *Anas discors* EUS
 Mottled duck..... *Anas fulvigula* EUS, BD
 Mallard..... *Anas platyrhynchos* EUS
 American black duck..... *Anas rubripes* EUS
 Gadwall..... *Anas strepera* EUS
 Lesser scaup *Aythya affinis* EUS
 Redhead..... *Aythya Americana* EUS
 Ring-necked duck *Aythya collaris*..... EUS
 Canvasback..... *Aythya valisineria*..... EUS
 Red-breasted merganser *Mergus serrator*..... EUS
 Hooded merganser..... *Lophodytes cucullatus* EUS

Grebes

Horned grebe *Podiceps auritus*..... EUS
 Pied-billed grebe..... *Podilymbus podiceps*..... EUS

Hawks, Eagles and Kites

Cooper's hawk..... *Accipiter cooperii* OF
 Sharp-shinned hawk..... *Accipiter striatus*..... MTC, OF
 Red-tailed hawk..... *Buteo jamaicensis* BD, DV, MAH, OF
 Red-shouldered hawk *Buteo lineatus* BD, DV, MAH, OF
 Broad-winged hawk *Buteo platypterus* OF
 Swallow-tailed kite..... *Elanoides forficatus* OF
 Merlin..... *Falco columbarius*..... BD, DV, MAH, OF
 Peregrine falcon *Falco peregrinus* OF
 American kestrel..... *Falco sparverius* BD, DV, MAH, OF
 Osprey *Pandion haliaetus*..... MTC

Vultures

Turkey vulture *Cathartes aura*..... BD, MAH, DV, OF
 Black vulture..... *Coragyps atratus* BD, MAH, DV, OF

Shorebirds

Spotted sandpiper *Actitis macularia* BD, MUS
 Ruddy turnstone *Arenaria interpres*..... BD, MUS
 Sanderling *Calidris alba* BD, MUS
 Dunlin..... *Calidris alpine* BD, MUS
 Red knot *Calidris canutus*..... BD, MUS

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Western sandpiper	<i>Calidris mauri</i>	BD, MUS
Least sandpiper	<i>Calidris minutilla</i>	BD, MUS
Semipalmated sandpiper	<i>Calidris pusilla</i>	BD, MUS
Willet	<i>Catoptrophorus semipalmatus</i>	BD, MUS
Piping plover	<i>Charadrius melodus</i>	BD, MUS
Semipalmated plover	<i>Charadrius semipalmatus</i>	BD, MUS
Wilson's plover	<i>Charadrius wilsonia</i>	BD, MUS
Killdeer	<i>Charadrius vociferous</i>	BD, MUS
American oystercatcher.....	<i>Haematopus palliatus</i>	BD
Short-billed dowitcher.....	<i>Limnodromus griseus</i>	BD, EUS
Long-billed dowitcher.....	<i>Limnodromus scolopaceus</i>	BD, EUS
Marbled godwit.....	<i>Limosa fedoa</i>	EUS, MS
Black-bellied plover	<i>Pluvialis squatarola</i>	BD, MUS

Gulls, Terns and Skimmers

Black tern	<i>Chlidonias niger</i>	BD, EUS, MUS
Herring gull.....	<i>Larus argentatus</i>	BD, EUS, MUS, MAH
Laughing gull	<i>Larus atricilla</i>	BD, EUS, MUS, MAH
Ring-billed gull.....	<i>Larus delawarensis</i>	BD, EUS, MUS, MAH
Lesser blacked-back gull.....	<i>Larus fuscus</i>	BD, EUS, MUS, MAH
Great black-backed gull	<i>Larus marinus</i>	BD, EUS, MUS, MAH
Bonaparte's gull.....	<i>Larus philadelphia</i>	BD, EUS, MUS, MAH
Black skimmer	<i>Rynchops niger</i>	BD, MUS
Least tern.....	<i>Sterna antillarum</i>	BD, EUS, MUS
Caspian tern.....	<i>Sterna caspia</i>	BD, EUS, MUS
Forster's tern	<i>Sterna forsteri</i>	BD, EUS, MUS, MAH
Common tern	<i>Sterna hirundo</i>	BD, EUS, MUS
Royal tern	<i>Sterna maxima</i>	BD, EUS, MUS
Gull-billed tern.....	<i>Sterna nilotica</i>	BD, EUS, MUS
Sandwich tern.....	<i>Sterna sandvicensis</i>	BD, EUS, MUS
Lesser yellowlegs	<i>Tringa flavipes</i>	BD, EUS, MUS
Greater yellowlegs	<i>Tringa melanoleuca</i>	BD, EUS, MUS

Doves

Rock dove	<i>Columba livia</i> *	MTC
Common ground-dove	<i>Columbina passerina</i>	DV
Mourning dove	<i>Zenaida macroura</i>	MTC

Cuckoos

Yellow-billed cuckoo	<i>Coccyzus americanus</i>	MAH, MS
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Owls

Eastern screech owl	<i>Otus asio</i>	MAH
Barred owl	<i>Strix varia</i>	MAH

Hummingbirds

Ruby-throated hummingbird	<i>Archlochus colubris</i>	DV
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John D. MacArthur Beach State - Park Plants and Animals

Goatsuckers

Chuck-will's-widow.....	<i>Caprimulgus carolinensis</i>	MAH, DV
Whip-poor-will.....	<i>Caprimulgus vociferous</i>	MAH, DV
Common nighthawk.....	<i>Chordeiles minor</i>	MAH, DV

Kingfishers

Belted kingfisher	<i>Ceryle alcyon</i>	MS, EUS
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Woodpeckers

Northern flicker	<i>Colaptes auratus</i>	MAH, DV
Pileated woodpecker.....	<i>Dryocopus pileatus</i>	MAH
Red-bellied woodpecker.....	<i>Melanerpes carolinus</i>	MTC
Downy woodpecker.....	<i>Picoides pubescens</i>	MAH
Yellow-bellied sapsucker	<i>Sphyrapicus varius</i>	MAH, DV

Flycatchers

Eastern wood-pewee.....	<i>Contopus virens</i>	MAH
Great crested flycatcher	<i>Myiarchus crinitus</i>	MAH
Gray kingbird	<i>Tyrannus dominicensis</i>	MAH
Eastern kingbird.....	<i>Tyrannus tyrannus</i>	MAH

Vireos

Yellow-throated vireo	<i>Vireo flavifrons</i>	MAH
White-eyed vireo.....	<i>Vireo griseus</i>	MAH
Red-eyed vireo.....	<i>Vireo olivaceus</i>	MAH
Blue-headed vireo	<i>Vireo solitarius</i>	MAH

Flycatchers and Kingbirds

Eastern phoebe	<i>Sayornis phoebe</i>	BD, DV
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Shrikes

Loggerhead shrike	<i>Lanius ludovicianus</i>	BD, RD, DV
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Jays and Crows

American crow	<i>Corvus brachyrhynchos</i>	MTC
Fish crow	<i>Corvus ossifragus</i>	MTC
Blue jay.....	<i>Cyanocitta cristata</i>	MTC

Swallows and Martins

Barn swallow	<i>Hirundo rustica</i>	MTC
Purple martin	<i>Progne subis</i>	OF
Tree swallow	<i>Tachycineta bicolor</i>	DV

Wrens

Carolina wren.....	<i>Thryothorus ludovicianus</i>	MAH
House wren	<i>Troglodytes aedon</i>	DV

Kinglets

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Ruby-crowned kinglet..... *Regulus calendula* MAH, DV

Gnatcatchers

Blue-gray gnatcatcher..... *Polioptila caerulea* MAH

Thrashers

Gray catbird..... *Dumetella carolinensis* MAH, DV

Northern mockingbird..... *Mimus polyglottos* MTC

Brown thrasher..... *Toxostoma rufum* MAH, DV

Thrushes

American robin *Turdus migratorius* MTC

Waxwings

Cedar waxwing *Bombycilla cedrorum*..... MAH, DV

Warblers

Black-throated blue warbler. *Setophaga caerulescens* MAH

Yellow-rumped warbler..... *Setophaga coronata*..... MAH

Prairie warbler *Setophaga discolor* MAH, MS, DV

Yellow-throated warbler *Setophaga dominica* MAH

Palm warbler..... *Setophaga palmarum*..... BD, DV

Yellow warbler..... *Setophaga petechia* MAH, MS

Blackpoll warbler *Setophaga striata* MAH

Cape May warbler *Setophaga tigrina*..... MAH, MS

Common yellowthroat *Geothlypis trichas*..... MAH

Worm-eating warbler *Helmitheros vermivorus* MAH

Black-and-white warbler *Mniotilta varia* MAH

Northern parula *Parula americana*..... MAH

Prothonotary warbler *Protonotaria citrea* MAH

Ovenbird *Seiurus aurocapillus* MAH

American redstart *Setophaga ruticilla*..... MAH

Orange-crowned warbler *Vermivora celata* MAH

Hooded warbler..... *Wilsonia citrina*..... MAH

Meadowlarks, Blackbirds and Orioles

Red-winged blackbird *Agelaius phoeniceus*..... MTC

Common grackle *Quiscalus quiscula* MTC

Boat-tailed grackle..... *Quiscalus major*..... MTC

Eastern meadowlark *Sturnella magna* MTC

Cardinals, Buntings and Grosbeaks

Northern cardinal..... *Cardinalis cardinalis* MTC

Painted bunting *Passerina ciris*..... BD, MAH

Indigo bunting *Passerina cyanea*..... BD, MAH

Rose-breasted grosbeak *Pheucticus ludovicianus* DV, MAH

Sparrows

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Seaside sparrow (Atlantic race) *Ammodramus maritimus*
BD, MAH

Nelson's sharp-tailed sparrow *Ammodramus nelsoni*
MAH

Finches

Pine siskin *Spinus pinus* OF
American goldfinch *Spinus tristis* BD, MAH

MAMMALS

Didelphids

Virginia opossum *Didelphis virginiana* BD, DV, MAH

Weasels and Skunks

Eastern spotted skunk *Spilogale putorius* MTC

River otter *Lutra canadensis* EUS

Lagomorphs

Eastern cottontail *Sylvilagus floridanus* MTC

Marsh rabbit *Sylvilagus palustris* MTC

Rodents

Black rat *Rattus rattus** MTC

Eastern gray squirrel *Sciurus carolinensis* DV, MAH

Hispid cotton rat *Sigmodon hispidus* MTC

Armadillos

Nine-banded armadillo *Dasyus novemcinctus** MTC

Bats

Northern yellow bat *Lasiurus intermedius* MAH, DV

Seminole bat *Lasiurus seminolis* MAH, DV

Carnivores

Coyote *Canis latrans** MTC

Domestic cat *Felis catus* * MTC

Raccoon *Procyon lotor* MTC

Gray fox *Urocyon cinereoargenteus* MAH

Sirens

Florida manatee *Trichechus manatus latirostris* EUS

Cetaceans

Bottle-nosed dolphin *Tursiops truncatus* MUS, EUS, MCNS

John D. MacArthur Beach State Park Plants

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

Primary Habitat Codes

TERRESTRIAL

Beach Dune.....	BD
Coastal Berm	CB
Coastal Grassland	CG
Coastal Strand	BD
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

Wet Prairie WP

LACUSTRINE

Clastic Upland Lake..... CULK
Coastal Dune Lake CDLK
Coastal Rockland Lake CRLK
Flatwoods/Prairie.....FPLK
Marsh Lake MLK
River Floodplain LakeRFLK
Sandhill Upland Lake SULK
Sinkhole Lake SKLK
Swamp Lake..... SWLK

RIVERINE

Alluvial Stream AST
Blackwater StreamBST
Seepage StreamSST
Spring-run Stream.....SRST

SUBTERRANEAN

Aquatic Cave..... ACV
Terrestrial Cave TCV

ESTUARINE

Algal Bed EAB
Composite SubstrateECPS
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

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..... ABF
Abandoned pasture..... ABP
Agriculture..... AG
Canal/ditch..... CD
Clearcut pine plantation..... CPP
Clearing.....CL
Developed..... DV
Impoundment/artificial pond IAP
Invasive exotic monoculture IEM
Pasture - improved.....PI
Pasture - semi-improvedPSI
Pine plantation PP
Road RD
Spoil area SA
Successional hardwood forestSHF
Utility corridor UC

MISCELLANEOUS

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

Addendum 6—Imperiled Species Ranking Definitions

Imperiled Species Ranking Definitions

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)

Imperiled Species Ranking Definitions

- G#T#Q..... same as above, but validity as subspecies or variety is questioned.
- 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.

Imperiled Species Ranking Definitions

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.
- 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

Imperiled Species Ranking Definitions

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 Information

Management Procedures for Archaeological and Historical Sites and Properties on State-Owned or Controlled Properties (revised March 2013)

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)

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 .

* * *

Questions relating to the treatment of archaeological and historic resources on state lands should be directed to:

Robin Jackson
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) 245-6333

Toll Free: (800) 847-7278

Fax: (850) 245-6435

Eligibility Criteria for National Register of Historic Places

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

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.