# Biscayne Bay Aquatic Preserve Management Plan

Florida Department of Environmental Protection
Office of Resilience and Coastal Protection
2600 Blair Stone Road, MS #235
Tallahassee, FL 32399
www.floridacoasts.org

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## Mission Statement

The Office of Resilience and Coastal Protection's mission statement is: Conserving, protecting, restoring, and improving the resilience of Florida's coastal, aquatic, and ocean resources for the benefit of people and the environment.

The four long-term goals of the Office of Resilience and Coastal Protection's Aquatic Preserve Program are to:

1. Protect and enhance the ecological integrity of the aquatic preserves.
2. Restore areas to their natural condition.
3. Encourage sustainable use and foster active stewardship by engaging local communities in the protection of aquatic preserves.
4. Improve management effectiveness through a process based on sound science, consistent evaluation, and continual reassessment.

# Executive Summary

**Lead Agency:** Florida Department of Environmental Protection's (DEP) Office of Resilience and Coastal Protection (ORCP)

**Common Name of Property:** Biscayne Bay Aquatic Preserves (BBAP)

**Location:** Miami-Dade and Monroe counties, Florida

**Acreage:** 64,607

**Management Agency:** DEP's ORCP

**Designation:** Aquatic Preserve

**Unique Features:** Biscayne Bay's cultural heritage owes its richness to the remnants and reminders of the Tequestas. Rock middens and the not yet fully understood "Miami Circle" bordering the Bay are evidence of the native uses of the area. Early settlers along the Bay noted the mystery of the natural limestone bridge in today's North Miami known as "Arch Creek." Virginia Key is one of the southeast coast's few remaining natural barrier islands. To the south, BBAP encompasses an offshore parcel of land in the open Atlantic. BBAP borders the most populous county in the state of Florida and its natural resources have rebounded tremendously in areas that have been protected after decades of habitat loss and destruction. Biscayne Bay is a renowned water body that is protected in its entirety by either a national park or state preserve and is part of the Kissimmee-Okeechobee-Everglades ecosystem, historically receiving freshwater from the Everglades.

**Archaeological/Historical Sites:** Biscayne Bay's coastline was used by the native Tequesta Indians as well as the extant Seminole and Miccosukee tribes. Along Biscayne Bay's coastline there are overtures to the Tequesta including the Miami Circle, a 2,000-year-old site that has been preserved at the immediate edge of where the Miami River meets Biscayne Bay. The shoreline of Biscayne Bay is home to numerous sites recognized by the National Register of Historic Places.

| FNAI Natural Community Type | # Acres | % of Area | Federal Rank | State Rank |
|---|---|---|---|---|
| Beach Dune | 5.5 | 0% | G3 | S2 |
| Coastal Berm | 0.8 | 0% | G3 | S2 |
| Coastal Strand | U | U | G3 | S2 |
| Maritime Hammock | U | U | G3 | S2 |
| Shell Mound | U | U | G2 | S2 |
| Consolidated Substrate | U | U | G3 | S3 |
| Unconsolidated Substrate | U | U | G5 | S5 |
| Tidal flats (unconsolidated substrate type) | 163 | 0% | G5 | S5 |
| Composite substrate | 7,967 | 12.3% | G3 | S3 |
| Coral (composite substrate type) | U | U | G2 | S1 |
| Mollusk Reef | U | U | G3 | S3 |
| Octocoral Bed | U | U | G2 | S1 |
| Sponge Bed | U | U | G2 | S2 |
| Algal Bed | U | U | G3 | S2 |
| Seagrass Bed | 43,371 | 67.1% | G3 | S2 |
| Salt Marsh | 4 | 0% | G5 | S4 |
| Mangrove Swamp | 921 | 0% | G5 | S4 |

*Management Needs*

**Ecosystem Science:** The existing water quality and benthic monitoring networks need to be optimized to better understand sources of changes in the system such as vegetative composition and algal blooms. Aerial photography needs to be more frequent and more accessible to staff, which would allow layers to be digitized and used in GIS mapping efforts.

**Resource Management:** Sewage mains need to be replaced and stormwater issues need to be addressed comprehensively to reduce nutrient loading into an oligotrophic system like BBAP. The proposed Reserved Allocation Area protection needs to be implemented to prevent consumptive use withdrawals that are inconsistent with restoration or would further impact Biscayne Bay. Unmanaged mooring areas should be evaluated against those that are managed to see if an effort should be made to bring unofficial, unmanaged areas under a less environmentally impactful arrangement.

**Education and Outreach:** BBAP needs to have a greater presence in Miami-Dade County in order to engage locals and promote access across user groups.

**Public Use:** Greater access to and awareness of the bay by user groups should be supported. Businesses and rental concessionaires that offer Bay experiences should be encouraged to have their patrons understand the rules and ecological value of Biscayne Bay before taking to the waterway.

**Public Involvement:** Public support is vital to the success of conservation programs. The goal is to create and foster an understanding of the challenges that these ecosystems are facing and the steps to manage these precious resources. BBAP staff have scheduled an advisory committee meeting for Monday, January 13, 2025. The draft management plan will be edited based on the feedback of the advisory committee and a public meeting will be held to receive additional feedback. After further edits, the final management plan will be presented to the Acquisition and Restoration Council.

### *Coastal Zone Management Issues:*

The main impacts to the aquatic preserve's natural resources stem from boating and upland impacts. Biscayne Bay is heavily trafficked by all types of watercraft. With the bay being surrounded by the vibrant City of Miami there are always new types of crafts and activities to address. Further connection to the watercraft users must be made to reduce direct and shading impacts to the seagrasses and inform them of more environmentally friendly boating practices. On the water quality side, the threats originate on the uplands. Monitoring of the bay's water quality and benthic ecosystems allows managers to better inform the upland community on the success of infrastructure projects and areas to focus on further. Both funding and outreach should be provided to improve the infrastructure to increase the amount of noncontaminated water reaching the bay. Large areas of the bay have been filled or dredged reducing seagrass habitat while the shorelines are no longer natural reducing the space for species like mangroves to live. Restoration can take place to increase the areas for natural communities to thrive.

### *Goals:*

Many of the issues impacting Biscayne Bay Aquatic Preserve could be prevented or minimized with improved water quality, enhanced enforcement, and public education campaigns. Better resource monitoring and analysis will guide our management practices and make them more effective overall. Reducing user conflict at nearby access points will also reduce other negative impacts associated with overuse and encourage more sustainable use of the aquatic preserve.

#### *Issue One: Water Quality*

**Goal 1:** Maintain and improve water quality within and entering the preserves to meet natural resources needs.

**Objective 1:** Support local, state, and federal efforts to continue and expand monitoring and research programs, produce analyses of data, define gaps in watershed water quality restoration, identify management strategies, and enact policies to address those gaps in Biscayne Bay.

**Objective 2:** Reduce water quality impacts to surface water and groundwater caused by stormwater within the watershed.

**Objective 3:** Reduce water quality impacts to surface water and groundwater caused by septic system sources within the watershed.

**Objective 4:** Work with city, county, and municipal agencies to preserve and restore natural shorelines and enhance armored shorelines adjacent to the aquatic preserve to maintain or restore water quality natural resources, and public access.

**Objective 5:** Understand and ensure adaptability and responsiveness to changing precipitation patterns and upland freshwater delivery to Biscayne Bay to maintain salinity levels.

**Goal 2:** Increase public and industry awareness about water quality issues in BBAP and what actions can be taken to improve water quality.

**Objective 1:** Inform the public and partners about water quality conditions within BBAP.

***Issue Two: Natural and Cultural Resource Protection***

**Goal 1:** Document and preserve the natural resources within the preserve.

**Objective 1:** Establish a baseline and/or add to the knowledge base of the current location, composition and abundance of the various habitat types and associated fauna, with specific focus on seagrass habitats.

**Objective 2:** Maintain a comprehensive monitoring program in Biscayne Bay, with particular focus on the northern bay, to include monitoring of existing sites and include additional sites as needed.

**Objective 3:** Work with local governments and nonprofits to create a comprehensive marine debris prevention, reduction, and removal program within BBAP.

**Goal 2:** Educate the public on the importance of BBAP's natural resources and history and cultural resources to the public.

**Objective 1:** Partner with other agencies and/or non-governmental organizations to promote greater understanding and interpretation of cultural and natural resources including threats to those resources that businesses, residents, and visitors can minimize.

**Objective 2:** Partner with state, county and municipal parks to incorporate information about BBAP history and resources into guided tours, signage, staff training, and promotional materials.

***Issue Three: Habitat Loss***

**Goal 1:** Protect Biscayne Bay from impacts related to land use changes that disrupt the ecological functions of natural resources within ORCP's purview.

**Objective 1:** Participate in the regulatory process with partner agencies to reduce the impacts of coastal construction on Biscayne Bay and its resources

**Objective 2:** Describe and/or quantify function of ecological services provided by coastal habitats.

**Objective 3:** Protect the natural resources by reducing harmful and illegal activities.

**Objective 4:** Protect and restore seagrass areas.

**Objective 5:** Mitigate the impacts of erosion.

**Objective 6:** Help identify suitable locations for habitat migration of mangrove and seagrass species.

**Objective 7:** Understand and ensure adaptability and responsiveness to changing precipitation patterns and upland freshwater delivery in delivery of freshwater to Biscayne Bay to maintain salinity levels.

***Issue Four: Public Awareness, Access and Use***

**Goal 1:** Maintain a safe environment for Biscayne Bay's wildlife, habitats and user groups.

**Objective 1: I**dentify human use conflicts with natural resources.

**Objective 2:** Reduce the amount of debris, contaminants, and resource injuries associated with user group activities.

**Objective 3: I**dentify ways to increase and enhance effective on-water law enforcement patrols in BBAP.

***Issue Five: Sustainable Public Use***

**Goal 1:** Promote sustainable recreational opportunities, while increasing access to the bay.

**Objective 1:** Increase awareness and promote sustainable use of the bay's resources.

**Objective 2:** Identify and support appropriate locations for paddling launch sites and desirable destinations to access via kayak, canoe, or paddleboard.

**Objective 3:** Make the bay more accessible to underserved communities, while simultaneously promoting sustainable uses.

**ORCP approval date:**

**ARC approval date:**

**State approval date:**

# Acronym List

| Abbreviation | Meaning |
|---|---|
| AGM | Annual Geometric Mean |
| AIWW | Atlantic Intracoastal Waterway |
| BBAP | Biscayne Bay Aquatic Preserve |
| BBEC | Biscayne Bay Environmental Center |
| BNP | Biscayne National Park |
| CBSF | Citizens for a Better South Florida |
| CDMP | Comprehensive Development Master Plan |
| CERP | Comprehensive Everglades Restoration Plan |
| CFSP | Bill Baggs Cape Florida State Park |
| Corps | U.S. Army Corps of Engineers |
| CRCP | Coral Restoration and Conservation Program |
| CSO | Citizen Support Organization |
| CWA | Critical Wildlife Area |
| DEAR | Division of Environmental Assessment and Restoration |
| DEP | Florida Department of Environmental Protection |
| DERM | Division of Environmental Resources Management (Miami-Dade County) |
| EEL | Environmentally Endangered Lands (a Miami-Dade County program) |
| EPA | U.S. Environmental Protection Agency |
| F.A.C. | Florida Administrative Code |
| FIND | Florida Inland Navigation District |
| FIU | Florida International University |
| FKNMS | Florida Keys National Marine Sanctuary |
| FOBB | Friends of Biscayne Bay |
| FNAI | Florida Natural Areas Inventory |
| FPL | Florida Power & Light |
| F.S. | Florida Statutes |
| FTE | Full Time Equivalent |
| FWC | Florida Fish and Wildlife Conservation Commission |
| GIS | geographic information science |
| HUC | Hydrologic Unit (Code) |
| MARS | Marine Animal Rescue Society |
| MAST | Marine Advisory Support Team |

| Abbreviation | Meaning |
|---|---|
| MDC | Miami-Dade County |
| NERR | National Estuarine Research Reserve |
| NOAA | National Oceanic and Atmospheric Administration |
| NWS | National Weather Service |
| OFW | Outstanding Florida Water |
| OPS | Other Personal Services |
| ORCP | Office of Resilience and Coastal Protection |
| QAQC | quality control and quality assurance |
| RAP | Reasonable Assurance plan |
| RSMAS | Rosenstiel School of Marine and Atmospheric Science |
| SAV | Submerged Aquatic Vegetation |
| SEACAR | Statewide Ecosystem Assessment of Coastal and Aquatic Resources |
| SEFSC | NOAA's Southeast Fisheries Science Center |
| SERC | Southeast Environmental Research Center |
| SFWMD | South Florida Water Management District |
| SWaPS | Shallow Water Positioning System |
| TNC | The Nature Conservancy |
| TPL | Trust for Public Land |
| Trustees | Board of Trustees of the Internal Improvement Trust Fund |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | U.S. Geological Survey |
| WIN | Watershed Information Network |

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# Chapter 1 / Introduction

The Florida aquatic preserves are administered on behalf of the state by the Florida Department of Environmental Protection's (DEP) Office of Resilience and Coastal Protection (ORCP) as part of a network that includes 43 aquatic preserves, three National Estuarine Research Reserves (NERRs), and the Florida Keys National Marine Sanctuary (Map 1). This provides for a system of significant protections to ensure that our most popular and ecologically important underwater ecosystems are cared for in perpetuity. Each of these special places is managed with strategies based on local resources, issues and conditions.

Our extensive coastline and wealth of aquatic resources have defined Florida as a subtropical oasis, attracting millions of residents and visitors, and the businesses that serve them. Florida's submerged lands play important roles in maintaining good water quality, hosting a diversity of wildlife and habitats (including economically and ecologically valuable nursery areas), and supporting a treasured quality of life for all. In the 1960s, it became apparent that the ecosystems that had attracted so many people to Florida could not support rapid growth without science-based resource protection and management. To this end, state legislators provided extra protection for certain exceptional aquatic areas by designating them as aquatic preserves.

Title to submerged lands not conveyed to private landowners is held by the Board of Trustees of the Internal Improvement Trust Fund (the Trustees). The Governor and Cabinet, sitting as the Trustees, act as guardians for the people of the state of Florida (§253.03, Florida Statutes [F.S.]) and regulate the use of these public lands. Through statute, the Trustees have the authority to adopt rules related to the management of sovereignty submerged lands (Florida Aquatic Preserve Act of 1975, §258.36, F.S.). A higher layer of protection is afforded to aquatic preserves including areas of sovereignty lands that have been "set aside forever as aquatic preserves or sanctuaries for the benefit of future generations" due to "exceptional biological, aesthetic, and scientific value" (Florida Aquatic Preserve Act of 1975, §258.36, F.S.).

The tradition of concern and protection of these exceptional areas continues, and now includes the Rookery Bay NERR in southwest Florida, designated in 1978; the Apalachicola NERR in northwest Florida, designated in 1979; and the Guana Tolomato Matanzas NERR in northeast Florida, designated in 1999. In addition, the Florida Oceans and Coastal Council was created in 2005 to develop Florida's ocean and coastal research priorities and establish a statewide ocean research plan. The group also coordinates public and private ocean research for more effective coastal management. This dedication to the conservation of coastal and ocean resources is an investment in Florida's future.

## 1.1 / Management Plan Purpose and Scope

Florida's aquatic resources are at risk for both direct and indirect impacts of increasing development and recreational use, as well as resulting economic pressures, such as energy generation and increased fish and shellfish harvesting to serve and support the growing population. These potential impacts to resources can reduce the health and viability of the ecosystems that contain them, requiring active management to ensure the long-term health of the entire network. Effective management plans for the aquatic preserves are essential to address this goal and each site's own set of unique challenges. The purpose of these plans is to incorporate, evaluate, and prioritize all relevant information about the site into a cohesive management strategy, allowing for appropriate access to the managed areas while protecting the long-term health of the ecosystems and their resources.

The mandate for developing aquatic preserve management plans is outlined in Section 18-20.013 and Subsection 18-18.013(2) of the Florida Administrative Code. Management plan development and review begins with the collection of resource information from historical data, research and monitoring, and includes input from individual ORCP managers and staff, area stakeholders, and members of the general public. The statistical data, public comment, and cooperating agency information is then used to identify management issues and threats affecting the present and future integrity of the site, its boundaries, and adjacent areas. The information is used in the development and review of the management plan, which is examined for consistency with the statutory authority and intent of the Aquatic Preserve Program. Each management plan is evaluated periodically and revised as necessary to allow for strategic improvements. Intended to be used by site managers and other agencies or private groups involved with maintaining the natural integrity of these resources, the plan includes scientific information about the existing conditions of the site and the management strategies developed to respond to those conditions.

To aid in the analysis and development of the management strategies for the site plans, the ORCP identified four comprehensive management programs applicable to all aquatic preserves. To address the goals, objectives, integrated strategies and performance measures of the four programs, relevant information about the specific site has been collected, analyzed, and compiled to provide a foundation for development of the management plan. While it is expected that unique issues may arise with regard to resource or management needs of a particular site, the following management programs will remain constant across the resource protection network:

- Ecosystem Science
- Resource Management
- Education and Outreach
- Public Use

Each aquatic preserve management plan will identify unique local and regional issues and contain the goals, objectives, integrated strategies, and performance measures to address those issues. The plan will also identify the program and facility needs required to meet the goals, objectives, and strategies of the management plan. These components are key elements for achieving the resource protection mission of each aquatic preserve.

The previous plan for Biscayne Bay Aquatic Preserve was approved by the Acquisition and Restoration Council in 2012.

## 1.2 / Public Involvement

ORCP recognizes the importance of stakeholder participation and encourages their involvement in the

management plan development process. ORCP is also committed to meeting the requirements of Florida's Government-in-the-Sunshine Law (§286.011, F.S.), including:

- meetings of public boards or commissions must be open to the public;
- reasonable notice of such meetings must be given; and
- minutes of the meetings must be recorded.

Several key steps are be taken during management plan development. First, staff gathered public input on the most pressing issues impacting the aquatic preserve and potential ways of addressing them. Staff then composed a draft plan after gathering information of current and historic uses; resource, cultural and historic sites; and other valuable information regarding the property and surrounding area. Staff then organize an advisory committee comprised of key stakeholders,and conduct public meetings to engage the stakeholders for feedback on the draft plan and the development of the final draft of the management plan. Additional public meetings are held when the plan was reviewed by the Acquisition and Restoration Council and the Trustees for approval. For additional information about the advisory committee and the public meetings refer to Appendix C - Public Involvement


*Map 1/ DEP's Office of Resilience and Coastal Protection system*

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*Photo 1 | Manatees are an iconic resident of Biscayne Bay Aquatic Preserve.*

# Chapter 2 / The Florida Department of Environmental Protection's Office of Resilience and Coastal Protection

## 2.1 / Introduction

The Florida Department of Environmental Protection (DEP) protects, conserves and manages Florida's natural resources and enforces the state's environmental laws. DEP is the lead agency in state government for environmental management and stewardship and commands one of the broadest charges of all the state agencies, protecting Florida's air, water and land. DEP is divided into three primary areas: Regulatory Programs, Land and Recreation, and Ecosystem Restoration. Florida's environmental priorities include restoring America's Everglades; improving air quality; restoring and protecting the water quality in our springs, lakes, rivers and coastal waters; conserving environmentally sensitive lands; and providing citizens and visitors with recreational opportunities, now and in the future.

The Office of Resilience and Coastal Protection (ORCP) is the unit within the DEP that manages more than five million acres of submerged lands and select coastal uplands. This includes 43 aquatic preserves, three National Estuarine Research Reserves (NERRs), and the Florida Keys National Marine Sanctuary (FKNMS), as well as providing management support through the Florida Coastal Management Program, the Outer Continental Shelf Program, the Coral Reef Conservation Program, the Clean Boating Program, the Florida Resilient Coastlines Program, and the Beach and Inlet Management Program. The

three NERRs and FKNMS are managed in cooperation with the National Oceanic and Atmospheric Administration (NOAA).

ORCP manages sites in Florida for the conservation and protection of natural and historical resources and resource-based public use that is compatible with the conservation and protection of these lands. ORCP is a strong supporter of the NERR system and its approach to coastal ecosystem management. Florida has three designated NERR sites, each encompassing at least one aquatic preserve within its boundaries. Rookery Bay NERR includes Rookery Bay Aquatic Preserve and Cape Romano-Ten Thousand Islands Aquatic Preserve; Apalachicola NERR includes Apalachicola Bay Aquatic Preserve; and Guana Tolomato Matanzas NERR includes Guana River Marsh Aquatic Preserve and Pellicer Creek Aquatic Preserve. These aquatic preserves provide discrete areas designated for additional protection beyond that of the surrounding NERR and may afford a foundation for additional protective zoning in the future. Each of the Florida NERR managers serves as a regional manager overseeing multiple other aquatic preserves in their region. This management structure advances ORCP's ability to manage its sites as part of the larger statewide system. In the southeast region, where there is no NERR, the regional administrator oversees the Coral Reef Conservation Program, the co-management of FKNMS, Kristin Jacobs Coral Aquatic Preserve, the Biscayne Bay Aquatic Preserve and the Florida Keys Aquatic Preserves.

FKNMS, established in 1990 by Congress and confirmed by the Board of Trustees of the Internal Improvement Trust Fund (Trustees), covers 2.3 million acres of state and federal submerged lands. FKNMS contains unique and nationally significant marine resources, including the southern portion of Florida's Coral Reef, extensive seagrass beds, mangrove-fringed islands and more than 6,000 species of marine life. ORCP leads state co-management efforts in the Sanctuary in partnership with the Florida Fish and Wildlife Conservation Commission (FWC) and NOAA. Lignumvitae Key and Coupon Bight Aquatic Preserves are completely within FKNMS as well as the Card Sound portion of Biscayne Bay Aquatic Preserve.

The Coral Reef Conservation Program coordinates research and monitoring, develops management strategies and promotes partnerships to protect the northern portion of the Florida Coral Reef along the southeast Florida coast, pursuant to the U.S. Coral Reef Task Force's National Action Plan. The Coral Reef Conservation Program also implements Florida's Local Action Strategy, the Southeast Florida Coral Reef Initiative. The program leads response, assessment and restoration efforts and jointly oversees enforcement efforts for non-permitted reef resource injuries (vessel groundings, anchor and cable drags, etc.) in southeast Florida pursuant to the Florida Coral Reef Protection Act (Section 403.93345, Florida Statutes (F.S.).

The Coral Protection and Restoration Program was created to focus the state's protection of Florida's Coral Reef and the administration of funds appropriated from the Legislature for these critical efforts. The Coral Protection and Restoration Program provides leadership on coral reef-related national and state legislative issues, represents Florida on the U.S. Coral Reef Task Force and U.S. All Islands Coral Reef Committee and represents DEP on the Stony Coral Tissue Loss Disease leadership team.

The Florida Coastal Management Program is based on a network of agencies implementing 24 statutes that protect and enhance the state's natural, cultural and economic coastal resources. The goal of the program is to coordinate local, state and federal government activities using existing laws to ensure that Florida's coast is as valuable to future generations as it is today. ORCP is responsible for directing the implementation of the statewide coastal management program. The Florida Coastal Management Program provides funding to promote the protection and effective management of Florida's coastal resources at the local level through the Coastal Partnership Initiative grant program.

The Outer Continental Shelf Program is responsible for coordinating the state's review, oversight, monitoring and response efforts related to activities that occur in federal waters on the Outer Continental Shelf to ensure consistency with state laws and policies and that these activities do not adversely affect state resources. Reviews are conducted under federal laws, including the Outer Continental Shelf Lands Act, Coastal Zone Management Act, National Environmental Policy Act, Deepwater Ports Act, Marine Protection, Research and Sanctuaries Act, Rivers and Harbors Act, Clean Air and Water Acts and the

regulations that implement them.

The Clean Boating Program includes Clean Marina designations to bring awareness to marine facilities and boaters regarding environmentally friendly practices intended to protect and preserve Florida's natural environment. Marinas, boatyards and marine retailers receive clean designations by demonstrating a commitment to implementing and maintaining a host of best management practices. Via the Clean Boating Program, the Clean Vessel Act provides grants, with funding provided by the U.S. Fish and Wildlife Service, for construction and installation of sewage pumpout facilities and purchase of pumpout boats and educational programs for boaters.

The Resilient Florida Program's mission is synergizing community resilience planning and natural resource protection tools and funding to prepare Florida's coastline for the effects of climate change, especially rising sea levels. This program is working to ensure Florida's coastal communities are resilient and prepared for the effects of rising sea levels, including coastal flooding, erosion, and ecosystem changes. The program is synergizing community resilience planning and natural resource protection tools; providing funding and technical assistance to prepare Florida's coastal communities for sea level rise; and continuing to promote and ensure a coordinated approach to sea level rise planning among state, regional, and local agencies.

A healthy beach and dune system provides protection for upland development and critical infrastructure, preservation of critical wildlife habitat for threatened and endangered species, and a recreational space that drives the state's tourism industry and economy. In order to protect, preserve and manage Florida's valuable sandy beaches and adjacent coastal systems, the Legislature adopted the Florida Beach and Shore Preservation Act, Chapter 161, Florida Statutes, in 1986. The Act provides for the creation of a statewide, comprehensive beach management program that integrates coastal data acquisition, coastal engineering and geology, biological resource protection and analyses, funding initiatives and regulatory programs designed to protect Florida's coastal system both above and below the water line. This comprehensive approach allows DEP's Beaches Programs to collaborate with coastal communities to address erosion caused by managed inlets, imprudent construction, rising seas and storm impacts. DEP's Beaches Programs consist of the following: Beach Survey Services, Coastal Engineering and Geology Group, the Coastal Construction Control Line Program, the Beaches, Inlets and Ports Program and the Beach Management Funding Assistance Group.

## 2.2 / Management Authority

Established by law, aquatic preserves are exceptional areas of submerged lands and associated waters that are to be maintained in their natural or existing conditions. The intent was to forever set aside submerged lands with exceptional biological, aesthetic, and scientific values as sanctuaries, called aquatic preserves, for the benefit of future generations.

The laws supporting aquatic preserve management are the direct result of the public's awareness of and interest in protecting Florida's aquatic environment. The extensive dredge and fill activities that occurred in the late 1960s spawned this widespread public concern. In 1966 the Trustees created the first offshore reserve, Estero Bay, in Lee County.

In 1967, the Florida Legislature passed the Randall Act (Chapter 67-393, Laws of Florida), which established procedures regulating previously unrestricted dredge and fill activities on state-owned submerged lands. That same year, the Legislature provided the statutory authority (§253.03, F.S.) for the Trustees to exercise proprietary control over state-owned lands. Also in 1967, government focus on protecting Florida's productive water bodies from degradation due to development led the Trustees to establish a moratorium on the sale of submerged lands to private interests. An Interagency Advisory Committee was created to develop strategies for the protection and management of state-owned submerged lands.

In 1968, the Florida Constitution was revised to declare in Article II, Section 7, the state's policy of conserving and protecting natural resources and areas of scenic beauty. That constitutional provision also established the authority for the Legislature to enact measures for the abatement of air and water

pollution. Later that same year, the Interagency Advisory Committee issued a report recommending the establishment of 26 aquatic preserves.

The Trustees acted on this recommendation in 1969 by establishing 16 aquatic preserves and adopting a resolution for a statewide system of such preserves. In 1975, the state Legislature passed the Florida Aquatic Preserve Act of 1975 (Act) that was enacted as Chapter 75-172, Laws of Florida, and later became Chapter 258, Part II, F.S. This Act codified the already existing aquatic preserves and established standards and criteria for activities within those aquatic preserves. Additional aquatic preserves were individually adopted with the newest aquatic preserve being designated in 2020.

In 1980, the Trustees adopted the first aquatic preserve rule, Chapter 18-18, Florida Administrative Code (F.A.C.), for the administration of the Biscayne Bay Aquatic Preserve. All other aquatic preserves are administered under Chapter 18-20, F.A.C., which was originally adopted in 1981. These rules apply standards and criteria for activities in the aquatic preserves, such as dredging, filling, building docks and other structures that are stricter than those of Chapter 18-21, F.A.C., which apply to all sovereignty lands in the state.

This plan is in compliance with the Conceptual State Lands Management Plan, adopted March 17, 1981, by the Trustees and represents balanced public utilization, specific agency statutory authority, and other legislative or executive constraints. The Conceptual State Lands Management Plan also provides essential guidance concerning the management of sovereignty lands and aquatic preserves and their important resources, including unique natural features, seagrasses, endangered species, and archaeological and historical resources.

Through delegation of authority from the Trustees, the DEP and ORCP have proprietary authority to manage the sovereignty lands, the water column, spoil islands (which are merely deposits of sovereignty lands), and some of the natural islands and select coastal uplands to which the Trustees hold title.

Enforcement of state statutes and rules relating to criminal violations and non-criminal infractions rests with the FWC law enforcement, DEP Environmental Crimes Unit, and local law enforcement agencies. Enforcement of administrative remedies rests with ORCP, the DEP Districts, and Water Management Districts.

In 1992 the Trustees leased submerged lands managed under the aquatic preserve to the Florida Department of Natural Resources for inclusion within the Lignumvitae Key Botanical State Park (LKBSP) (see Appendix A.4). This was an amendment to Lease Agreement No. 2534, the founding document for LKBSP, which previously had just included the emergent lands on Lignumvitae and Shell keys. This lease will be up for renewal on June 8, 2070.

## 2.3 / Statutory Authority

The fundamental laws providing management authority for the aquatic preserves are contained in Chapters 258 and 253, F.S. These statutes establish the proprietary role of the Governor and Cabinet, sitting as the Board of Trustees of the Internal Improvement Trust Fund, as Trustees over all sovereignty lands. In addition, these statutes empower the Trustees to adopt and enforce rules and regulations for managing all sovereignty lands, including aquatic preserves. The Florida Aquatic Preserve Act was enacted by the Florida Legislature in 1975 and is codified in Chapter 258, F.S.

The legislative intent for establishing aquatic preserves is stated in Section 258.36, F.S.: "It is the intent of the Legislature that the state-owned submerged lands in areas which have exceptional biological, aesthetic, and scientific value, as hereinafter described, be set aside forever as aquatic preserves or sanctuaries for the benefit of future generations." This statement, along with the other applicable laws, provides a foundation for the management of aquatic preserves. Management will emphasize the preservation of natural conditions and will include lands that are statutorily authorized for inclusion as part of an aquatic preserve.

Management responsibilities for aquatic preserves may be fulfilled directly by the Trustees or by staff of the DEP through delegation of authority. Other governmental bodies may also participate in the

management of aquatic preserves under appropriate instruments of authority issued by the Trustees. ORCP staff serves as the primary managers who implement provisions of the management plans and rules applicable to the aquatic preserves. ORCP does not “regulate” the lands per se; rather, that is done primarily by the DEP Districts (in addition to the Water Management Districts) which grant regulatory permits. The Florida Department of Agriculture and Consumer Services through delegated authority from the Trustees, may issue proprietary authorizations for marine aquaculture within the aquatic preserves and regulates all aquaculture activities as authorized by Chapter 597, Florida Aquaculture Policy Act, F.S. Staff evaluates proposed uses or activities in the aquatic preserve and assesses the possible impacts on the natural resources. Project reviews are primarily evaluated in accordance with the criteria in the Act, Chapter 18-20, F.A.C., and this management plan.

Comments of ORCP staff, along with comments of other agencies and the public are submitted to the appropriate permitting staff for consideration in their issuance of any delegated authorizations in aquatic preserves or in developing recommendations to be presented to the Trustees. This mechanism provides a basis for the Trustees to evaluate public interest and the merits of any project while also considering potential environmental impacts to the aquatic preserves. Any activity located on sovereignty lands requires a letter of consent, a lease, an easement, or other approval from the Trustees.

Florida Statutes that authorize and empower non-ORCP programs within DEP or other agencies may also be important to the management of ORCP sites. For example, Chapter 403, F.S., authorizes DEP to adopt rules concerning the designation of “Outstanding Florida Waters" (OFWs), a program that provides aquatic preserves with additional regulatory protection (the entire Florida Keys are designated an OFW). Chapter 379, F.S., regulates saltwater fisheries, and provides enforcement authority and powers for law enforcement officers. Additionally, it provides similar powers relating to wildlife conservation and management. The sheer number of statutes that affect aquatic preserve management prevents an exhaustive list of all such laws from being provided here.

## 2.4 / Administrative Rules

Chapters 18-18, 18-20 and 18-21, F.A.C., are the three administrative rules directly applicable to the uses allowed in aquatic preserves specifically and sovereignty lands generally. These rules are intended to be cumulative, meaning that Chapter 18-21 should be read together with Chapter 18-18 or Chapter 18-20 to determine what activities are permissible within an aquatic preserve. If Chapter 18-18 or Chapter 18-20 are silent on an issue, Chapter 18-21 will control; if a conflict is perceived between the rules, the stricter standards of Chapter 18-18 or Chapter 18-20 supersede those of Chapter 18-21. Because Chapter 18-21 concerns all sovereignty lands, it is logical to discuss its provisions first.

Originally codified in 1982, Chapter 18-21, F.A.C., is meant “to aid in fulfilling the trust and fiduciary responsibilities of the Trustees for the administration, management and disposition of sovereignty lands; to insure maximum benefit and use of sovereignty lands for all the citizens of Florida; to manage, protect and enhance sovereignty lands so that the public may continue to enjoy traditional uses including, but not limited to, navigation, fishing and swimming; to manage and provide maximum protection for all sovereignty lands, especially those important to public drinking water supply, shellfish harvesting, public recreation, and fish and wildlife propagation and management; to insure that all public and private activities on sovereignty lands which generate revenues or exclude traditional public uses provide just compensation for such privileges; and to aid in the implementation of the State Lands Management Plan.”

To that end, Chapter 18-21, F.A.C., contains provisions on general management policies, forms of authorization for activities on sovereignty lands, and fees applicable for those activities. In the context of the rule, the term “activity” includes “construction of docks, piers, boat ramps, boardwalks, mooring pilings, dredging of channels, filling, removal of logs, sand, silt, clay, gravel or shell, and the removal or planting of vegetation” (Rule 18-21.003, F.A.C.). In addition, activities on sovereignty submerged lands must be not contrary to the public interest (Rule 18-21.004, F.A.C.). Chapter 18-21 also sets policies on aquaculture, geophysical testing (using gravity, shock wave and other geological techniques to obtain data on oil, gas or other mineral resources), and special events related to boat shows and boat displays.

The rule also addresses spoil islands, preventing their development in most cases.

Chapters 18-18 and 18-20, F.A.C., apply standards and criteria for activities in the aquatic preserves that are stricter than those of Chapter 18-21. Chapter 18-18 is specific to the Biscayne Bay Aquatic Preserve and is more extensively described in that site's management plan. Chapter 18-20 is applicable to all other aquatic preserves. It further restricts the type of activities for which authorizations may be granted for use of sovereignty lands and requires that structures that are authorized be limited to those necessary to conduct water dependent activities. Moreover, for certain activities to be authorized, "it must be demonstrated that no other reasonable alternative exists which would allow the proposed activity to be constructed or undertaken outside the preserve" (Paragraph 18-20.004(1)(g), F.A.C.).

Chapter 18-20, F.A.C., expands on the definition of "public interest" by outlining a balancing test that is to be used to determine whether benefits exceed costs in the evaluation of requests for sale, lease, or transfer of interest of sovereignty lands within an aquatic preserve. The rule also provides for the analysis of the cumulative impacts of a request in the context of prior, existing, and pending uses within the aquatic preserve, including both direct and indirect effects. The rule directs management plans and resource inventories to be developed for every aquatic preserve. Further, the rule provides provisions specific to certain aquatic preserves and indicates the means by which the Trustees can establish new or expand existing aquatic preserves.

Aquatic preserve management relies on the application of many other DEP and outside agency rules. Perhaps most notably, Chapter 62-302, F.A.C., concerns the classification of surface waters, including criteria for OFW, a designation that provides for the state's highest level of protection for water quality. All aquatic preserves contain OFW designations. No activity may be permitted within an OFW that degrades ambient water quality unless the activity is determined to be in the public interest. Once again, the list of other administrative rules that do not directly address ORCP's responsibilities but do affect ORCP-managed areas is so long as to be impractical to create within the context of this management plan.

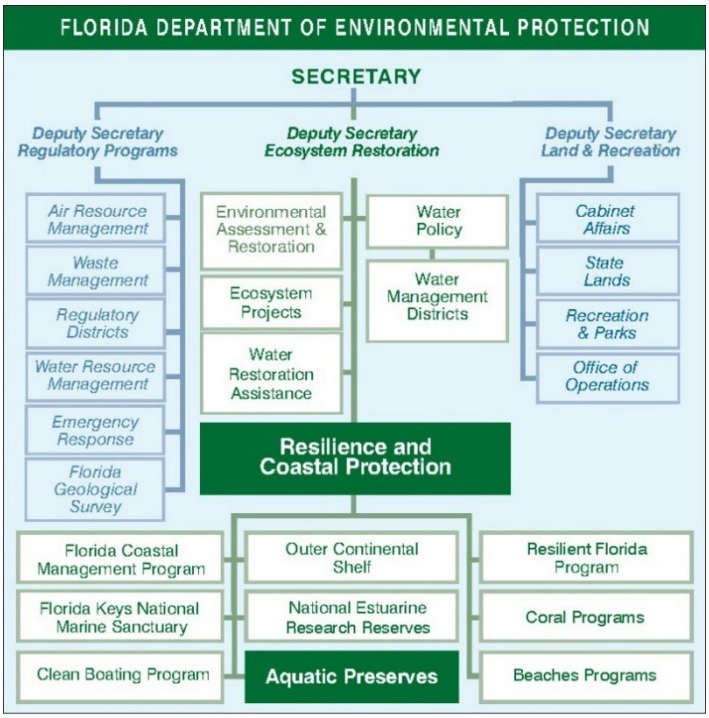



*Figure 1 | State management structure.*

*Photo 2 / A beach dune on Morningside Island.*

# Chapter 3 / The Biscayne Bay Aquatic Preserve

## 3.1 / Historical Background

The earliest known records of human habitation in what today is Biscayne Bay actually precede the very formation of the water body. Evidence from the Cutler Fossil site suggests that humans may have occupied South Florida as early as 11,000 years ago, which is between 4,000-6,000 years before the bay formed over the present interglacial period and resulting sea level rise (Carr, 2012). However, the first continuous settlement of the region, especially along the now aqueous Biscayne Bay, likely started with the ancestral precursors to the Tequesta who entered South Florida around 3,000 BCE.

Providing waterway access for transportation, trade and sourcing food, Biscayne Bay became dotted with villages of the Tequesta people due to its importance as a connective waterway and foraging area. The Tequesta people traveled inland and into nearshore waters using dugout canoes. Several archeological sites have been found in the forms of mounds, middens, cemeteries, and other deposits along central Miami-Dade County locations next to Biscayne Bay, such as Arch Creek, Indian Creek, Key Biscayne, Sands Key, and Cutler Bay. However, the principal population center was Tequesta, built around the mouth of the Miami River, that debouches into the bay. The Miami Circle, an archaeological site 38 feet in diameter and dated around 1100-1200 CE, is believed to be part of this population center (Carr, 2012). On February 5, 2002, the site, located along the coast at Brickell Point, was added to the National Register of Historic Places and subsequently declared a National Historic Landmark on January 16, 2009. Evidence also suggests that settlements extended all the way from the New River into the Lower Keys and Key West up to the Ten Thousand Islands (which represented their western frontier) and inland deep into the Everglades, and that the Tequesta relied on Biscayne Bay and other water bodies

as routes in their travels to and from their more distant outposts (Carr, 2012).

The main food types consumed by the residents reveal the importance of the bay and its brackish environment. Deposits from coastal middens and other sites include sea turtles, fish, and conch, with oysters and other invertebrates consumed around brackish waterways. Also, of importance were mollusk shells that were fashioned into shell axes and shark teeth used as composite knives and saws. Remains from a site at the mouth of the Miami River and Biscayne Bay showed that the bay was of particular importance for a variety of marine species, including 14 shark species, sea turtles, Caribbean monk seals, and other marine mammals. It is likely that early inhabitants during the Early Archaic (6500-5000 B.C.) and Middle Archaic (5000-3000 B.C.) periods were small bands of people who lived in strategic locations along the coast and relied on shellfish, fish, and native plants and animals (Carr, 2012). It is well documented that these early populations increased their reliance on fishing and cultivating the wetland environment. Coastal sites like the Atlantis and Santa Maria sites provide clear evidence that sea turtle, shark, other fish, and conch provided the main source of calories during the Late Archaic period (3000 - 700 BCE), supplemented by deer and other smaller terrestrial species. Archaeological records suggest the first continuous habitation of South Florida began around 3000 BCE (Carr, 2012). Remains from the Granada site, located at the mouth of the Miami River, demonstrate that during the Glades period, early inhabitants' subsistence practices benefitted from the diversity provided by the adjacent source of freshwater. Elizabeth Wing and Jill Loucks examined fossil evidence from the Granada site in 1978 and identified ninety-nine species from the Glades I - Glades IIIB periods. This investigation reveals that sharks and rays made up a significant percentage of fish biomass (61.2 percent), and sea turtles made up the most amount of weight in the faunal assemblage. Marine mammal remains at this site include Caribbean monk seal (*Monachus tropicalis*), bottle-nosed dolphins (*Tursiops truncatus*), and a whale vertebra. Though there is a scarcity of archaeological evidence for plant species, ethnographic evidence suggests plants like cocoplum (*Chrysobalanus icaco*) and saw palmetto (*Serenoa repens*) were readily relied upon by these early inhabitants (Carr, 2012).

The etymology of "Biscayne Bay" remains uncertain, but is often attributed to the early Spanish explorer, Ponce de Leon, who is purported to have compared it to the Bay of Biscay, a bay located in the eastern Atlantic Ocean off Spain and France, during his 1513 expedition to Florida. Other Spanish historical figures in the Americas are also candidates for the bay's name, and in these cases, the bay presumably derived its appellation from a derivation of the figures themselves. For example, Don Pedro el Biscaino is considered a possible source, as he reportedly lived on one of the bay's islands before returning to Spain; another is Sebastian Viscaino, a wealthy Spanish merchant prominent in the late 16th and early 17th century, for whom there is no record of his having visited Florida (Browder & Wanless, 2001).

The Columbian era commenced in Biscayne Bay in 1513 when Ponce de Leon, who had been part of the crew on Columbus' second voyage to the Americas in 1493, led an expedition to conquer the island of Bimini. By the Easter season, de Leon's ships had reached what he presumed was an island that he called La Florida, from where the vessels traveled southward, reaching Biscayne Bay later that same year (Diaz Balsera & May, 2014). On that visit, the Spanish-led expedition made contact with a Tequesta village in Key Biscayne, an island they named Santa Marta, representing the first contact between the Native Americans and the European explorers. Thereafter and until the mid-18th century, Spain would dominate European settlement and development in Biscayne Bay and much of Florida.

Unlike Ponce de Leon, who made only a brief stop in Biscayne Bay, it is Pedro Menéndez de Áviles who can be rightly identified as the first European to settle in Florida and to establish meaningful contact with a number of Native American populations in the region, including the Tequesta. He built a marriage alliance with the Calusa in southwest Florida and worked with emissaries to develop relations with the Tequesta across the peninsula (Carr, 2012). By 1567, Menéndez de Áviles returned to Spain as a conquering hero who had expelled the French and built alliances with various groups, including the Tequesta, to repel any further European incursions into Florida. However, these alliances quickly broke down into bloody conflicts, and by 1570, the last of the Spanish settlements in Tequesta-controlled, southeast Florida were abandoned. The Tequesta remained hostile to European visitors throughout the 16th century, with only brief records of trade and ransom of shipwrecked persons, and the name faded into obscurity into the next century as a steep population decline took hold due to introduced diseases.

By 1743, when the Spanish built the Santa María de Loreto mission on the north bank of the Miami River, only hundreds of Tequesta remained in the once flourishing population center. Merely two decades later, most of the remaining Tequesta relinquished their homeland to the Ullies, a Native American group allied with the British who were then fighting the Spanish in the Seven Year War. Within 200 years of contact with Spanish explorers, this group, which had thrived in Biscayne Bay and its environs, became culturally extinct, only surviving as Spanish Indians who would later become part of the Miccosukee and Seminoles (Carr, 2012).

The British occupation of Florida, including Biscayne Bay, commenced in 1763 and lasted two decades, after which the territory was returned to Spain. While the occupation focused mainly on northern Florida, as the southern part of the peninsula was considered too wild for immediate settlement, Bernard Romans, a British surveyor, did produce the first detailed map of Biscayne Bay. The map, completed in 1770, identified the upper bay as Dartmouth Streams, Boca Ratones pass (later Indian Creek), Biskaino Island (later Key Biscayne), and Sandwich Gulf, which is the main portion of Biscayne Bay (Cantilo et al., 2000). The British did have plans to settle the Biscayne Bay area in the region of Cutler Bay as a colony of 20 families under the Cape Florida Society contract. Like this proposed colony, two others - planned for areas north and south of the Miami River, respectively - were never built. By contrast, Bahamian communities did colonize areas of South Florida, especially near Biscayne Bay, occupying coastal lands mainly after the Spanish reacquired Florida from the British in 1783 and growing from tiny pockets in the early 19th century into larger settlements along the coastal fringe by the 1850s. The Spanish, by contrast, struggled to contain growing conflicts along the northern parts of their Florida territory, as the U.S. forces steadily increased their incursions to fight Indian rebellions and quell slave rebellions (Diaz Balsera & May, 2014). After General Andrew Jackson marched on and occupied Pensacola in 1818 during the First Seminole War as retribution for the Spanish authorities refusing U.S. permission to search for Seminoles, the Spanish crown realized that it could not defend Florida from the U.S. for much longer, given its empire's precarious position across the Americas. Thus, the following year, Spain and the U.S. signed the Adam-Onis Treaty, ratified in 1821, ceding Florida to the U.S. All of Florida, including Biscayne Bay and its environs, formally became a U.S. territory, a designation it would hold until Florida joined the United States as a slave state in 1845 (Taylor, 2005).

Carr (2012), in his archeological history of Miami, points out that the term 'Seminole' refers to the corruption of the Spanish word, "cimarron", meaning wild or untamed. The term likely referred to any tribe encountered by white settlers and became commonplace when referring to any 19th century Floridian Native American tribe. The term also was used to describe escaped slaves from the Southern states, who were welcomed by the Seminoles and became known as Black Seminoles. Many Seminoles and Black Seminoles escaped slavery and oppression by American settlers by using dugout canoes, launched from Cape Florida, to reach freedom in the Bahamas and Haiti to escape slavery and oppression by American settlers. (Dixon, 2020).

From the late 1700s onwards, Creek and Seminole Indians moved down to South Florida, encountering returning "Spanish Indians" (Carr, 2012, p. 142) consisting of Tequesta and Calusa tribe members who had returned from Cuba after the end of British rule in Florida. These Spanish Indians would play a major role in the Second Seminole War (1835-42), joining forces with other tribes in repelling US efforts to forcibly move Native Americans from Florida under the 1830 Indian Removal Act, and profoundly impacting the settlement and trade patterns in the region and indeed the development of the entire Florida territory.

The settlers who arrived in South Florida following the U.S. acquisition of Florida included those interested in agriculture, especially in tropical plants that they sought to introduce to the warm region (Carr, 2012). This included coffee, sisal, coontie, and pineapple, among others. However, most of these endeavors failed, and even those that enjoyed modest success were mostly slowed or shut down over the 22 years of military conflict during the Second and Third Seminole Wars. Perhaps most emblematic of these pioneers was Henry Perrine, who moved to Cutler in 1836 with the expectation of establishing a sisal plantation but ended up getting killed by a Native American attack in Indian Key in 1840.

To protect U.S. interests during the Seminole Wars, the federal government erected a series of forts in

the Florida territory, six of which were located in today's Miami-Dade County. The largest of these, Fort Dallas, was completed in 1838, most likely on the northern bank of the Miami River. Another coastal fort, Fort Bankhead (later Fort Russell), was built in southern Key Biscayne to protect the strategic Cape Florida Lighthouse. These and other forts would serve in part to protect settlers in the Seminole Wars, and when the military left in the years after the Civil War, the structures would form the basis for further settlement and the eventual establishment of the City of Miami (Shappee, 1961). It was only after the end of the Third Seminole War (1855-1858) and Civil War (1861-65) that immigration and development accelerated in Dade County, with settlements concentrating in pockets, mostly notably around the mouth of the Miami River and environs abutting Biscayne Bay.

Julia Tuttle and William and Mary Brickell are considered to be the co-founders of the city of Miami. The Brickells moved from Cleveland, Ohio in 1871 and opened a trading post and post office on the south bank of the Miami River, near the site of Fort Dallas (Shappee, 1961). The Brickell Trading Post became the primary source of trading between settlers and Seminoles in the area. Julia Tuttle moved to Fort Dallas in 1891 on land inherited from her father. Tuttle saw the potential of Fort Dallas and convinced Henry Flagler to extend the Florida East Coast Railway to Fort Dallas in exchange for parcels of her land to construct a hotel. Through this exchange, Flagler built the Royal Palm Hotel on the northern bank of the Miami River where it empties into Biscayne Bay. Settlement on the shoreline of Biscayne Bay increased after the arrival of Flagler's railroad, which led to the incorporation of the city of Miami in 1896.

Several other important settlements developed along the bay in the mid-to-late 1800s (Peters, 1976; Shappee, 1961). After the Civil War, American settlers streamed into the area and formed communities around the bay and the Miami River. Lemon City, six miles (9.7 kilometers (km)) to the north, was known for its citrus groves and settlements around a natural limestone arch crossing Arch Creek. The town of Biscayne (present day Miami Shores) was founded five miles (eight km) north of the Miami River. Cocoanut Grove, later shortened to Coconut Grove, was located three miles (4.8 km) south of the Miami River along a bight in the bay's shoreline. Commodore Ralph Middleton Munroe built his "Barnacle" inspired house along the Cocoanut Grove shoreline in 1891 when the primary travel was by boat (Munroe and Gilpin, 1930). He founded the Biscayne Bay Yacht Club and served as Commodore for 22 years. Commodore Munroe designed sharpies and other shallow draft sailing vessels that were fit for the shallow waters of Biscayne Bay. His house and property were listed on the National Register of Historical Places in 1973 as the Barnacle Historic State Park.

In the 1950s, the U.S. Army Corps of Engineers (Corps) began a major construction program in the Everglades, creating a complex system of canals, levees, dams, and pump stations that were built to provide protection from seasonal flooding to former marsh land being used for agriculture and real estate development. Marjory Stoneman Douglas, a journalist and conservationist, foresaw the ecological impact the Everglades drainage program would have on the natural environment in Miami-Dade County (MDC). Long before scientists studied the effects of the drainage program on the natural ecosystems of South Florida, Douglas challenged officials who were destroying the wetlands by eliminating the natural flow of water and upsetting hydrological cycles upon which the entire ecosystem depends. Ms. Douglas advocated against these projects and worked her entire life to protect and restore natural systems from the Everglades to Biscayne Bay and Florida Bay. In honor of her dedication to environmental conservation, the state of Florida honored her by naming the Department of Environmental Protection's (DEP) headquarters in Tallahassee the Marjory Stoneman Douglas Building in 1980. In April 2007, Florida placed her home in the care of the Florida Park Service, a division of the Florida DEP. Ms. Douglas and Mabel Miller, a prominent MDC environmental educator, helped to secure a permanent location for what became the Marjory Stoneman Douglas Biscayne Nature Center. This facility is now an active center that leads environmental education and environmental conservation efforts, focusing on issues concerning Biscayne Bay.

***Past Uses***

Biscayne Bay has been a source of sustenance for many generations. The Tequesta people, who settled along the shores of the bay, were renowned anglers who relied on the bay's resources. They were not an agricultural society, but ate a varied diet that included palmetto berries, coco plum, sea grape, pigeon

plum, and prickly pears along with their harvest from the ocean of turtles, marine mammals and fish. Unlike other coastal tribes, researchers have found little evidence that demonstrates marine invertebrates were a major part of their diet (Bullen, 1965). Instead, the Tequesta utilized shells and sharks' teeth for a variety of tools, including hammers, chisels, fishhooks, drinking cups, and spearheads. The Tequesta used sharks' teeth to carve out logs to build dugout canoes and used those canoes to access Biscayne Bay and the Atlantic Ocean. Fish remains provide evidence that the Tequesta traveled great distances in dugout canoes to catch a variety of ocean species (Bullen, 1965). As new explorers settled the shores of Biscayne Bay, the Tequesta's lush land and bay continued to provide bountiful food and a source of freshwater. In the late 1800s, Biscayne Bay was known for its freshwater springs surfacing from the Biscayne Aquifer. One unique spring located near today's Coconut Grove Peacock Park even bubbled up through the saltwater of the bay. Dr. Jacob Rhett Motte, a U.S. Army Surgeon during the Seminole Wars, described the spring, "We were fortunate in hitting upon this spot, for there we found a remarkable spring of fresh water, of the coolest and most delicious flavour I ever drank" (Parks, 2004). The "Devil's Punch Bowl", located near what is now the western end of the Rickenbacker Causeway, was another favorite spring and local landmark for Southeastern Florida pioneers. Most springs in and around Biscayne Bay disappeared early in the 20th century due to the hydrological changes from draining the Everglades, which lowered the water table, no longer allowing spring water to surface.*Cooks Island*

Until Arch Creek Military Trail (now Dixie Highway) was built during the Third Seminole War (1855-1858), Miami was only accessible by shallow draft sailboats. With no overland route, reaching Miami was an arduous journey. Travelers cruised from New York City to Key West (150 miles/240 km south of Miami), then chartered small sailboats back to Miami. The City of Miami grew, requiring larger draft vessels to deliver building supplies that could not travel through the shallow waters of Biscayne Bay. Henry Flagler is credited with receiving government financing to breach the south end of Miami Beach, creating Government Cut. The U.S. Congress authorized this project in 1902; dredging began in 1903 and finished in the summer of 1905. The Atlantic Intracoastal Waterway (AIWW) was dredged into the bay by 1912 to further accommodate inshore travel by larger vessels. The dredging to allow access for ships with deeper drafts impacted seagrasses and algal beds. The dredged material, called "spoil", was piled next to the channels, exacerbating the impact on the seagrasses and algal beds. (George, 1996)

The process of dredging and placing spoil material aside for port facilities and MDC-owned islands is responsible for creating or enlarging at least 20 islands within the Biscayne Bay Aquatic Preserve. Today, spoil islands in Biscayne Bay are home to recreation areas, neighborhoods, and restoration projects to restore native vegetation. Additional dredging took place at Baker's Haulover Inlet, another channel connecting the northern end of Biscayne Bay with the Atlantic Ocean. This inlet was cut in 1925 through a narrow point in the peninsula where a man named Baker would regularly "haul" his sponge boat from Biscayne Bay over the thickly wooded dunes for access to the ocean. Mention of "Baker's Haulover" appears on maps as early as 1823. New access to the mainland greatly improved shipping access to the new port, which led to it becoming one of the busiest ports in Florida.

In 1960, the Dade County Board of Commissioners and the city of Miami approved a resolution to modernize the Port of Miami (PortMiami, 2021). Construction began on Dodge Island soon afterwards, expanding it with spoil material to join Lummus Island and Sam's Island. Fisherman's Channel provides a shipping route to the Miami River by a dredged connection to the wharves on the south side of Dodge and Lummus islands. PortMiami is known as the shipping link for the shallow draft ports of the Caribbean and Central and South America (PortMiami, 2021). The Port is the closest U.S. East Coast deepwater container port to the Panama Canal. It is also known as the "Cruise Capital of the World." In 2012, the White House Administration authorized the modernization of five major US ports, including PortMiami. This project sought to meet global shipping needs as the Panama Canal underwent an expansion to accommodate "Post-Panamax" vessels, which are twice the size of previous ships. The "Deep Dredge" project used federal, state, and local funds to deepen the Miami Harbor to 52 ft and widen the entrance channel to 800 ft. Throughout the course of the expansion project, five different dredges removed five million cubic yards of rock, limestone, and sand. The project was completed in 2015.

The Miami Harbor dredging caused concern over the sedimentation impacts the dredging had on

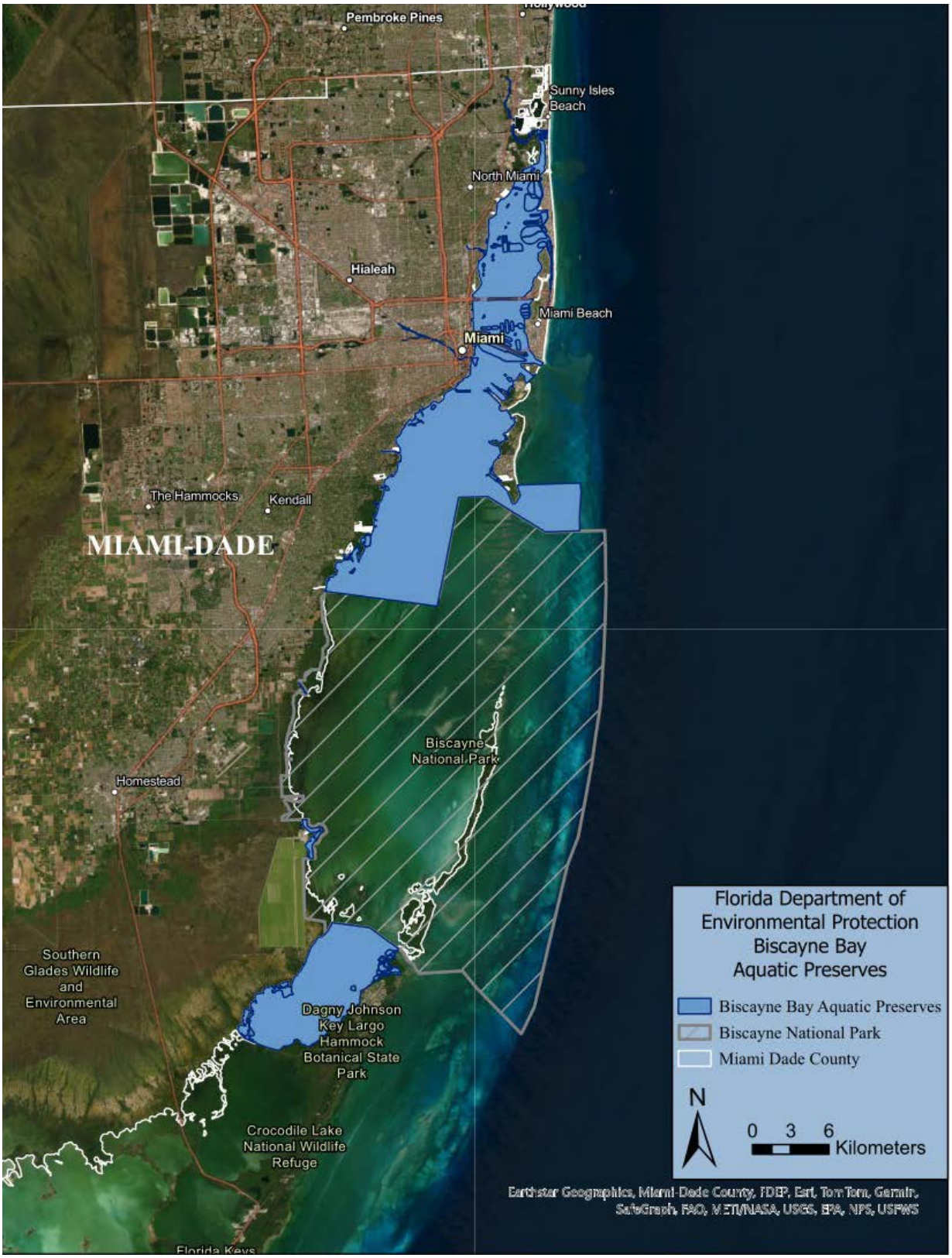
seagrass and coral species. One component of the mitigation involved the creation of 17 acres of seagrass beds and 11 acres of artificial reefs and the relocation of thousands of corals. (US Army Corps of Engineers, Jacksonville District [Corps] 2020).

Until the 1950s, no large-scale sewage treatment system existed within MDC, and waste was released into bay waters. Cantillo, Hale, Collins, & Caballero (2000) report three centralized treatment plants were built close to coastal locations in the 1970s so that treated sewage effluent could be piped offshore (for Northern and Central MDC plants) or injected below the Biscayne Aquifer (for the southern plant). The confinement and treatment of human waste is thought to be the cause of the largest improvement of water quality of the bay. Today, over 100,000 households in Miami-Dade County remain on septic systems instead of being connected to county facilities (DRER et al., 2018). In addition, several cities have had to update their lines after numerous breaks and contamination events.

As water quality improvements began in Biscayne Bay, so grew public awareness of the bay's value. In the 1960s, citizens petitioned the federal government to stop proposed causeway construction to the barrier island of Elliot Key. As a result of intense lobbying, Congress designated the Biscayne National Monument in 1968. Similar efforts by concerned citizens were successful at preventing an oil refinery and a jet port that were proposed for southern Biscayne Bay. In 1967, the Atomic Energy Commission (later to become the Nuclear Regulatory Commission) granted a construction license to Florida Power and Light (FPL) to build Turkey Point Nuclear Power Plant on the shores of Biscayne Bay and Card Sound 25 miles (40.2 km) south of Miami and 10 miles (16.1 km) east of Homestead. FPL owns and operates all five electric generating units. Units I, 2, and 5 are fossil-fired and Units 3 and 4 are nuclear reactors. The operation of Unit 3 began in 1972, followed by Unit 4 in 1973, and initially allowed heated water effluent, used to cool the reactors, to flow into Biscayne Bay. Early investigations funded by the U.S. Atomic Energy Commission and the Federal Water Pollution Control Administration (beginning in the summer of 1968 through winter of 1969) indicated a significant loss of plants and reduced populations of animals due to warm water effluent. Approximately 100 acres of nearshore seagrasses died from the elevated temperatures and salinity. These investigations led to the discontinuation of warm water effluent into the bay. Turtle grass was successfully replanted after the heated water flow ceased. Instead of releasing the water to Biscayne Bay, the plant was permitted to build 168 miles (270.4 km) of cooling canals, removing 6,800 acres of mangroves. The cooling canals' impact on area wetlands is permanent, but now serves as a nursery ground for the American crocodile (*Crocodylus acutus*). Their successful nesting and reproduction sites on canal banks may have contributed to the downlisting from endangered to threatened in 2007 by the U.S. Fish and Wildlife Service (USFWS).

### *Biscayne Bay Aquatic Preserve Designation Rules*

Unlike the other 42 aquatic preserves around the state whose management authorities are cited in Paragraph 18-20 Florida Administrative Code (F.A.C.), Biscayne Bay Aquatic Preserve's boundaries, management authorities, and rules are established in Chapter 18-18 F.A.C., according to its designation in Chapter 258.397, Florida Statutes (F.S.). The legislative intent for establishing this aquatic preserve is stated in Chapter 258.36, F.S. There are two distinct differences between the BBAP Rule 18-18 F.A.C. and 18-20 F.A.C.: first, both privately and publicly held submerged lands are included within the boundaries of BBAP; those aquatic preserves managed under Chapter 18-20 exclude privately held uplands from within their boundaries. Second, Chapter 18-18 includes an "extreme hardship" provision that ensures that most new leases for submerged lands require that applicants meet the criteria listed under paragraph Chapter 18-18.006(3)(b). Through these provisions, BBAP was established for the purpose of preserving and enhancing Biscayne Bay and all natural waterways tidally connected to the bay in an essentially natural condition so that its biological and aesthetic values may endure for the enjoyment of future generations.




*Map 2 | Biscayne Bay Aquatic Preserve boundary*

## 3.2 / General Description

### *International*/*National*/*State*/*Regional Significance*

Biscayne Bay is a unique waterbody along the Southeast Atlantic shoreline of the United States It was not formed by the drowning of a river but instead, Biscayne Bay formed between 5,000 and 2,400 years ago as sea level rose to fill the depression between ridges. BBAP shares the bay with Biscayne National Park (BNP), a division of the National Park Service. President Lyndon B. Johnson authorized BNP as a National Monument in 1968. Its boundaries were expanded in 1974, then again in 1980, when it became a National Park and thereby decreased BBAP's total acreage as the state of Florida donated submerged lands to Biscayne National Park (F.S.§ 258.397). BBAP provides habitat for a wide variety of juvenile and adult marine species as well as several of Florida's imperiled species, including the Florida manatee (*Trichechus manatus latirostris*), the smalltooth sawfish (*Pristis pectinata*), and the American crocodile (*Crocodylus acutus*).

According to the Florida Natural Areas Inventory (FNAI) (2010), an organization that documents Florida's significant natural resources, BBAP is located within a significant region of natural areas and habitat for several rare species. Other vital resources of the preserve include expansive hard bottom communities with corals, sponges, and algae; mangrove-lined shores; and a variety of animal species throughout the length of the bay. Seagrass beds within the aquatic preserve are prime feeding areas for wading birds and a valuable nursery area for juvenile fish and invertebrates, including many of commercial interest. The rich fauna found in Biscayne Bay results from the diverse habitats found in the bay. In addition to recreational fish species such as snook (*Centropomus spp*.), the mangrove and estuarine areas support a diverse collection of other fishes that serve as links in food webs which benefit the entire Biscayne Bay ecosystem. BBAP offers water-oriented recreational opportunities to the metropolitan areas of southeast Florida and the Keys. The mission of BBAP is to protect the natural resources for the benefit of future generations while allowing traditional uses. Typical impacts to resources result from dredging, propeller scarring, and grounding damage to seagrass and hard bottom communities, but there are others. Extended boat anchoring shades seagrasses. Fishing and extraction of marine life can introduce marine debris (fishing line, traps, etc.), chemicals, and human interference that all impact water quality and have reduced species abundance over the past 100 years. Secondary impacts include suspended sediments and increased turbidity, wildlife disruption and water pollution due to upland development and pollution in the form of litter, stormwater run-off, and septic leachate. Through education and outreach activities, BBAP strives to enlist the public in ownership of the bay and its resources in order to protect one of south Florida's greatest resources. BBAP lies downstream of major urban and agricultural developments and constantly faces new environmental challenges. Despite these challenges, BBAP remains resilient.

### *Location*/*Boundaries*

BBAP can be described as three distinctive sections: Northern, Central, and Southern. Northern Biscayne Bay begins where the Oleta River empties into Biscayne Bay and ends at the Rickenbacker Causeway, south of the mouth of the Miami River. Within the northern section, several basins vary in residence time (how long the water resides in a basin as a result of natural and human made tidal and meteorological changes), salinity, depths, adjacent hydrological alterations, shoreline type, and resources present. For ease of reference, BBAP staff named the basins in the northern part of the bay that are separated by causeways according to the causeway on the southernly border of that basin. The northernmost basin, located between Sunny Isles Beach and Broad Causeways, is regarded as the Broad Basin; the JFK Basin lies between Broad and John F. Kennedy (79th Street) Causeways; the Tuttle Basin lies between the John F. Kennedy and Julia Tuttle Causeways; and the Rickenbacker Basin lies between the Julia Tuttle and Rickenbacker Causeways. According to Cantillo et al. (2000), the area in Biscayne Bay with the largest number of organisms occurs in northern Biscayne Bay, within the Tuttle Basin. The three sampling sites in this basin alone totaled over 5,500 organisms, which is more than 2.5 times the amount in Southern Biscayne Bay, although slightly less diverse. This area is described as having "high water clarity, large diversity, and great productivity of organisms." BBAP's headquarters are located in the northern section of the bay at the Biscayne Bay Environmental Center (BBEC), with direct access to the bay. The BBEC was established in 2001 in a former Florida Marine Patrol office located in

the Pelican Harbor Marina and County Park on the 79th Street/John F. Kennedy Causeway in the city of Miami.

The area south of the Rickenbacker Causeway is regarded as Central Biscayne Bay. In this area, the bay experiences open flushing with the ocean at its easternmost edge and is not separated by any causeways or bridges. The central section extends south from the Rickenbacker Causeway to where BBAP meets the northern boundary of BNP and extends three nautical miles east of the southern tip of Key Biscayne. BBAP comprises 64,607submerged acres and are separated by 172,000 acres of BNP in the central section of Biscayne Bay. Here, the central section opens to the Atlantic Ocean at Bear Cut and south of Cape Florida, through the Safety Valve region of the bay. Several canal projects serve as tributaries to the central section of BBAP, including the Coral Gables Waterway and Snapper Creek Canal. Matheson Hammock, the Charles Deering Estate, Bill Baggs Cape Florida State Park (CFSP), and The Barnacle Historic State Park are just some of the many parks that are located on the shorelines of BBAP's central section and serve as public recreational access to BBAP. Matheson Hammock Park, as well as R. Hardy Matheson Preserve, are adjacent to Snapper Creek. The Snapper Creek and C-100 Canals also empty into the bay, bypassing former mangrove creeks and reducing the natural flow of freshwater to the bay. In order to restore natural conditions, the Biscayne Bay Coastal Wetlands Project of the Comprehensive Everglades Restoration Plan ([CERP], 2005) developed the Deering Estate Flow-way. The Phase I element redistributes excess freshwater runoff, diverting it away from existing canal discharges and spreading it out as sheetflow into BBAP. Sheetflow is another name for overland flow of water, where water moves over the land and not in distinct channels, historically common in the Kissimmee-Okeechobee-Everglades watershed. There is a portion of submerged lands along Blackpoint Marina, which includes a part of the C-1 canal, located south of the Deering Estate in the central part of Biscayne Bay that is included within the BBAP boundaries despite being mostly surrounded by Biscayne National Park.

The southern section of BBAP begins at the southern boundary of BNP at Cutter Bank, just south of the Arsenicker Keys and Broad Creek. The southern section terminates where Little Card Sound connects to Barnes Sound under the Card Sound Road Bridge. This section includes both Card Sound and Little Card Sound but is referred to as Card Sound. Adjacent to and north of Card Sound is the Turkey Point Nuclear Plant owned by FPL. The Turkey Point peninsula and the immediate area surrounding the peninsula (outside the privately held uplands owned by FPL) are contained within BBAP's boundaries. Like Blackpoint Marina and Turkey Point, there are several other portions of submerged lands included within BBAP's boundaries, such as Homestead Bayfront Park Marina and the C-103 canal. These parcels that are largely surrounded by BNP are included within the BBAP boundaries according to the language of the national park's establishment order and the BBAP statute that established the state aquatic preserve, Chapter 258.397 F.S. Lands that fall outside the national park boundaries but inside Biscayne Bay are considered part of the BBAP. BBAP overlaps with the Florida Keys National Marine Sanctuary in the Card Sound region. The Florida Keys National Marine Sanctuary includes Barnes Sound and is adjacent to Everglades National Park. Barnes Sound lies south of Card Sound and, like Dumfoundling Bay, is now connected by water flow under a causeway with the AIWW dredged at its deepest depth. The John Pennekamp Coral Reef State Park overlaps with BBAP in a small area of acreage in between and around the group of islands in the northeast corner of Card Sound. John Pennekamp Coral Reef State Park overlaps with BBAP in a small area of acreage in between and around the group of islands in the northeast corner of Card Sound. Several inlets or cuts grant access to the open ocean from Biscayne Bay. The northern and central sections of BBAP connect to the Atlantic Ocean through one natural and three human-made inlets between barrier islands. Inlets in the northern section of BBAP include Baker's Haulover Inlet, Government Cut, and Norris Cut. Both Government Cut and Baker's Haulover Inlets were dredged through the Miami Beach barrier island, twenty years apart. Baker's Haulover Inlet improved water quality in the northern part of the bay by increasing circulation within Biscayne Bay from the Atlantic Ocean. Hurricanes that occurred in 1835 and 1838 opened Narrows Cut, referred to later by Commodore Ralph Munroe as Narres Cut, and known today as Norris Cut. Norris Cut separates Virginia Key from what is now Fisher Island at the south end of Miami Beach. Bear Cut lies between Virginia Key and Key Biscayne. An inlet in the northern bay was mapped in the 1770s and has since been closed by a hurricane or gradual silting. The Biscayne Channel and a series of connections, called the Safety

Valve, lie within BNP's northeastern section and cycle freely with BBAP waters. Angelfish Creek connects Card Sound to the ocean along with other smaller creeks such as Sands Cut, Caesar's Creek, and Broad Creek south of Old Rhodes Key and at the northern end of Key Largo. Experienced local boaters use boats that can clear the shallow cuts in these creeks without running aground. Little Card Sound connects to Card Sound at high tide and through dredging from AIWW development. Inlets through the barrier islands to the east of the bay were created by hurricanes and by dredging.

## 3.3 / Resource Description

***Surrounding Population Data and Future Projected Changes***

Florida is the third most populous state in the U.S., and its population of 21.5 million residents is exceeded only by California and Texas. Southeast Florida's population has grown significantly over the past 50 years, increasing by 464% from 1970 to 2020, and it is expected to grow another 23% through 2045, by adding another two million residents. Florida has one of the longest coastlines in the nation, approximately 15 million Floridians (76.5 percent of the state´s population) live in coastal communities (NOAA Office for Coastal Management, 2021). Biscayne Bay extends the length of MDC. MDC continues to be Florida's most populous county in 2020, with 2,832,794 residents and approximately 13.1 percent of Florida's population (University of Florida Bureau of Economic and Business Research, 2020). From 2010- 2020, it ranked as one of the counties with the highest population change with an increase of 336,337 residents (University of Florida Bureau of Economic and Business Research, 2020). Monroe County, adjacent to Card Sound and Southern Biscayne Bay, is home to an estimated 77,823 residents in 2020 (Florida Legislature's Office of Economic and Demographic Research, 2020). However, visitors from other areas make use of the county, known as a premier fishing and scuba diving destination.

Southeast Florida's warm climate and expansive coasts contribute greatly to its popularity, for both residents and visitors. Tourism is among the most important economic drivers for the state, and it plays an essential role in the region's economy. In 2023, Florida's tourism industry achieved significant success, welcoming approximately 135 million visitors. The state generated around $101.4 billion in economic impact from tourism (Visit Florida, 2024). The surge in visitor numbers and economic activity was partly driven by increased international and domestic travel, alongside Florida's appeal as a key tourist destination. Miami-Dade County recorded 24.2 million visitors in 2019, and the county's beaches and climate were the main draw for both overnight visitors and day trippers (Greater Miami Convention and Visitors Bureau, 2020).

Rapid population growth and development in Southeast Florida contribute to impacts on natural resources. Loss of habitat due to human encroachment has affected many species, including those of commercial and recreational importance. Shortages in the groundwater supply from the Biscayne Aquifer, caused by expanding infrastructure development, saltwater intrusion, and groundwater contamination, stress natural systems throughout the region. Due to its shallow depth, the aquifer is highly permeable to contamination from saltwater, pesticides, fertilizers, and runoff from stormwater, landfills, and septic systems all negatively affecting water quality. This is a major concern since the Biscayne Aquifer is the principal source of water for Miami-Dade, Broward, and Palm Beach counties providing drinking water for over three million people (Miller, 1990). The Florida Keys are also reliant on water from the Biscayne Aquifer that is transported from the mainland via pipeline (Miller, 1990).

There are many recreational and commercial in-water activities for residents and visitors to enjoy such as boating, water skiing, jet skiing, hang gliding, swimming, windsurfing, snorkeling, scuba diving, and fishing. However, recreational activities can sometimes contribute to negative anthropogenic impacts on the ecosystem. The growing population in MDC combined with large numbers of tourists visiting every year places increasing pressure and demands on the environment (Yongquist, 2013).

*Table 1 | Population estimates for bayfront cities in Miami-Dade County (US Census Data, 2024).*

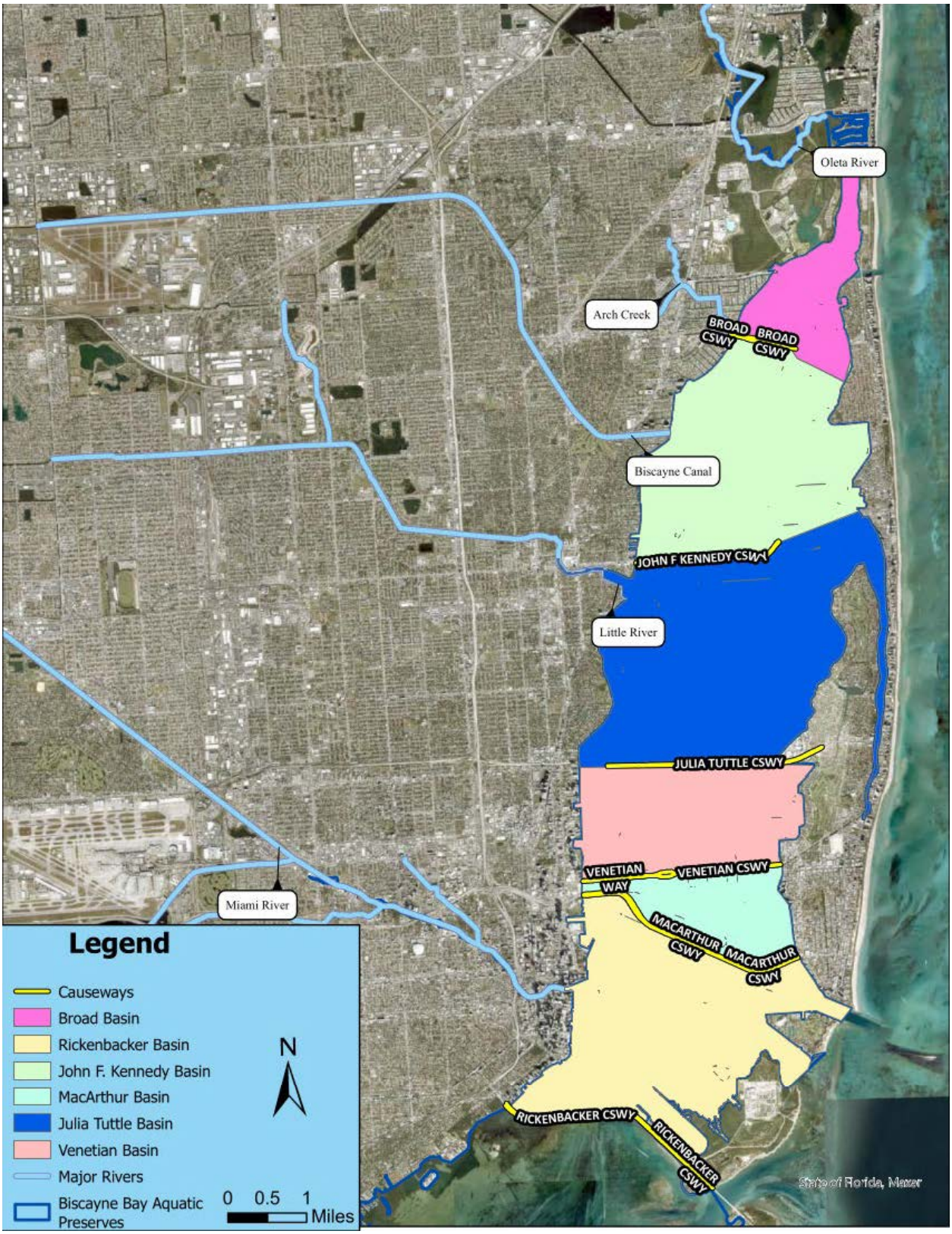
| City Name | 2010 (US Census) | 2020 (US Census) | 2024 (est.) | Total Change (2010-2024) |
|---|---|---|---|---|
| Bal Harbor | 2,513 | 2,721 | 3,010 | 497 |
| Bay Harbor Island | 5,628 | 5,922 | 5,793 | 165 |
| Coral Gables | 46,780 | 49,248 | 50,813 | 4,033 |
| Cutler Bay | 40,286 | 45,425 | 45,026 | 4,740 |
| Homestead | 60,512 | 80,737 | 84,014 | 23,502 |
| Indian Creek Village | 86 | 86 | 89 | 3 |
| Key Biscayne | 12,344 | 14,809 | 14,603 | 2,259 |
| Miami Beach | 87,779 | 82,890 | 83,230 | -4,549 |
| Miami | 399,457 | 442,241 | 467,171 | 67,714 |
| Miami Shores | 10,493 | 10,567 | 11,553 | 1,060 |
| North Bay Village | 7,137 | 18,159 | 7,977 | 840 |
| North Miami | 58,786 | 60,191 | 59,955 | 1,169 |
| North Miami Beach | 41,523 | 43,676 | 43,575 | 2,052 |
| Palmetto Bay | 23,410 | 24,439 | 25,091 | 1,681 |
| Sunny Isles Beach | 20,832 | 22,342 | 22,788 | 1,956 |
| Surfside | 5,744 | 5,689 | 5,401 | -343 |
| Key Largo (Monroe County) | 10,433 | 12,447 | * | * |

In 2023, the South Florida Water Management District (SFWMD), Hazen and Sawyer Environmental Engineers & Scientists published an update to the Biscayne Bay Economic Study to compile Biscayne Bay's recreational usage and economic contribution to the community. The economic output from bay was approximately $64 billion, (Hazen & Sawyer, 2023). This project estimated economic, commercial, and recreational uses of Biscayne Bay and the Miami River. Miami-Dade County's economy is highly dependent on tourism, which relies heavily on the use of Biscayne Bay. With increased visitors using the bay, the likelihood increases that resources will be damaged through incidents such as manatee vessel collisions, increased pollution, and seagrass scarring. It is integral that BBAP staff adapts management to these evolving threats. The recreational vessel fleet in southeast Florida (Broward, Martin, Miami-Dade, and Palm Beach counties) has grown substantially, to nearly 180,000 vessels by 2023 (Florida Department of Highway Safety and Motor Vehicles [FLHSMV], n.d.). While commercial fishing and vessels have declined in the region the recreational fleet has continued to grow leading to increasing physical impacts on nearby ecosystems.

BBAP previously offered educational opportunities such as the Florida Master Naturalist Courses. These courses are designed by the University of Florida and help participants learn about bay area habitats and species through forums and coursework. This course aims to promote awareness, understanding, and respect of Florida's natural world among Florida's citizens and visitors (UF/IFAS, n.d.). BBAP staff have created other educational opportunities for citizens, including the Junior Biologist kids' educational day camps and the Green Below the Blue: Marine Plant Identification classes to promote stewardship of the bay's natural environments and educate communities of all ages on BBAP's species. BBAP will continue education and outreach programs to increase awareness and appreciation of Biscayne Bay and encourage stewardship of the bay's resources.

### *Topography and Geomorphology*

Biscayne Bay, Card Sound, and Little Card Sound were formed three to five thousand years ago as sea level rose. These water bodies are located between mainland MDC and Monroe County and the barrier islands that separate the bay from the Atlantic Ocean. According to USGS Report 90-4108, geomorphological features have significantly controlled the environment, drainage, and ultimately, the land use in MDC. The Atlantic Coastal Ridge forms the highest ground in the county; it is 2 to 10 miles in width and is a natural barrier to drainage of the interior part of the watershed, except where it is breached by shallow sloughs or rivers. The Everglades are by far the largest feature and, before development, were wet most years and least subject to seasonal flooding. Drainage was slow and generally to the south and southwest, channeled behind the higher coastal ridge. The Everglades form a natural trough in north-central, central, and southwestern MDC. Elevations range from about 9 ft above sea level in the northwestern corner to about three ft above sea level in southwestern Dade County, except for tree islands or hammocks, which may be a few feet higher than the surrounding land. Most of the eastern part of the Everglades within MDC is now used for agriculture, rock quarrying, or urban development. Drainage from eastern MDC into BBAP is primarily controlled by the system of canals, levees, and control structures as part of the Central and South Florida Flood Control Program. Southeast of the Atlantic Coastal Ridge are mangroves and coastal glades which were historically low-lying wetlands that were developed into urban and agricultural areas. The northern and central sections of BBAP are more urbanized, compared with less development and increased agriculture in the southern section. Geomorphology is a science that deals with the relief features of the earth. BBAP has unique geomorphology due to the dredging and filling that have altered Biscayne Bay indefinitely. The first dredging projects were completed in the late 1800s to provide access via the bay to the mainland for deep draft vessels. The AIWW, Port of Miami, and Port of Miami River dredging projects led to the creation of spoil islands throughout the bay, by pumping dredged material behind bulkheads for port facilities, residential developments, and parks. The onset of the Great Depression in the late 1920s stopped most of the island building within Biscayne Bay, but islands were also created to allow causeways to connect barrier islands to the mainland. The first of seven causeways in the northern part of the bay was the wooden Collins Bridge built in 1913; it was rebuilt to connect spoil islands then renamed the Venetian Causeway in 1925. The Collins Causeway was built in 1918 and renamed the MacArthur Causeway in 1942 and includes the 86-acre Watson Island. This was followed by the 79th Street/John F. Kennedy Causeway in 1928, which was widened in 1938. The Rickenbacker Causeway replaced ferries to Virginia Key and Key Biscayne in 1943. The Broad Causeway opened in 1951, with a bridge replacement plan intended to fulfill new safety standards and limit traffic set to begin in 2024. The replacement plan does not detail further damage to the seafloor, but additional dredging around an expanded portion of the bridge may be required. The Julia Tuttle Causeway in 1961. Port Boulevard was built to Dodge and Lummus islands in the 1960s. These causeways create the artificial basins that are useful for discussing the bay and its resources.




*Map 3 | Northern Biscayne Bay basins and associated tributaries*

### *Geology*

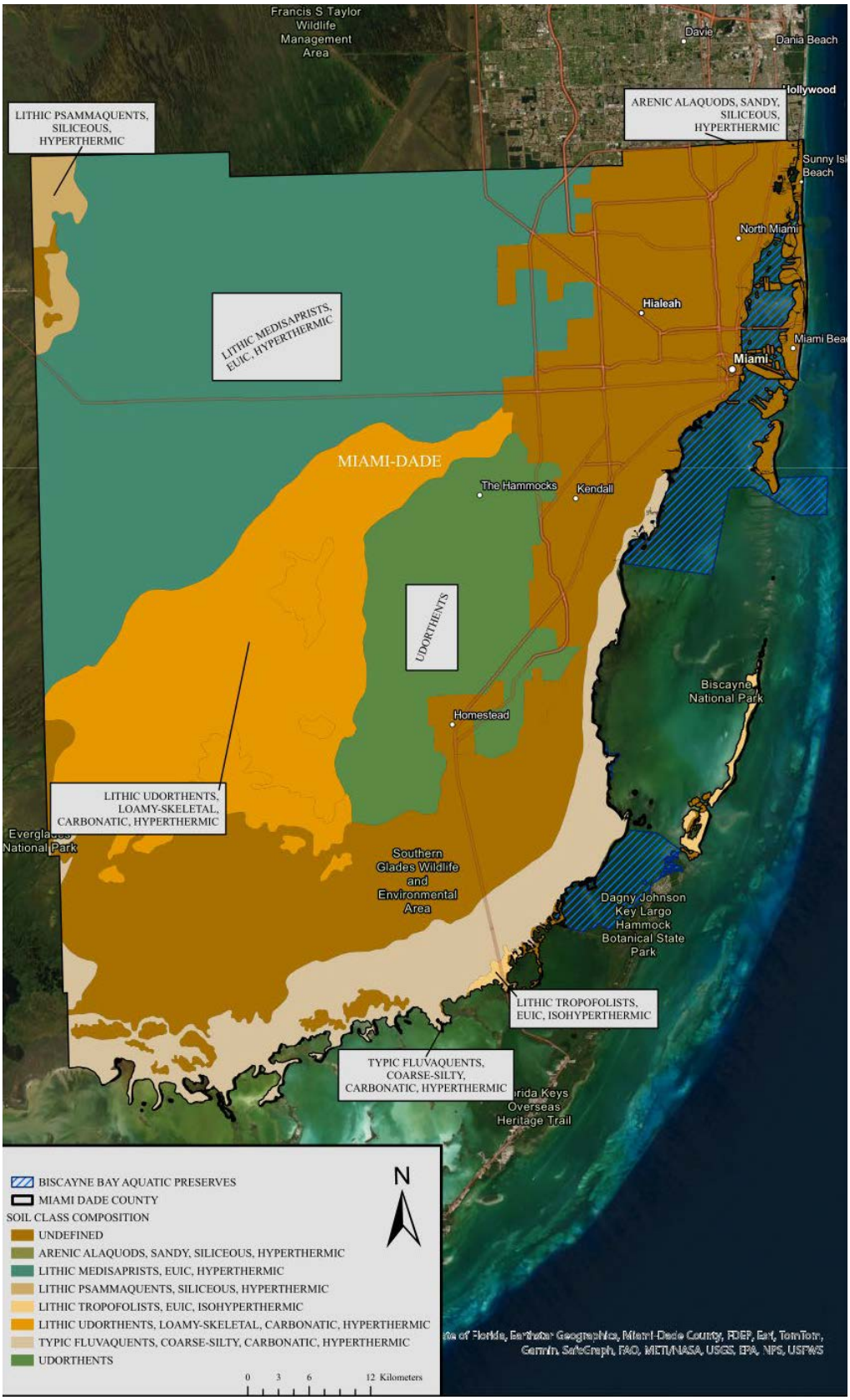
The geology of southeastern Florida is characterized by the shallow surficial water (occurring near the surface) of the Biscayne aquifer system and the deeper Floridan aquifer. Groundwater discharge flows into Biscayne Bay and provides a salinity regime that has allowed flora and fauna in various life stages to find a home. The flow originates at the Biscayne Aquifer, which is part of the surficial aquifer system. The Biscayne Aquifer is regarded as shallow and highly permeable, made up of porous limestone. The creation of the Biscayne Aquifer dates back to between the Pliocene era (5.3 to 2.6 million years ago) and the Pleistocene epoch (2.6 million to 11,700 years ago). This aquifer is known for its hydrogeologic properties (how groundwater is distributed and moves through soil and rocks). The Biscayne Aquifer runs less than 30 feet (9.1 meters) below sea level and is comprised of the Pamlico Sand, Miami Oolite (limestone), Anastasia Formation, Key Largo Limestone, and Fort Thompson Formation from the Pleistocene age, and a contiguous highly permeable bed of the Tamiami Formation of the Pliocene Epoch (Scott et al., 2001). Since permeability and porosity of the limestone are highly variable in the aquifer, groundwater flow is therefore difficult to predict.

The Atlantic Coastal Ridge separates the Everglades from the Atlantic Ocean and Biscayne Bay and is made of oolitic limestone (spheres of calcium carbonate). This ridge follows the bay's western shore and reaches elevations of 20 feet (6.1 meters) above sea level in northern MDC to the northwest portion of the Card Sound. It was formed chemically during times when sea level rise was higher and extends east two miles (3.2 km) to the western shore of Biscayne Bay in its northern and central sections. Holocene sediments border the southwestern shore of Card Sound. The barrier islands of Card Sound and the Florida Keys were once submerged coral reefs, representing the calcareous remains that accumulated to form a highly porous rock formation called Key Largo Limestone (Florida Department of Natural Resource Management, 1991). In geology, calcareous formations refer to those that contain or are formed from a high proportion of calcium carbonate. The islands in northern and central BBAP (Miami Beach and Key Biscayne) have quartz and sand deposits on top of the limestone. Sands originate in the Appalachian Mountains and are carried southward along the coast by what is called the longshore drift. Smaller amounts of this sand are transported further south to the barrier islands within BNP or Card Sound, where coral limestone is exposed. A carbonate platform underlies Florida, and carbonate sediments are predominant in BBAP. Due to chemical processes with the rock, phosphorus is a limiting nutrient (the nutrient that is less available in the water column) in the bay (Graves et al.,2005).

Biscayne Bay has eleven identified sedimentary environments, including rocky bottoms, dredged rocky bottoms, sandy bottoms, quartz sands, barrier island sands, skeletal carbonate sands, muddy bottoms, barren mud bottoms, carbonate mud, spoil margins, and mangrove soils. The Biscayne Bay Surface Water Improvement Management Plan reported that carbonate and sandy mud bottoms are found throughout the middle and eastern portions of the northern and central bay (Alleman et al., 1995). Card Sound has distinctive sediment gradients from north to south. Northern Card Sound is influenced by the northern section of the bay and contains quartzous sands, while the southernmost section of Little Card Sound contains calcarenite sands, which are also known as dune limestone formations (Early and Goodell, 1968). Storm sedimentation plays a major role in reworking and redistributing the sediments within Card Sound. Sediment cores taken in the central and southern sections of the bay provide clues to the Bay's geologic past. Paleosalinity is the study of the amount of salt in the bay in the past as measured in the sediment cores. Foraminifera are a class of microscopic, shelled protists (single-celled organisms) found in sediment cores that can be used as bioindicators of coastal pollution and can also indicate past salinity conditions (Carnahan, 2005). Bioindicators are species that are used to represent the presence of pollutants or indicate the overall health of the area.

### *Soils*

The soils in Biscayne Aquatic Preserve consist mostly of rock, sand, marl and muck.




*Map 4 | Soils adjacent to Biscayne Bay Aquatic Preserve*

### *Hydrology and Watershed*

The hydrology of southeast Florida is unique in its dynamic interaction between surface water and groundwater. Hydrology in the region is driven by flat topography, highly variable rainfall (can be highly variable), rainfall-generated run-off, groundwater recharge and discharge, and evapotranspiration. Before dense urbanization, South Florida's hydrologic system covered an area of about four million acres (Obeysekera et al.,2010) BBAP is downstream of the Kissimmee Okeechobee Everglades watershed that originally covered four million acres as estimated by the USGS South Florida Information Access. In Central Florida, the Kissimmee Chain of Lakes form the headwaters and flow through the Kissimmee River to Lake Okeechobee, then south to the Everglades basin with its sheetflow in the "River of Grass". The Everglades wetlands were historically connected to Biscayne Bay by water flow through rivers and creeks that carved through the Atlantic Coastal Ridge. During the late 1800s, coinciding with steady human population increase, water management began to alter the natural slow- moving sheet flow of water through the construction of canals, ditches, dams, and levees. This has been to accommodate agricultural use, oil and gas exploration, and urban development. The Central and South Florida Flood Control Project was initially created in response to disastrous flooding events that occurred in 1926, 1928, and 1947. The expertly engineered water management system constructed by the U.S. Army Corps of Engineers, successfully prevented flooding, while at the same time significantly altering the region's ecology by decreasing the areal extent of the Everglades by half, reducing flow of freshwater to Florida and Biscayne Bay (Obeysekera et al. 2010). The ridge parallels the coast along the northern part of MDC and is farther inland along the southern section. The transverse glades were low-lying areas that cut through the Atlantic Coastal Ridge and allowed surface water to flow into Biscayne Bay.

Today, most of these waterways have been dredged into canals over the past 100 years. The Central and South Florida Flood Control Project, beginning in 1948, was initiated to manage water flow. Meant to prevent flooding in low-lying developed areas and to prevent saltwater intrusion, the canals and levees throughout south Florida effectively route surface water towards Biscayne Bay. These water control structures have lowered the water table, reducing available groundwater to Biscayne Bay, while water is in demand for use in newly developed urban areas and for agricultural irrigation.

The Central and South Florida Flood Control Project was disbanded when SFWMD was formed in the late 1940s, following several hurricanes that caused extensive flooding for months in South Florida. Today, water flow is managed by SFWMD through a complex system of canals and levees; the boundaries of SFWMD include the Kissimmee Okeechobee Everglades watershed and cover 16 counties. The South Florida water management system, alternatively known as the Central and Southern Florida Project (C&SF Project), is a vast engineering project, immensely engineered including approximately 2,200 miles of canals, 2,100 miles of levee/berms, and 1,400 water control structures (operated under regulation schedules and operational rules) (SFWMD, 2020a). This system was designed to provide flood protection, maintain adequate groundwater elevations in agricultural and urban areas for water supply needs of a growing population, and inhibit potential saltwater intrusion into the freshwater aquifers (Strowd et al. 2017). Constructed wetlands called the Everglades Storm Water Treatment Areas and flow equalization basins for water quality treatment are also components of the South Florida water management system. In addition to surface waters, several groundwater aquifers contribute to the hydrology in South Florida, most responding quickly to rainfall and surface water conditions. The agencies responsible for the region's water resource management, the SFWMD and the Corps, have divided the area into four main planning regions: the Kissimmee Basin, Upper East Coast, Lower West Coast, and the Lower East Coast. Each region is supplied water for various uses from their associated aquifers. The primary source of groundwater for the Lower East Coast is the Biscayne Aquifer and for the Upper East Coast, the Surficial Aquifer (SFWMD, 2020a). Water Conservation Areas have also been constructed to support urban water supply and protect fish and wildlife in the Everglades.

Although the channelization of natural tributaries and creation of canals severely altered the location, timing and delivery of freshwater to the Bay, morphologically these freshwater streams still exist in a modified form even if almost none continue to flow naturally. Natural streams include Snake Creek (Oleta River lying downstream), Arch Creek (comprising two creeks), Little River, the Miami River, and Black Creek. Unlike northern streams, these do not originate at a headwater channel but instead emanate from

transverse glades (wet prairies) that cross the main limestone ridge and deliver water from the Everglades to the coastal streams. These have all been channelized at some point upstream to accomplish the initial task of draining the Everglades, thus eliminating natural sheetflow to Biscayne Bay. The channelized streams currently provide flood protection to the residential areas. Some springs are spring-fed streams, meaning the source of freshwater comes from underground sources. Snapper Creek and Cutler Creek were the most well-known of these; however, there were several others south of Coconut Grove between the areas known today as Matheson Hammock and the Cutler Power Plant where the rocky outcrop is close to the bay. Arch Creek was a spring-fed stream in the geological past before the arch collapsed (known as the “natural bridge”). These spring-fed streams no longer flow naturally due to canal construction or by regional lowering of the water table. Seepage streams that existed along the coastal plain of southern Biscayne Bay do not have names but were very common. A seepage stream will normally have one or more tree islands at its headwaters where the water seeps into the surface water as the tree island’s rocky core provided a direct connection to the surface aquifer and facilitated a way for water to escape from under the marl blanket. It is possible that higher groundwater levels could reactivate many of these as few have been directly modified, although mangroves now grow at the downstream end of these streams, often at higher elevations, which would prevent flow from reaching the bay. Also, there are still several functioning springs with most of the known examples in the coastline area in or near the Charles Deering Estate. The presence of at least four of these, as well as the presence of oysters in Biscayne Bay north of the Cutler Power Plant, suggest there may be others. Historical examples include the one photographed by Commodore Ralph Middleton Munroe in the late 1890s, located as much as 200 meters offshore of Coconut Grove (P. Harlem, personal communication, August 10, 2010).

Repeated observations of widgeon grass (*Ruppia maritima*) at some sites in northern Biscayne Bay by BBAP staff suggests that the bay may still be receiving enough freshwater inputs to allow species diversification. This could be from groundwater inputs, or from stormwater outfalls from surrounding urban areas. Stormwater can also bring nutrients and pollutants, such as metals and hydrocarbons, to the bay. Most of the other waterways were deepened and straightened, but the major tributary to Biscayne Bay, the Miami River, was extended across the Everglades to Lake Okeechobee through the creation of the Miami Canal. In the central part of the bay, freshwater once flowed through numerous creeks into Biscayne Bay.

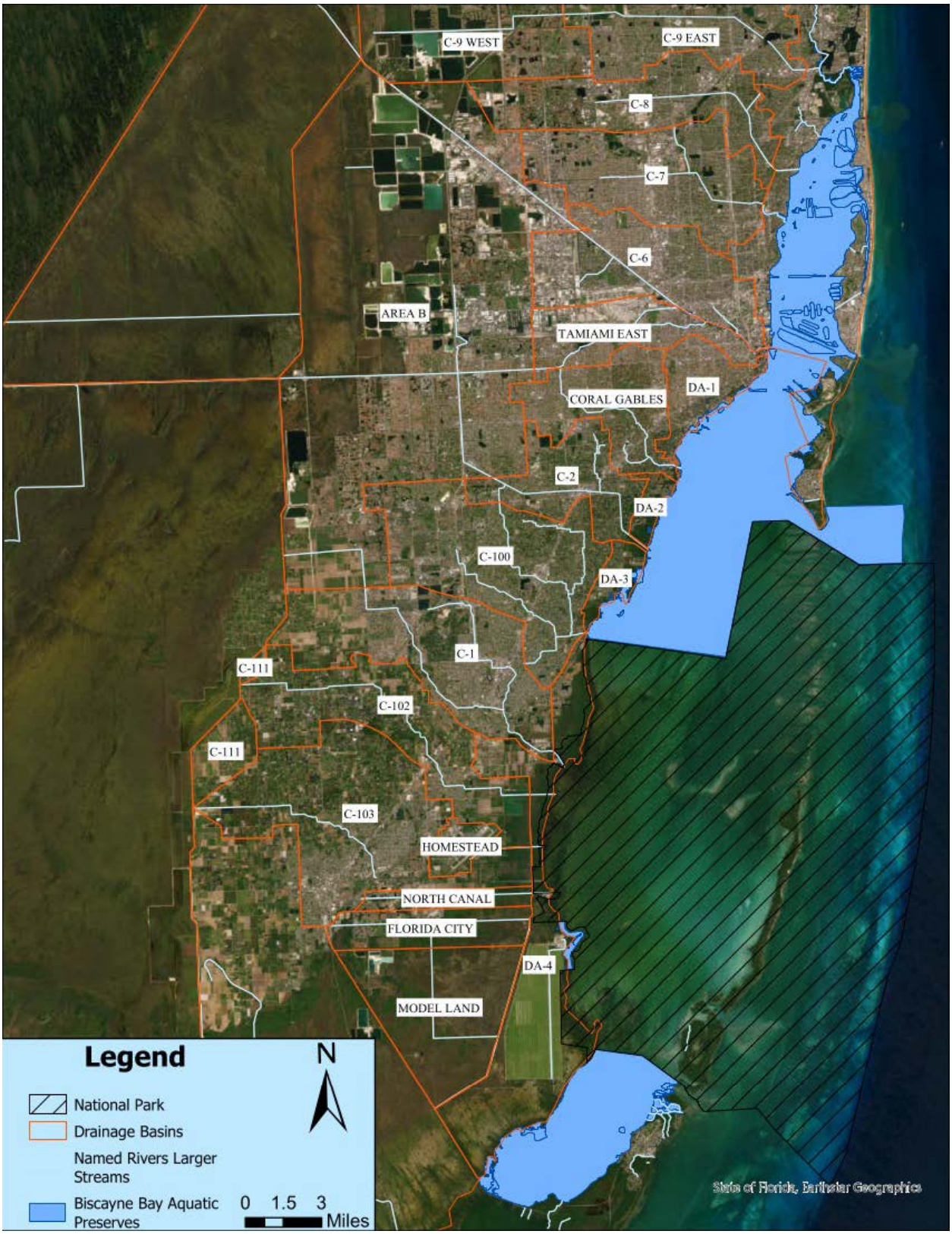
Today, water flows through canals, such as the Coral Gables Waterway, created by drilling through oolitic limestone with 20’ (6.1 m) walls. It is now a destination for canoeists and kayakers who paddle through the ridge. The Coral Gables Waterway was the dream of developer George Merrick. Merrick’s master plan for Coral Gables in the 1920s created the “Forty Miles of Waterfront” acreage for new residents upon which to build. Snapper Creek is now the main channel for freshwater, bypassing surrounding natural creeks, in Matheson Hammock and the R. Hardy Matheson Preserve. Water flows through canals in a pulsed discharge, creating highly variable salinity conditions at the mouths of 19 major canals. Two examples of projects designed to increase freshwater flow include a mitigation project with FPL where culverts breach the L-31 E levee and a CERP project with the C-111 Spreader Canal. To further encourage freshwater returning into the natural hydrological system, SFWMD and CERP have worked to restore the Cutler Drain within the Deering Estate as part of the Biscayne Bay Coastal Wetlands project. Phase I of Southeast Florida CERP projects includes the Deering Estate Flow-way, begun in May 2010. This project redistributes excess freshwater runoff, directing it away from existing canal discharges and spreading it out as sheetflow prior to discharge into the aquatic preserve. The results have been impressive including healthier coastal wetlands, recreation of natural sheetflow of water through the land into the bay, and rehydration of previous spring heads in the bay. Improved freshwater flow and salinity distribution near the shore has also help re-establish productive nursery habitat for shrimp and shellfish.

Intensive development of the Kissimmee Okeechobee Everglades watershed has altered the natural cycle of freshwater inflows to the bay. Northern and Central Biscayne Bay are influenced by urban development associated with rapid population growth of MDC. In addition to these freshwater inputs

from pulsed discharges, saltwater flows into the bay through natural inlets, dredged inlets, and through the Safety Valve region of Biscayne Bay. The opening of inlets and further channelization has contributed to the Bay's transition from a freshwater estuary to a marine lagoon. In the north Baker's Haulover Inlet and Government Cut were dredged to allow access for vessels in the early 1900s (Chardon, 1978). Through these inlets, saltwater mixing has increased in what was a typically less saline environment in the northern part of the bay. The central section of the Bay adjacent to the Safety Valves is more of a marine system that is heavily influenced by daily tidal flushing, due to the forks in the Miami River at NW 27th Avenue, where rapids once existed. Southern Biscayne Bay has been heavily influenced by drainage from the Everglades, which was altered by canals and agricultural activities. The Card Sound region was traditionally fed by sheetflow through freshwater wetlands and is greatly affected by the reduction in freshwater. Barnes Sound, located to the south of Card Sound and like Dumfoundling Bay in the north, is now connected by water flow under a causeway with the AIWW dredged at its deepest depth. These wetlands suffer from saltwater intrusion. Card Sound's freshwater wetlands have been significantly reduced as indicated by increased salinity levels during periods of low rainfall and mangrove establishment along the shoreline. Restoration and preservation of Biscayne Bay requires scientific research, engineering accomplishments. A better understanding of the relationships between the hydrological system, the bay ecosystem and of the natural versus human-induced variability of the ecosystem will be needed in order to continue large-scale projects for reservoirs, pump stations, and stormwater treatment areas (SFWMD, 2010; SFWMD 2021).

The Biscayne Aquifer is a surficial aquifer (water-bearing rock) underlying MDC and Broward County. It is the sole source supply for the drinking water of both counties' residents and is recharged by rainwater. As surface water flow has changed, groundwater recharge has lessened. Groundwater flow into the bay is now studied by scientists from National Oceanic Atmospheric Association (NOAA) and U.S. Geological Survey (USGS). The Biscayne Aquifer is vulnerable to saltwater intrusion that occurs when salt water enters the freshwater aquifer beneath the land. Saltwater intrusion has occurred in the Biscayne aquifer for a variety of reasons, including: the drainage of freshwater by canals, the seepage of saltwater into the aquifer by canals, the over-pumping of freshwater by wells, and the lowering of the water table by drought. The deeper Floridan Aquifer is 1,200 to 1,600 feet (365.8 to 487.7 meters) below the Biscayne Aquifer. Unlike potable freshwater found in the Biscayne Aquifer, the Floridan's water is brackish. The aquifer is used for deep well injections of treated wastewater because it is separated from the Biscayne Aquifer by a confining layer. It also receives surface waters from aquifer storage and recovery wells. This water will be available for use during droughts to fulfill the dry-season needs of urban, agricultural, and industrial water users, with less impact to surface waters or shallow water-supply wells. Non-potable water, stored in Aquifer Storage and Recovery wells, has many applications such as irrigation, fire department tank storage, and pressure-washing streets.

The waters of Florida's aquatic preserves are among those designated as Outstanding Florida Waters (OFW) and are considered worthy of special protection because of their natural attributes. DEP provides the highest protection to these waters and no degradation of water quality, other than that allowed by rule, is to be permitted. State and national parks, along with aquatic preserves and select other water bodies, were granted this protection through designation in the F.A.C. The intent of OFW designation is to prevent activities requiring a permit from DEP from lowering existing water quality. Section 403.061(27), F.S., created additional protection for water bodies that are classified as OFW. BBAP became an OFW in 1982. With some exceptions, DEP must not allow a lowering of existing or ambient water quality through pollutant discharges directly to the OFW. In addition, indirect discharges cannot significantly degrade the waterbody (Florida Department of Environmental Protection [DEP], n.d.). The Monroe County waters of the BBAP (Card Sound and Little Card Sound) are classified as Class II waters for shellfish propagation or harvesting [Rule 62-302.300, F.A.C.]. The MDC waters of BBAP are Class III waters for recreation, fishing, and wildlife protection. These classifications establish standards for pollutants according to the water bodies' classification. On August 5, 2010, the definition of Class III waters was amended to subdivide those that are "predominantly fresh" or "predominantly marine." BBAP waters in MDC are regarded as "predominantly marine" as the chloride concentration in surface waters is greater than or equal to 1500 milligrams per liter.




*Map 5 | Biscayne Bay Aquatic Preserve drainage basins*

### *Climate*

BBAP is described as having a hot-humid tropical monsoon climate according to the Köppen-Geiger Climate Map (Peel et. al, 2007). Tropical climate zones are defined as having no monthly average temperatures below 64.4 degrees (°) Fahrenheit (F) (18° Celsius (C)) (US Department of Commerce, 2019). The warm waters of the Gulf Stream largely influence the tropical climate. NOAA (2021) reports constant high temperatures with average monthly temperatures varying from 84.2 °F (29.0 °C) in July to 67.3 °F (19.6 °C) in January. Monthly highs vary from 92.6 (33.7°C) in July to 77.2 °F (25.1°C) in January and monthly lows vary from 57.3 °F (14.1°C) in January to 75.8 °F (24.3°C) in July. Past temperatures have been recorded below freezing on occasion during winter months anywhere from early December to early March (U.S. Department of Commerce, 2020). The winter of 2022 was especially cold, with temperatures dropping into the 30-40 degree Fahrenheit range during the month of January (NOAA, n.d.-c.). Temperatures near Card Sound are slightly lower than in Miami during the summer months due to the cooling influence of prevailing winds (Florida Department of Natural Resources, 1995).

Southern Florida has two seasons that are determined by precipitation rather than the weather. The dry season begins in December and lasts until May and the rainy season usually begins in May or June and ends in late November. Rainfall in south Florida averages 53 inches per year with approximately 64% of the precipitation occurring over the five-month wet season (SFWMD, 2020a). The rainy season coincides with the Atlantic hurricane season. Peak hurricane months are September and October, which coincide with the warmest ocean temperatures. South Florida's exposed location makes it more vulnerable to hurricanes and tropical storms than any other area of equal size in the U.S. (Schomer & Drew, 1982). Florida has suffered more than $450 billion in hurricane-related damage from the early 1900s until 2009, and this value will continue to increase given that hurricanes are getting more powerful and more frequent (Malmstadt et al., 2009). Since then, Florida has been hit by six major hurricanes- Irma, Michael, Ian, Idalia, Helene, and Milton several tropical storms and other hurricanes, Financial damages from Hurricane Ian alone (the costliest of the storms, although damage assessments are ongoing for recent storms in Florida) was more than $100B (Neely, 2023). 2020 was the most active hurricane season in the Atlantic Basin since records began in 1851. The 2020 hurricane season yielded 30 tropical storms, 13 of which became hurricanes, and six which achieved major hurricane status (Category 3 or higher on the Saffir-Simpson Hurricane Wind Scale). The thirty-year average (1991-2020) for hurricane seasons results in an average of 14 storms, of which seven become hurricanes and three major hurricanes (NOAA National Hurricane Center and Central Pacific Hurricane Center, 2024). Fluctuations in climate can also occur over a few months or seasons as a result of the El Niño Southern Oscillation phase (generally refers to El Niño and La Niña weather patterns). This phenomenon can result in climatic fluctuations in temperature and/or precipitation for a period of time.

NOAA's National Centers for Environmental Information collected climate data at various points around Biscayne Bay Aquatic Preserve (BBAP) from 1971 to 2023. The average annual rainfall in BBAP has historically ranged from 58.3 inches in the northern areas of the bay to 38.94 inches in Card Sound. In recent years, including 2023, Miami-Dade County has experienced annual rainfall variations averaging between 64 and 70 inches, influenced by changing climate patterns (NOAA, 2023). For the northern and central sections, June typically remains the wettest month, averaging up to 11.67 inches of rain, while December is the driest at 1.39 inches. In the southern areas, September is still the wettest with about 5.45 inches, while February records the least, at around 1.51 inches. Average wind speeds continue to measure around 9.2 mph (14.81 kph) in Miami and 11.2 mph (18.2 kph) in the Florida Keys, consistent with past observations (Florida State University, 2012).

Higher winds occur during summer thunderstorms (38-73 mph/61.6-117.5 kph), hurricanes (74 – 123 mph/119.1-198 kph), and major hurricanes (>124 mph/200 kph) and may be expected from June until November. Winds less than 6 mph (10 kph) occur about 25 percent of the time and winds less than 11.5 mph (18.5 kph) occur 60% of the time. Water temperatures within BBAP average 66.2°F (19°C) in winter and 87°F (30.5°C) in summer. Cold fronts may cause 18°F (7.77°C) drops in temperatures within a few days (Bader, Roessler & Thorhaug, 1971). The average Sea Surface Temperature of Biscayne Bay is 79.88°F (26.6 °C) with a slight temperature gradient. Cooler waters occur in the north and warmer waters

occur in the southern estuaries. Highly varied air temperatures, such as extreme warm and cold events, have a significant impact on Biscayne Bay's Sea Surface Temperature (Johns & Kelble, 2012).

***Natural Communities***

In 1990, FNAI and Florida's DEP developed the natural community classification system and guide, which were updated in 2010 and used in this plan. The guide includes 45 community types that are defined by a variety of factors, such as vegetation structure and composition, hydrology, fire regime, topography, and soil type. The community types are named for the most characteristic biological or physical 24 features (FNAI & DEP, 2010). FNAI also assigns Global (G) and State (S) ranks to each natural community and species that FNAI tracks. These ranks reflect the status of the natural community or species worldwide (G) and in Florida (S). Lower numbers reflect a higher degree of imperilment (e.g., G1 represents the most imperiled natural communities worldwide, S1 represents the most imperiled natural communities in Florida).

Data used to produce a map delineating the major natural community types found within and adjacent to BBAP were developed by FNAI using multiple sources that include, but were not limited to: SFWMD, Florida Land Use Cover and Forms Classifications System, digital ortho-photographs, black and white aerial photographs (1:25,000 scale), FNAI data on Element Occurrences, Potential Natural Areas and Areas of Conservation Interest. The data used are not always based on comprehensive or site-specific field surveys, and additional fieldwork was not conducted for purposes of producing this map (FNAI & DEP, 2010).

The marine natural communities within and adjacent to BBAP occur in subtidal, intertidal, and supratidal zones of the sea, landward where seawater becomes diluted with freshwater inflow from the land. Marine communities represent the majority of the area within BBAP. Significant marine communities within BBAP include seagrass beds, algal beds, consolidated marine substrate, unconsolidated marine substrate, composite marine substrate, corals, limited shoreline of salt marsh, mangrove swamps, and some ruderal or dredged areas. The subsequent sections below include community types located within BBAP. The information below is primarily site-specific comments, but full descriptions of these natural communities can be found in 2010 FNAI Field Guide to the Natural Communities of Florida.

Many of the original coastal natural communities of south Florida were destroyed in 1950 by urban development. Since the 1960s, many of these communities have been threatened and outcompeted by invasive species such as the Australian pine (*Casuarina equisetifolia*). In many areas of south Florida this continued until 1992, when Hurricane Andrew destroyed much of the Australian pine forest (DEP, 2012). Before the population explosion and mass development of the 20th century, MDC held large tracts of coastal mangroves, freshwater marshes, seagrass beds, and coral reefs. Over the past hundred years, however mangroves and marshes have been significantly reduced and drained to make way for waterfront development. Only remnants of these ecosystems outside the major parks are left and many small fragments are surrounded by other land uses, particularly urban. The fragmented habitats that remain are not secure and are functionally islands of habitat. Those fragments are likely to support fewer species, and those species are placed at a higher risk of extinction (MacArthur & Wilson, 1967). Continued population growth, development, and invasion of exotic species degrade remaining areas (Alonso & Heinen, 2011).

The distinction between the marine and estuarine natural communities is often subtle, and the natural community types found under these two community categories have the same descriptions. For these reasons they have been grouped together – subtidal, intertidal and supratidal zones of the sea, landward to the point at which seawater becomes significantly diluted with freshwater inflow from the land.

**Consolidated Substrates**

Marine and estuarine consolidated substrates are mineral-based natural communities generally characterized as expansive, relatively open areas of subtidal, intertidal, and supratidal zones which lack dense populations of sessile plant and animal species. Consolidated substrates are solidified rock or shell conglomerates and include coquina, limerock, or relic reef materials (FNAI & DEP, 2010). In parts of the north and south bay, there are areas of exposed hardbottom which are densely populated with

sessile organisms and which are in fact areas of high diversity.

Consolidated substrate communities are easily destroyed through siltation or placement of fill, and deliberate removal by actions, such as blasting or non-deliberate destruction by forces, such as vehicular traffic. Another type of disturbance involves the accumulation of toxic levels of heavy metals, oils, and pesticides in consolidated substrates. Significant amounts of these components in the sediments will kill the infauna, thereby eliminating a food source for certain fishes, birds and other organisms. A film of pollutants engulfing consolidated substrates can render these areas unsuitable for colonization by marine and estuarine flora and fauna.

Such problems occur in major port cities, such as Miami, in areas where there is heavy industrial development, and along major shipping channels where oil spills are likely to occur. Hardbottom and algal beds are important benthic areas that transition into seagrass beds. Hardbottom areas also known as consolidated marine sediments contain solitary stony corals, gorgonians, and sponges (FNAI & DEP, 2010). Although there are few of these hardbottom natural environments in the bay they need to be further studied to better understand their condition and resilience.

**Unconsolidated Substrates**

Marine and estuarine unconsolidated substrates are mineral-based natural communities generally characterized as expansive, relatively open areas of subtidal, intertidal, and supratidal zones which lack dense populations of sessile plant and animal species. Unconsolidated substrates are unsolidified material and include coralgal, marl, mud, mud/sand, sand or shell. This community may support a large population of infaunal organisms, as well as a variety of transient planktonic and pelagic organisms (e.g., tube worms, sand dollars, mollusks, isopods, amphipods, burrowing shrimp, and an assortment of crabs). In general, marine and estuarine unconsolidated substrate communities are the most widespread communities in the world. Unconsolidated sediments in BBAP originate from calcium carbonate depositions of plants or animals (e.g., coralgal, marl and shell substrates). Unconsolidated substrate communities are associated with and often transition into beach dunes, salt marshes, mangrove swamps, seagrass beds, coral reefs, mollusk reefs, worm reefs, octocoral beds, sponge beds, and algal beds. Unconsolidated substrate communities that are composed chiefly of sand (e.g., sand beaches) are the most important recreational areas in Florida, attracting millions of residents and tourists annually. This community is resilient and may recover from recreational disturbances. Generally, these areas are easily re-colonized either by the same organisms or a series of organisms that eventually results in the community returning to its original state once the disturbance has ceased. Epifaunal and infaunal species include hundreds of species of marine worms, crustaceans, fish, and mollusks. Although sometimes regarded as “Barren” on maps or descriptions of the bay bottom, unconsolidated substrates are never devoid of life in Biscayne Bay (FNAI & DEP, 2010). These areas are in good condition.

**Composite Substrate**

Marine and estuarine composite substrates consist of a combination of natural communities, such as “beds" of algae and seagrasses or areas with small patches of consolidated and unconsolidated bottom with or without sessile floral and faunal populations. Composite substrates may be dominated by any combination of marine and estuarine sessile flora or fauna, or mineral substrate type. Typical combinations of plants, animals and substrates representing composite substrates include soft and stony corals with sponges on a hard bottom such as a limerock outcrop; algae and seagrasses scattered over a sand bottom; and patch reefs throughout a coral-algal bottom. Any of the remaining marine and estuarine natural communities can transition into composite substrate communities. Although composite substrates can occur in any marine or estuarine area in Florida, some combinations are common while others are extremely rare. Combinations of consolidated and unconsolidated substrate components offer the greatest opportunity for diversity and should be high priority areas for protection. However, very few biodiversity studies have been conducted researching this community’s significance. Management requirements are negligible, providing the composite community is adequately protected. Protection efforts will vary slightly based on components of the composite substrate community. Generally, degradation of physical and chemical water quality parameters should be prevented, as well as mechanical disturbance from anchoring, dredging, trawling and similar

activities.

**Coral**

Two main classes of Cnidaria contribute to reef building in Biscayne Bay Aquatic Preserve (BBAP): Hydrozoa, which includes fast-growing, temperature-tolerant reef corals, and Anthozoa, divided into Octocorallia (e.g., soft corals, sea fans) and Zoantharia (e.g., stony corals like Scleractinians). Although BBAP doesn't have continuous reef formations, stony corals like lesser starlet coral and various species in Card Sound form smaller colonies. The preserve's reefs face significant threats from pollution, diseases, and increased tourism, which affect coral health and biodiversity (Roessler et al., 2002; Walton et al., 2018).

Florida's coral reefs, such as the Southeast Florida Reef Tract, play critical roles in coastal protection and biodiversity but have experienced severe declines due to bleaching and diseases like stony coral tissue loss disease. Major reef-building species, including Acropora and Orbicella corals, have become endangered, impacting reef complexity. Monitoring efforts, such as Southeast Florida Coral Reef Evaluation and Monitoring Project, have been essential in tracking coral health and adapting management strategies to address urbanization and water quality concerns (Lirman et al., 2019; Johnson, 2019).

**Mollusk Reef**

Marine and estuarine mollusk reefs are faunal-based communities typically characterized as expansive concentrations of sessile mollusks occurring in intertidal and subtidal zones to depths of about 40 feet (12.2 meters). In Florida, the most developed mollusk reefs are generally restricted to estuarine areas and are dominated by the American oyster (*Crassostrea virginica*). Mollusk reefs that are exposed during low tides (e.g., coon oysters) are frequented by a multitude of shorebirds, wading birds, raccoons, and other vertebrates. Mollusk reefs occupy a unique position among estuarine invertebrates and have been an important human food source since prehistoric times. They present a dynamic community of estuarine ecology, forming refugia, nursery grounds, and feeding areas for a myriad of other estuarine organisms (FNAI & DEP, 2010).

Mollusk reef is the rarest natural community in BBAP. American oysters are found attached to mangrove roots and structures built in the bay, including docks and pilings, but oyster reef formation is limited to upstream areas of the Oleta River likely due to increased salinity. Historically, Biscayne Bay was mostly estuarine, but because of low rainfall and reduced water flow the bay became hyper-saline. The life cycles of animals such as the American crocodile (*Crocodylus acutus*), oysters, silver perch (*Bidyanus bidyanus*), mojarras (*Gerreidae* spp.), mangroves, seagrasses, and mollusks are tightly coupled with salinity. Therefore, with increased salinity in the bay, these populations were significantly reduced. The Biscayne Bay Coastal Wetlands project was established to redistribute water to the bay in an attempt to reduce episodes of hyper-salinity in the bay and restore water quality conditions necessary for important estuarine fish and mollusk species (Lesneski, 2016).

**Octocoral Reef**

Marine and estuarine Octocoral beds, found in marine and estuarine environments, are soft coral communities primarily composed of gorgonians, sea fans, sea feathers, and sea plumes. These sessile invertebrates belong to the Class Anthozoa, Subclass Octocorallia, and are typically located in the subtidal zone, as they are highly sensitive to desiccation. Octocoral beds also support a diverse array of associated organisms such as sea anemones, sponges, mollusks, and various fish species. They require hard-bottom substrates (e.g., coquina or limerock) for attachment and thrive in warmer waters, mainly in the southern parts of Florida.

Factors influencing their distribution include temperature, substrate type, water movement, and human activities (Roessler et al., 2002; Bayer, 1961; Johnson, 2019). In Biscayne Bay, species like purple sea fans (*Pseudoptergorgia acerosa*) and sea plumes (*Pterogorgia* spp.) are found, particularly in the Card Sound region. Octocorals are now dominant reef organisms following the decline of stony corals. However, they face threats from storms, disease, and overgrowth (Fabricius & Alderslade, 2001;

Yoshioka, 1996). Despite their ecological importance, long-term monitoring of octocoral beds has been insufficient (Johnson, 2019).

**Sponge Bed**

Marine and estuarine sponge beds are soft faunal-based natural communities characterized as dense populations of sessile invertebrates of the phylum Porifera, Class Demospongiae. Sponges prefer the warmer waters of the southern portion of Florida, significantly limiting their distribution (FNAI & DEP, 2010).

Species such as the Caribbean spiny lobster (*Panulirus argus*), among other animals, rely on sponges for shelter. In 1992, persistent blooms of cyanobacteria caused the decimation of sponge communities in South Florida leading to a significant loss of habitat for the Caribbean spiny lobsters (Butler et al.,1995). Management considerations should include locating all true sponge beds within the state and providing protection for them from external degradation. Primary threats to sponge beds include siltation from beach nourishment or restoration projects, anchor damage by nautical crafts, trawling by commercial fishermen, collecting for tourist-oriented trade, and water pollution (particularly oil spills). Since 1981, when Biscayne National Park was established, sponging has been prohibited, in the entire bay. The sponge communities are strong in areas with hard substrate for attachment.

**Seagrass Beds**

Marine and estuarine seagrass beds are floral-based natural communities typically characterized by expansive stands of vascular plants. This community occurs in subtidal (rarely intertidal) zones, in clear, coastal waters where wave energy is moderate. Seagrasses are not true grasses. The three most common species of seagrass in Florida are turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), and shoal grass (*Halodule wrightii*). Nearly pure stands of any one of these species can occur, but mixed stands are also common. Species of Halophila such as paddle grass (*Halophila decipiens*) may be intermingled with the other seagrasses, but species of this genus are considerably less common than turtle grass, manatee grass and shoal grass. Widgeon grass (*Ruppia maritima*) can also be found occurring with the previously listed seagrasses, although those species usually occur under high salinities, while widgeon grass occurs in areas of lower salinity.

Attached to the seagrass leaf blades are numerous species of epiphytic algae and invertebrates. Together, seagrasses and their epiphytes serve as important food sources for manatees, marine turtles, and many fish, including spotted sea trout (*Cynoscion nebulosus*), spot (*Leiostomus xanthurus*), and sheepshead (*Archosargus probatocephalus*). The dense seagrasses also serve as shelter or nursery grounds for many marine invertebrates, and fish such as gray snappers (Lutjanus griseus), mojarras (*Gerreidae spp.*), tarpon (*Megalops atlanticus*), bonefish (*Albula vulpes*), seahorses (*Hippocampus, spp.*), and Florida pompano (*Trachinotus carolinus*). Marine and estuarine seagrass beds occur most frequently on unconsolidated substrates of marl, muck or sand, although they may also occur on other unconsolidated substrates (FNAI & DEP, 2010). The dense blanket of leaf blades reduces the wave-energy on the bottom and promotes settling of suspended particulates. The dense roots and rhizomes of the seagrasses stabilize settled particles. Thus, marine and estuarine seagrass beds are generally areas of soil accumulation. One of the most prominent ecological functions of the seagrass beds is their capacity to stabilize and to modify the unconsolidated substrates in which they are rooted (Den Hartog & Phillips, 2001).

Tropical seagrass beds are among the most productive ecosystems in the world. Seagrasses have high levels of primary production due to their efficient uptake of nutrients, therefore, have the ability to maintain high rates of productivity in relatively low nutrient environments. Highest production rates occur in summer months. Seagrasses also release dissolved organic carbon into the water column, which is an important food source for microorganisms at the lowest levels of the food web (Kruczynski & Fletcher, 2012). Seagrass beds also act as blue carbon storage. Tremendous amounts of biomass and carbon are

*Photo 3 | This seagrass bed includes the three most common types of seagrass in Biscayne Bay - turtle grass, manatee grass, and shoal grass.*

stored below the substrate because seagrass roots can extend many meters below the substrate. This carbon can stay in place for hundreds of years in the root system if undisturbed, however, fragmented seagrass habitats have lower blue carbon storage (McLeod et al., 2011).

Seagrasses occur most frequently in areas with moderate current velocities, as opposed to either low or high velocities. Although marine and estuarine seagrass beds are most commonly submerged in shallow subtidal zones, they may be exposed for brief periods of time during extreme low tides. One of the more important factors influencing seagrass communities is the amount of solar radiation reaching the leaf blades. In general, the water must be fairly clear because turbidity blocks essential light necessary for photosynthesis. The rapid growth rate of seagrass under optimum conditions rivals that of most intensive agricultural practices, without human energy input. Marine and estuarine seagrass beds are often associated with and transition into unconsolidated substrate, coral reefs, mangrove swamps, and salt marshes, but may also be associated with any other marine and estuarine natural community (FNAI & DEP, 2010). In South Florida, there are five environmental factors that control the distribution of seagrasses: sediment, salinity, temperature, the amount of available nutrients, and light (Kruczynski & Fletcher, 2012).

Marine and estuarine seagrass beds are extremely vulnerable to human impacts. In the past 150-300 years, human activities have destroyed 65 percent of seagrass and wetland habitats (Lotze et al., 2006). Seagrass beds are often heavily impacted by increased boat traffic. Seagrass scars are often seen near shallow beds caused by groundings, anchors, and propellers (Lirman et al., 2019). Scarring can refer to either the activity of scarring or to a group of scars within a seagrass bed. Numerous activities can cause seagrass scarring, but most often they are made when a boat's propeller produces a long, narrow furrow devoid of seagrasses. Boats operating in shallow waters can cause severe scarring, and sometimes completely denuding seagrass beds throughout the state. Such gouges may require many years to become revegetated. The basin between 79th Street and the Julia Tuttle Causeway is one of the most severely scarred basins in MDC, despite its richness in biodiversity. Many have been destroyed through dredging and filling activities or have been damaged by sewage outfalls and industrial wastes. In these instances, the seagrass beds are either physically destroyed, or succumb as a result of decreased solar radiation resulting from increased water turbidity. Seagrass beds are also highly vulnerable to oil spills. Low concentrations of oil are known to greatly reduce the ability of seagrasses to photosynthesize.

When protected from disturbances, seagrasses have the ability to regenerate and recolonize areas; however, the best management is to preserve and protect marine and estuarine seagrass beds in their natural state. Lush seagrass beds form grassy undersea meadows throughout Biscayne Bay. There are six species of seagrasses found within BBAP. They are turtle grass, manatee grass, shoal grass, paddle

grass (*Halophila decipiens*), and star grass (*H. engelmannii*). In addition, a seagrass associate, widgeon grass, is also found within BBAP waters. It is not considered a true sea grass because it grows in waters that are either fresh or saline.

Seagrasses are direct and indirect food sources for the threatened Florida manatee and green sea turtle (*Chelonia mydas*), as well as numerous invertebrate species. Algal blooms in Biscayne Bay from 2006 to 2020 have caused shifts in the landscape from dense seagrass beds to macroalgae bare sediment (Santos et al., 2020).

Proposed management and restoration attempts should be aimed at channel marking, no-motor/ idle-speed only zones, increased enforcement, and education of the public and boaters on the importance of seagrass conservation areas. In the 1990s, researchers noticed that seagrasses were abundant in areas around channel markers and other pilings where birds were perched. That observation led to the development of a new restoration technique to help replenish damaged seagrass areas. Bird perches were installed in areas where seagrass beds were damaged to attract birds that defecate in the water. Nutrients from the bird feces increase the rate of growth of seagrasses and result in rapid plant colonization (Kruczynski & Fletcher, 2012).

**Algal Beds**

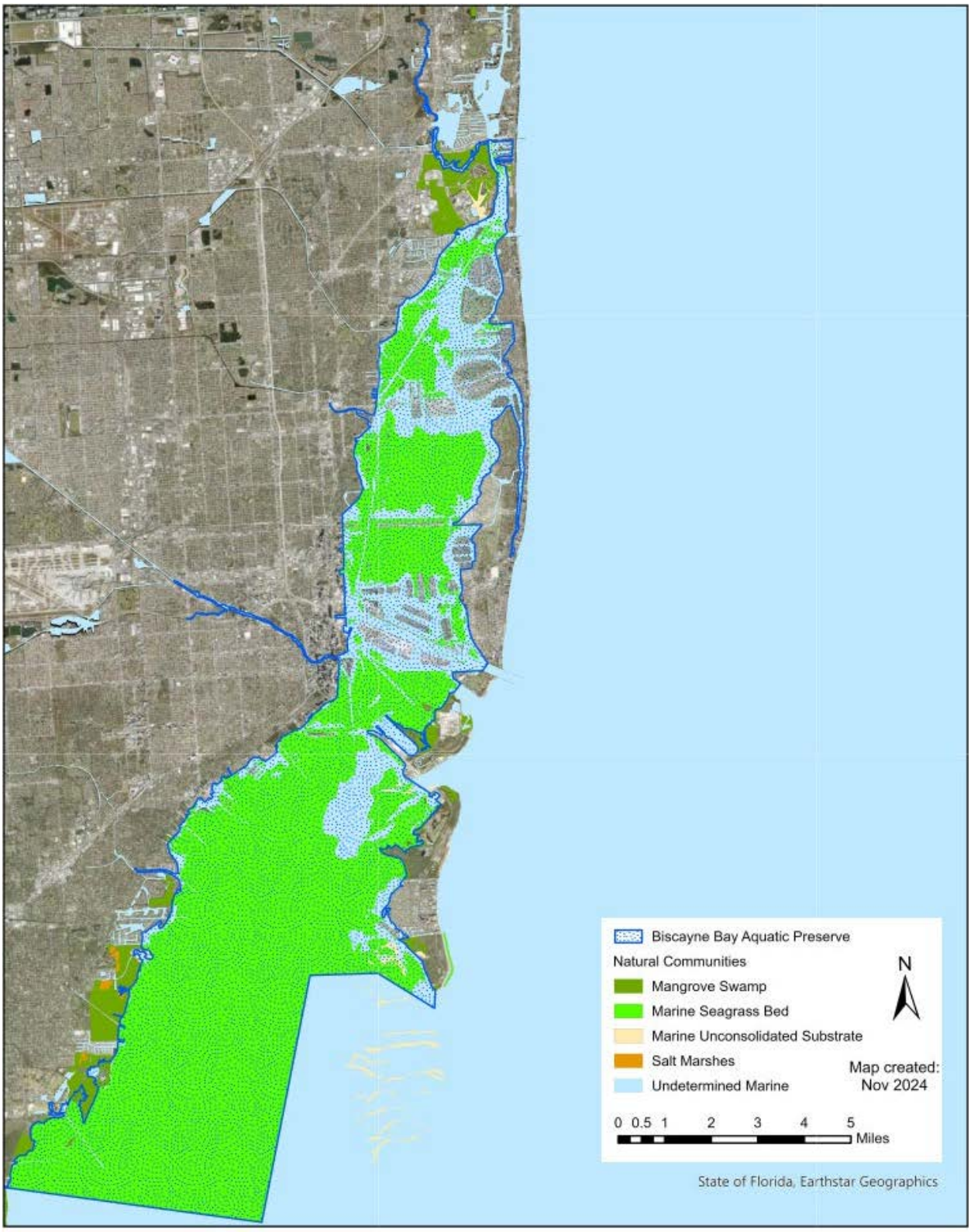
Marine and estuarine algal beds are natural communities composed of large populations of macro and microalgae, such as *Calothrix*, *Caulerpa*, *Dictyota*, and *Gracilaria*. These communities occur in subtidal, intertidal, and supratidal zones on both soft and hard bottom substrates. Algal beds often coexist with seagrasses, salt marshes, or mangrove swamps, transitioning between these communities. The fauna associated with algal beds varies depending on the substrate, with species similar to those found in octocoral or sponge beds on hard substrates, and additional infauna species on soft bottoms. Recent studies highlight the importance of algal beds for juvenile spiny lobsters (*Panulirus argus*), an economically significant species (FNAI & DEP, 2010).

Environmental factors like salinity and nutrient availability strongly influence algal bed distribution. Research in Biscayne Bay identified three macroalgal assemblages correlated with salinity: low-salinity areas dominated by *Chara hornemannii*, brackish areas by *Penicillus capitatus* and *Batophora oerstedii*, and high-salinity areas by *Halimeda incrassata* and *Anadyomene stellata* (Collado-Vides et al., 2011). Algal beds are also sensitive to nutrient inputs, particularly nitrogen, and are affected by human activities such as dredging, which can physically damage or bury these communities. Increased turbidity, pollution, and boat damage also threaten algal beds. This natural community is currently in fair condition and is underrepresented in management protections compared to seagrass beds, which are more directly protected by existing laws (FNAI & DEP, 2010).

**Salt Marsh**

Salt marshes are coastal herbaceous communities that occur in intertidal zones influenced by tides and seawater. These marshes are protected from large waves by features like barrier islands or estuaries. The vegetation often forms distinct zones dominated by specific species of grasses or rushes. The soils in salt marshes vary from deep, clay-rich mucks to silts and sands. Salt marshes are vital habitats for a variety of rare species, including the American crocodile (*Crocodylus acutus*) and several bird species such as the federally listed reddish egret (*Egretta rufescens*) and roseate spoonbill (*Platalea ajaja*). Other birds like the white ibis and little blue heron also frequent these habitats, and mammals such as certain rare species of saltgrass-loving mammals are found in the upper marsh.

In the Biscayne Bay area, salt marshes have largely diminished, with only remnants found in areas like the Deering Estate North Addition and Oleta River State Park, where they have been restored. The transition of Biscayne Bay from a freshwater estuary to a marine lagoon has been accelerated by saltwater intrusion, canal construction, and dredging. The wetlands near Card Sound have faced reduced productivity due to a lack of freshwater flow, but restoration efforts through the Comprehensive Everglades Restoration Plan (CERP), including the creation of spreader canals, aim to improve water flow and restore historical vegetation and sloughs in these areas (FNAI & DEP, 2010; CERP, 2020).




*Map 6 | Florida Natural Areas Inventory natural communities for north Biscayne Bay Aquatic Preserve*

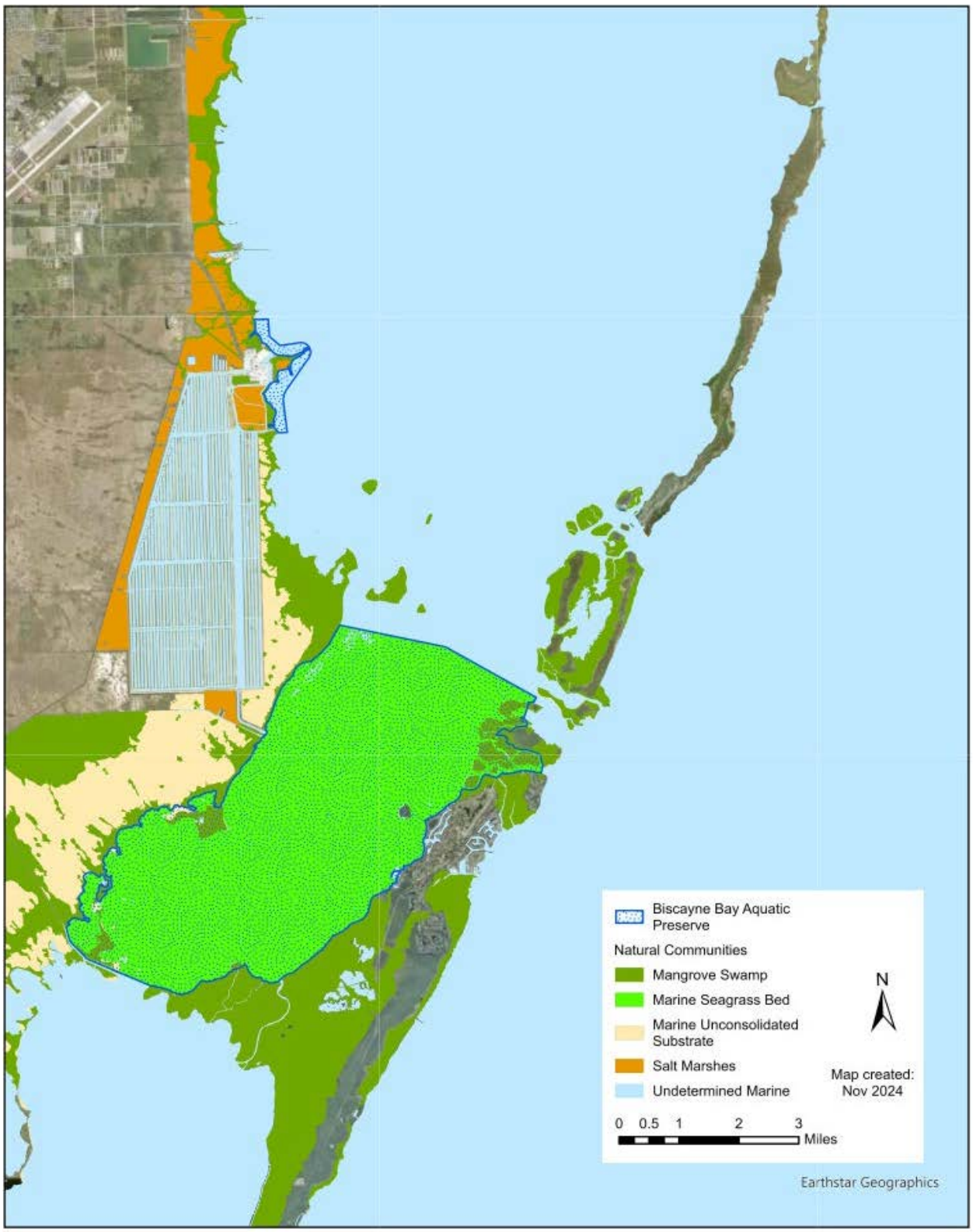
*Table 2 | Summary of Florida Natural Areas Inventory natural communities in Biscayne Bay Aquatic Preserve*

| FNAI Natural Community Type | # Acres | % of Area | Federal Rank | State Rank | Comments |
|---|---|---|---|---|---|
| Beach Dune | 5.5 | U | G3 | S2 | Active coastal dune with sand substrate; xeric; statewide; rare or no fire; marine influence; open herbaceous vegetation with no canopy; sea oats, railroad vine, bitter panicum, and/or mixed salt-spray tolerant grasses and herbs. |
| Coastal Berm | 0.8 | U | G3 | S2 | Old bar or storm debris with sand/shell substrate; xeric-mesic; southern peninsula and Keys; rare or no fire; marine influence; variable vegetation structure; mixed tropical herbs, shrubs, and trees. |
| Coastal Strand | U | U | G3 | S2 | Stabilized coastal dune with sand substrate; xeric; peninsula; rare fire; marine influence; primarily dense shrubs; saw palmetto in temperate coastal strand or seagrape and/or saw palmetto in tropical coastal strand. |
| Maritime Hammock | U | U | G3 | S2 | Stabilized coastal dune with sand substrate; xericmesic; statewide but rare in Panhandle and Keys; rare or no fire; marine influence; evergreen closed canopy; live oak, cabbage palm, red bay, red cedar in temperate maritime hammock; gumbo limbo, seagrape, and white or Spanish stopper in tropical maritime hammock. |

| | | | | | |
|---|---|---|---|---|---|
| Shell Mound | U | U | G2 | S2 | Small hill of shells deposited by Native Americans; mesic-xeric; statewide; rare or no fire; marine influence; closed canopy of mixed hardwoods; soapberry, snowberry, white stopper. |
| Consolidated Substrate | Ua | U | G3 | S3 | Composed primarily of nonliving compacted or coherent and relatively hard, naturally formed mass of mineral matter (e.g., coquina limerock and relic reefs); octocorals, sponges, stony corals, non-drift macrophytic algae, blue-green mat-forming algae and seagrasses sparse, if present. |
| Unconsolidated Substrate | U | U | G5 | S5 | Expansive subtidal, intertidal and supratidal area composed primarily of loose mineral matter (e.g., coral-algal, gravel, marl, mud, sand and shell); octocorals, sponges, stony corals, non-drift macrophytic algae, blue-green mat-forming algae and seagrasses sparse, if present. |
| Tidal flats (unconsolidated substrate subtype) | 163 | 0% | G5 | S5 | Tidal flats are a subtype of the unconsolidated substrate natural community. |
| Composite substrate | 7,967 | 12.3% | G3 | S3 | Expansive subtidal, intertidal, or supratidal area, occupied primarily by natural community elements from more than one natural community category (e.g., grass bed and algal bed species; octocoral and distributed occurrences. |

| | | | | | |
|---|---|---|---|---|---|
| Coral (composite substrate subtype) | U | U | G2 | S1 | BBAP does not have coral reefs, but has corals scattered in the bay as a subset of composite substrate. |
| Mollusk Reef | U | U | G3 | S3 | Substantial subtidal or intertidal area with relief from concentrations of sessile organisms of the Phylum Mollusca, Class Bivalvia (e.g., molluscs, oysters, & worm shells); octocorals, sponges, stony corals, macrophytic algae and seagrasses sparse, if present. |
| Octocoral Bed | U | U | G2 | S1 | Expansive subtidal area occupied primarily by living sessile organisms of the Class Anthozoa, Subclass Octocorallia (e.g., soft corals, horny corals, sea fans, sea whips, and sea pens); sponges, stony corals, non-drift macrophytic algae and seagrasses spares, if present |
| Sponge Bed | U | U | G2 | S2 | Expansive subtidal area occupied primarily by living sessile organisms of the Phylum Porifera (e.g., sheepswool sponge, Florida loggerhead sponge and branching candle sponge); statewide; octocorals, stony corals, nondrift macrophytic algae and seagrasses sparse, if present |
| Algal Bed | U | U | G3 | S2 | Expansive subtidal, intertidal or supratidal area, occupied primarily by attached thallophytic or mat-forming prokaryotic algae (e.g, halimeda, blue-green algae); octocorals, sponges, stony corals and seagrasses sparse, if present. |

| | | | | | |
|---|---|---|---|---|---|
| Seagrass Bed | 43,371 | 67.1% | G3 | S2 | Expansive subtidal or intertidal area, occupied primarily by rooted vascular macrophytes, (e.g., shoal grass, halophila, widgeon grass, manatee grass and turtle grass); may include various epiphytes and epifauna; octocorals, sponges, stony corals, and attached macrophytic algae sparse, if present. |
| Salt Marsh | 4 | 0% | G5 | S4 | Estuarine wetland on muck/sand/or limestone substrate; inundated with saltwater by daily tides; statewide; occasional or rare fire; treeless, dense herb layer with few shrubs; saltmarsh cordgrass, needle rush, saltgrass, saltwort, perennial glasswort, seaside oxeye. |
| Mangrove Swamp | 921 | 0% | G5 | S4 | Estuarine wetland on muck/sand/or limestone substrate; inundated with saltwater by daily tides; central peninsula and Keys; no fire; dominated by mangrove and mangrove associate species; red mangrove, black mangrove, white mangrove, buttonwood |




*Map 7 | Florida Natural Areas Inventory natural communities for south Biscayne Bay Aquatic Preserve*

**Mangrove Swamp**

Mangrove swamps are dense forests found along low-energy marine and estuarine shorelines, dominated by species like red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), white mangrove (*Laguncularia racemosa*), and buttonwood (*Conocarpus erectus*). These swamps feature varying densities and heights of mangroves, with different zones dominated by specific species based on tidal influence. The soils in mangrove swamps are anaerobic and water-saturated, and mangroves are equipped with specialized aerial roots (pneumatophores) to help them survive in waterlogged environments. Mangroves thrive in these ecosystems despite varying soil types and salinity levels (FNAI & DEP, 2010; Saha et al., 2011).

*Photo 4 | A mangrove island within Biscayne Bay Aquatic Preserve*

Mangrove swamps are significant for their carbon storage capabilities, often storing more carbon per unit area than terrestrial forests. They act as vital carbon sinks, sequestering carbon in their root systems for long periods (International Union of Concerned Scientists, 2017). Historically, these swamps have supported various species, including fish, crabs, and shrimp, that use mangrove roots for shelter and nutrition. Despite their benefits, large-scale deforestation around Biscayne Bay started in the late 19th century but has since been mitigated by restoration efforts. Following Hurricane Andrew in 1992, mangrove recovery has been ongoing, with red and black mangroves thriving along Biscayne Bay's edges. Restoration of mangroves is considered an ecologically sustainable and cost-effective solution for coastal protection (Sheng, 2017; Peters et al., 2015). These swamps are legally protected, though their range is limited due to urban development.

**Beach Dune**

Beach dune is a predominantly coastal herbaceous community of specialist salt-tolerant grasses and herbs on the vegetated upper beach and foredune (first dune above the beach). This community is usually built by sea oats (*Uniola paniculata*), a perennial rhizomatous grass. Sea oats´ stems trap sand grains blown off the beach, building up the dune by growing upward to keep pace with sand burial. Dunes form when wind speeds are sufficient (at least 10 - 12 mph) and individual grains of sand start to roll and bounce along the beach surface. Stems and leaves of coastal vegetation are critical for slowing wind speeds and causing sand to be deposited. (Williams, 2007). Other grasses that can tolerate sand burial are bitter panicgrass (*Panicum amarum*) and saltmeadow cordgrass (*Spartina patens*). Camphorweed (*Heterotheca subaxillaris*) often grows with sea oats where sand burial is absent or moderate. Seacoast marshelder (*Iva imbricata*), a succulent subshrub, is found at the seaward base of the foredune. These species may occupy the seaward face and crests of taller backdunes or storm overwash plains where the sand is not stabilized by vegetation. Several animal species are dependent on beach dunes for foraging or nesting, including beach mice, shorebirds, and sea turtles (FNAI & DEP, 2010). Beach dune communities can be found at Oleta River State Park and CFSP within BBAP. Within Oleta River State Park, the reclaimed narrow beach dune lies along the southeastern shoreline of a dredged lagoon. It was cleared of exotic vegetation and re-graded in 1988 to create a beach, swimming area, and coastal berm. Today, beach sunflower *(Helianthus debilis*), railroad vine (*Ipomoea pescaprae*), and necklace pod *(Sophora tomentosa)* colonize this area. At Bill Baggs Cape Florida State Park, the

beach dune community parallels the Atlantic Ocean and runs approximately 1.2 miles from the Cape Florida lighthouse to the northern park boundary. Most of this beach dune consisting of the wind-deposited foredune and the wave-deposited upper beach was restored in 1987, as part of a larger project for the Village of Key Biscayne. All beach dune locations within BBAP are threatened by foot traffic from high numbers of visitors each year. Signage and boardwalk areas may be needed in the future to reduce future impacts.

**Coastal Berm**

Coastal berm communities are found along low energy coastlines in south Florida and the Florida Keys. Coastal berm is a short forest or shrub thicket found on long narrow storm-deposited ridges of loose sediment formed by a mixture of coarse shell fragments, pieces of coralline algae, and other coastal debris. These ridges parallel the shore and may be found on the seaward or landward edges of mangroves or further inland depending on the height of the storm surge that formed them. They range in height from 1 to 10 feet (0.3 to 30.05 meters). Structure and composition of the vegetation is variable depending on height and time since the last storm event. Coastal berms share many of the same species with coastal strand communities and may be confused with maritime hammock communities (FNAI & DEP, 2010). The Florida prairie-clover (*Dalea carthagenensis*) is federally listed as endangered,and is dependent on this community. It is a woody shrub that averages six feet in height. This species was historically present in MDC conservation areas. The condition of this ecosystem is good.

**Coastal Strand**

Coastal strand is an evergreen shrub community growing on stabilized coastal dunes in the Florida Peninsula, often with a smooth canopy due to pruning by salt spray. It usually develops as a band between dunes dominated by sea oats (*Uniola paniculata*) along the immediate coast, and maritime hammock, scrub, or swamp communities further inland. On broad barrier islands or prograding (depositing sediments) coasts, it may also occur as patches of shrubs within a coastal grassland matrix. Along the Atlantic coast, species composition of coastal strand changes from north to south (FNAI & DEP, 2010). CFSP manages the coastal strand community within the park through restoration efforts and planting native trees, however, it still requires substantial restoration efforts (DEP, 2012). While this natural community is not documented within the aquatic preserve, but it is immediately adjacent and significantly impacts the aquatic preserve.

**Maritime Hammock**

Maritime hammock is a predominantly evergreen hardwood forest growing on stabilized coastal dunes lying at varying distances from the shore. Species composition changes from north to south with temperate species dominating from the Georgia border to Cape Canaveral and tropical species increasingly prevalent south of Cape Canaveral. Diverse tropical canopy species such as gumbo limbo, false mastic (*Sideroxylon foetidissimum*), strangler fig (*Ficus aurea*), seagrape (*Coccoloba uvifera*), poisonwood and Spanish stopper are often prevalent (DEP, 2012). The trees often deflect wind preventing hurricanes from uprooting them. Temperate and tropical maritime hammocks serve as crucial resting and foraging areas for migrating birds, such as the white-crowned pigeon (*Patagioenas leucocephala*), on their fall and spring migrations to and from the tropics (Cox, 1988). The uplands within the aquatic preserves are on publicly owned islands and include the imperiled maritime hammock that is natural or restored, rural areas with invasive exotics, and developed areas, such as marinas providing boat access. Although maritime hammock originally occurred in virtually continuous bands with coastal strand, it is now dissected into short strips by development and is rapidly disappearing (FNAI & DEP, 2010). Exotic plant species should be controlled in all the maritime hammock areas. In 1993, CFSP began restoration efforts of its maritime hammocks in two areas in the park, the largest restoration area following the park's western shoreline (DEP, 2012).

**Shell Mound**

Shell mounds are small hills, usually in coastal locations, composed entirely of shells (clams, oysters, whelks) discarded by generations of Native Americans, which support an assemblage of calciphilic

(prefers lime or alkaline soils) plant species. Archaeological evidence indicates they were occupied at the time Europeans first landed in Florida. Several are currently surrounded by mangroves, evidence that suggests they were built when sea levels were lower than today. A rich calcareous soil develops on the deposited shells which supports diverse hardwood forests on undisturbed mounds (FNAI & DEP, 2010). Biscayne Bay has numerous examples of shell mound communities that remain from the Tequesta tribe along the shoreline of the bay (See Appendix B.7). Cape Florida Midden, found in Bill Baggs Cape Florida State Park, is a black dirt and shell mound that was discovered by archaeologist Robert Carr in 1984. It is situated at the southern end of the park (DEP, 2012)

**Disturbed Lands**

Most islands within the Biscayne Bay Aquatic Preserve (BBAP) were formed from dredged material and are often categorized as maritime hammock, disturbed, or developed. These areas have experienced significant alteration from human activities and are frequently overtaken by invasive plant species like Australian pines and Brazilian pepper. Efforts by Miami-Dade County (MDC) have involved removing exotic vegetation and replanting native species on several northern islands.

Some natural islands, such as Sandspur Key and Bird Key, remain relatively undisturbed and are used for recreation and as bird rookeries, while others like Brickell Key and Belle Isle have been heavily developed. In the preserve's central region, Chicken Key continues to serve as a bird rookery, even after being restored following damage from Hurricane Andrew. In contrast, Fair Isle has been developed into Grove Isle, with a marina and residential buildings. In the southern part near Card Sound, several natural mangrove islands are managed by state park and wildlife refuge authorities.

Dredging since the 1920s created many spoil islands, which were neglected until the 1960s when MDC transformed some into parks, while others were restored to native habitat offering a unique atmosphere for recreation. This dredging created deep borrow pits in the bay that can be brought to grade to restore seagrass habitat.

***Native Species***

Fish diversity in Biscayne Bay remains a defining feature of its ecosystem. Species like bonefish (*Albula vulpes*), ladyfish (*Bodianus rufus*), and various grouper species continue to inhabit the bay, although some, such as the Nassau grouper (*Epinephelus striatus*), have faced significant declines. This decline is largely attributed to overfishing and habitat loss, leading to the species' listing as endangered. Biscayne Bay's role as a transitional zone between tropical and temperate marine environments is still evident, with seasonal shifts in species prevalence (Alleman et al., 1995). The bay’s invertebrate populations, including commercially important species like stone crabs (*Menippe mercenaria*), spiny lobsters (*Panulirus argus*), and shrimp, continue to thrive. The sustainability of stone crabs is supported by their regenerative claws, while Biscayne Bay's role as a nursery for juvenile spiny lobsters, particularly in the Cape Florida through Card Sound region, remains crucial (Ault et al., 1999).

Mangrove and seagrass habitats continue to serve vital ecological functions in Biscayne Bay. Mangroves, once dismissed by early settlers, are now recognized for their importance in protecting coastal areas, improving water quality, and providing shelter for species such as manatees and juvenile fish. Seagrass beds remain essential nursery grounds and food sources for various species, including spiny lobsters, sea turtles, and fish (MDC Department of Environmental Protection, 1995). The Atlantic bottlenose dolphin (*Tursiops truncatus*) population continues to flourish, with a genetically mixed resident group distributed across the bay, their home ranges influenced by factors such as habitat preferences and social dynamics (Litz et al., 2007). Additionally, Biscayne Bay hosts a variety of shark species, including bull sharks (*Carcharhinus leucas*) and nurse sharks (*Ginglymostoma cirratum*), which utilize the bay’s estuarine environment during different stages of their life cycles.

However, Biscayne Bay continues to face conservation challenges, including habitat degradation due to urban development and water pollution. Efforts to protect critical habitats have led to the establishment of sanctuary areas for species like manatees and marine turtles. Ongoing conservation efforts focus on mitigating human impacts, such as light pollution and boat traffic, to ensure the health of the bay's ecosystems. The expansion of protected areas and further action to address these challenges remain

essential for the continued health of Biscayne Bay (FNAI, 2010; MDC Department of Environmental Protection, 1995). These updates confirm that the description of Biscayne Bay's fauna and habitats remains accurate, with some changes in species' conservation statuses highlighting ongoing environmental concerns.

*Photo 5 | A sea star nestled on the bay bottom*

***Listed Species***

Listed species are those which are classified by organizations/ institutions, such as FNAI, USFWS, National Marine Fisheries Service, Florida Fish and Wildlife Conservation Commission (FWC) and the Florida Department of Agriculture and Consumer Services as endangered, threatened or species of special concern. Listed species include any species determined to be in danger of extinction or likely to become extinct within the foreseeable future throughout all or a significant portion of its range based upon the best scientific and commercial data available. State and/or federal agencies provide special protection and conservation measures to promote recovery of a listed species.

The Florida manatee, classified as both a state and federally threatened species, inhabits Biscayne Bay Aquatic Preserve (BBAP) and its surrounding tributaries and engineered canals. These manatees feed on mangrove and seagrass vegetation in shallow waters and require warm-water refuges during the winter. Critical areas like the Miami and Little Rivers serve as essential habitats, but rising boat traffic and expanding urban development pose significant threats. Conservation plans, including Manatee Protection Plans and community partnerships with the Marine Animal Rescue Society, aim to minimize risks and enhance manatee safety. Public workshops and training sessions further strengthen rescue and protection efforts.

BBAP is also crucial for several endangered sea turtle species: the hawksbill, Kemp's ridley, and leatherback turtles, along with the threatened loggerhead and green sea turtles. The turtles use the bay for feeding, resting, and nesting. Hatchlings depend on protective sargassum mats, while adults feed in

seagrass beds. Conservation challenges include shrimping practices and light pollution along nesting beaches. Turtle Excluder Devices (TEDs) developed by NOAA have been implemented to prevent drownings in shrimp nets. Although measures are in place to reduce the impact of artificial lighting, Miami-Dade County lacks comprehensive ordinances to address this ongoing issue, making nesting success a continued area of concern.

The American crocodile, federally designated as threatened, resides in BBAP's mangrove-lined marshes, creeks, and estuarine habitats. With a small population vulnerable to events like hurricanes and disease, some crocodiles face fatal road accidents along U.S. Highway 1, suggesting the need for wildlife corridors. The wood stork, a threatened wading bird, nests in mangrove and wetland habitats, depending on seasonal flooding to ensure sufficient prey. Additionally, species like the roseate spoonbill and reddish egret, categorized as threatened, experience habitat decline due to changes in hydrology and water quality, leading to concerted conservation efforts to protect these vulnerable bird populations.

### *Invasive Non-native and/or Problem Species*

In Florida, invasive species continue to threaten biodiversity, ecosystem stability, and the economy. The introduction of non-native species has been ongoing since the arrival of European settlers and has accelerated with global trade, particularly via ballast water from cargo ships. Invasive species like the Indo-Pacific red lionfish (*Pterois volitans*), first introduced in 1992, have become major threats in marine ecosystems such as Biscayne Bay. The lionfish preys on native fish and competes for resources, disrupting the local food chain (Schofield, 2010; Whitfield et al., 2014). Additionally, exotic plants, such as Brazilian pepper and Australian pine, continue to invade coastal areas, outcompeting native species and altering habitat dynamics (Langeland & Stocker, 2020).

Efforts to manage these invasions have included projects to restore native habitats. For instance, Oleta River State Park is working to remove invasive species like Australian pines, while local initiatives in Biscayne Bay focus on restoring habitats such as coastal strand and hardwood hammock communities (Langeland & Stocker, 2020; Miami-Dade County Parks, 2018). However, despite these ongoing efforts, invasive species remain a persistent challenge that continues to harm Florida's ecosystems. This is particularly true with species like the green iguana (*Iguana iguana*), which has established breeding populations across South Florida, where its numbers have been exacerbated by the pet trade (Rodda et al., 2019).

The economic costs of invasive species are also significant, affecting industries like agriculture, forestry, and fisheries. Recent estimates suggest that the economic impact of invasive species continues to rise, both from direct control measures and the loss of ecosystem services they provide (Pimentel et al., 2005; van Wilgen et al., 2020). Furthermore, climate change may accelerate the spread of invasive species by expanding their range and enabling them to thrive in areas previously inhospitable to them (Simberloff, 2011). Consequently, ongoing research and coordinated management efforts are crucial for mitigating the impacts of invasive species and protecting Florida's natural resources.

### *Problem Species*

Problem species are defined as native species whose habits create specific concerns or management problems. There are several problem species found in and around BBAP, ranging from terrestrial vertebrates to microbial marine organisms. Black vultures (*Coragyps atratus*) in South Florida have developed a taste for car parts. They prey on rubber from areas of the car, such as windshield wipers and the seals around windshields, doors, and sunroofs. They appear not to consume the car parts, and the reason for their behavior is not understood. Warning signs posted in parks that surround BBAP warn visitors to cover cars with towels or a car cover when vultures are present.

Raccoons (*Procyon lotor*) are a problem species particularly in public parks, recreational islands, and in developed areas along the shorelines of BBAP where they scavenge for food. Raccoon overpopulation can be detrimental through predation of nesting birds, Florida east coast diamondback terrapins (*Malaclemys terrapin tequesta*), sea turtle eggs on the beach, and other native species. Mosquitoes are one of the largest problem species in south Florida, but in fact they are an important component to the food chain in mangrove estuaries. There are about 80 known mosquito species in south Florida, and

about 17 of them are invasive (UF/IFAS, 2021; National Public Radio, 2021). The most abundant of the mosquito species in south Florida, is the tidal marsh mosquito (*Aedes taeniorhynchus*). It lays eggs on exposed moist soils, especially in black mangrove swamps. It is considered a natural vector for transmitting diseases such as canine heartworms. Mosquitoes are more active in early morning hours and at dusk, so avoid peak hours and search for breezy open areas.

Algal blooms, which have continued periodically through the years, result in significant seagrass and benthic organism mortalities (Gilbert et al., 2009). The presence of the cyanobacteria (*Synechococcus* spp.) was documented as the cause of an "algal bloom" in Card Sound. An algal bloom is defined as a rapid increase or accumulation in the population of algae in an aquatic system. A persistent green macroalgal bloom appeared in 2009 and lasted until 2013 (Collado-Vides et al., 2013; Santos et al., 2020). In August 2020, Biscayne Bay experienced another algal bloom, which contributed to thousands of dead fish in the bay (Miami Waterkeeper, 2020). Marine cyanobacteria of the *Synechococcus* spp. group, occupy an important position at the base of the marine food web as a major primary producer (Woods Hole Oceanographic Institution, n.d.). With the influence of excess amounts of nutrients, a harmful algal bloom can occur. In the case of the Card Sound bloom, nutrient overloading, particularly phosphorus, is thought to have triggered the bloom. The source of the excess phosphorus may be a combination of water releases associated with hurricane threats or a road construction project in northern Key Largo (Rudnick et al., 2006).

### *Archaeological and Historical Resources*

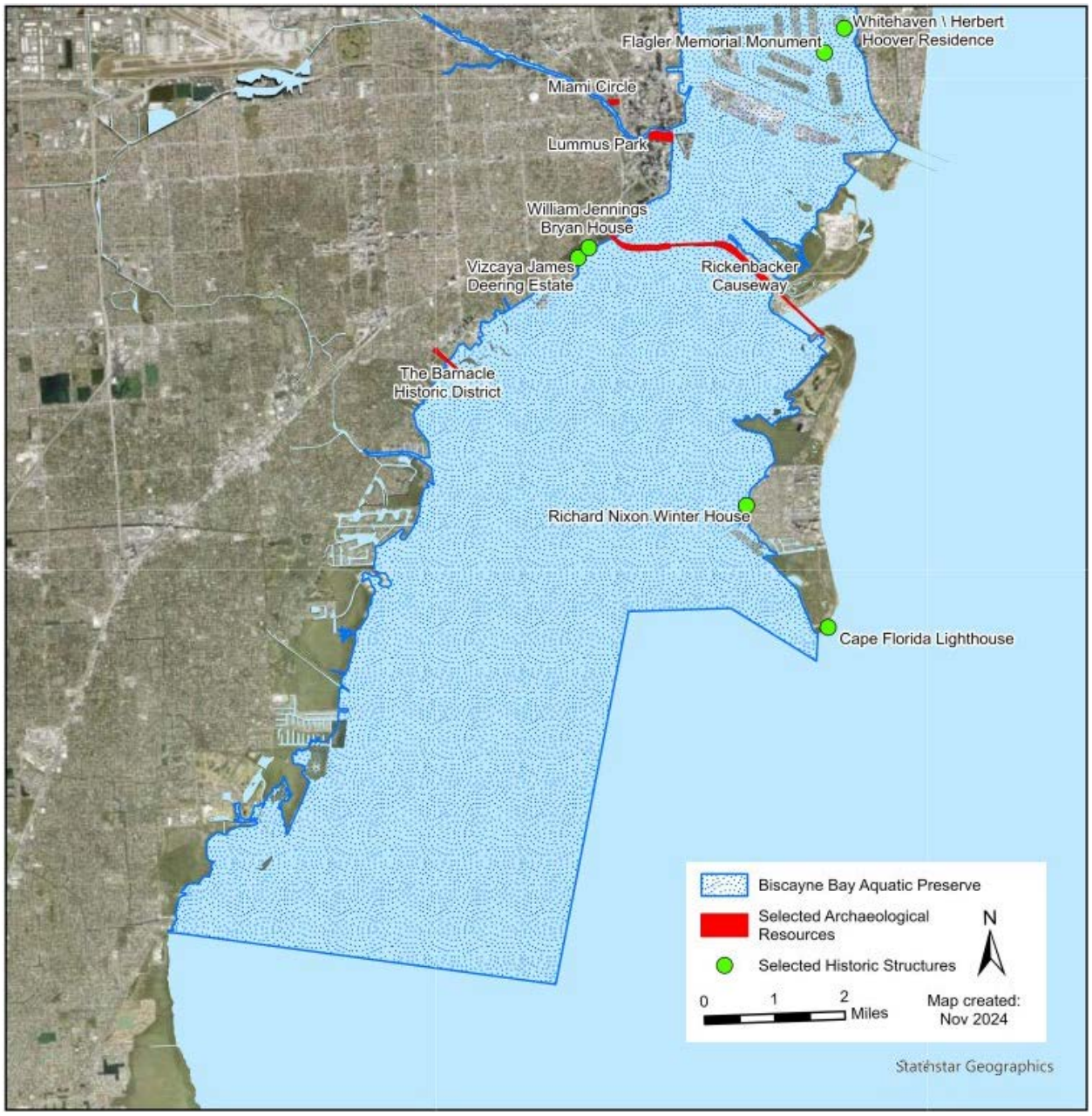
Florida's Master File site report from October 2024 identified a diverse collection of cultural and historical resources within a 50-meter (146-foot) buffer surrounding BBAP's borders. These include 46 archaeological sites, 53 historic bridges, over 800 structures, and 54 resource groups (refer to Appendix B.5). The Florida Master Site File documents cultural resources in the state that are at least 50 years old, irrespective of their recognized historical importance. In contrast, the National Register of Historic Places is a curated list of properties formally acknowledged as historically significant by the U.S. Department of the Interior's National Park Service. Additionally, the Florida Historical Marker Program highlights notable sites, individuals, and events through the placement of historic markers and plaques, emphasizing architecture, archaeology, and traditional culture.

Among the most prominent archaeological sites is the Miami Circle, an exceptionally well-preserved feature on the Biscayne Bay shoreline with 85% of its original structure intact. Unique for being the only oolitic limestone feature identified in North America, its discovery in 1998 occurred during the demolition of an apartment complex slated for redevelopment. To protect this cultural resource, Florida acquired the 2.2-acre site located at the convergence of the Miami River and Biscayne Bay. The site, now managed by the Florida Division of Historical Resources Bureau of Archaeological Research, has been the subject of five major field investigations since its discovery. These range from salvage excavations to extensive auger testing. Notably, three-dimensional laser mapping by scientists from the University of Miami and the University of Florida has captured the site's full extent. Artifacts excavated from the site are housed at HistoryMiami, offering insights into the region's past inhabitants.

The Cape Florida Lighthouse, constructed in 1825 and later rebuilt after a Seminole attack in 1836, is the oldest remaining structure in Miami-Dade County (MDC). It stands within CFSP and provides panoramic views of the Biscayne Bay section extending to Monroe County. A second historically significant structure, dating to Florida's statehood in 1845, is the Wagner House—a wooden cabin once used by early settler William Wagner, now relocated to Lummus Park along the Miami River. This area, a hub of settlement activity in the mid-19th century, also features a relocated slave quarters from an early plantation. This site includes remnants of the Military Trail, constructed in 1856 by U.S. Army troops under Captains Abner Doubleday and John Brannan. This trail, later incorporated into the Dixie Highway in 1915, played a significant role in the county's development and was designated a local historic site in 1995.

Virginia Key Beach Park, located off the Rickenbacker Causeway, serves as both an environmental and cultural landmark. Its earliest documented history includes an 1838 skirmish during the Second Seminole War. Later, during segregation, the area became an essential recreation site for African

Americans and officially opened as Virginia Key Beach on August 1, 1945. Accessible only by boat initially, the park quickly became a popular destination, drawing thousands of visitors each weekend. By the early 1960s, protests led to the desegregation of public beaches, solidifying Virginia Key Beach Park as a symbol of the African American struggle for civil rights in Miami. Additional cultural resources near BBAP are further described in Appendix B.5.




*Map 8 | Selected cultural and historic sites in Biscayne Bay Aquatic Preserve*

## 3.4 / Economic Values

The shoreline of Biscayne Bay is shared with MDC's growing population, at 2.7 million people in 2020 (U.S. Census Bureau, 2020). MDC residents and visitors alike engage in recreational activities on the Bay such as fishing, diving, snorkeling, swimming, picnicking, bird watching, sightseeing, sailing, and

boating. In order to evaluate the economic value of Biscayne Bay, SFWMD and Miami Dade County tasked contractors Hazen and Sawyer Environmental Engineers and Scientists to research and publish the Biscayne Bay Economic Study (2023). They found that the annual economic contribution of Biscayne Bay was roughly $64 billion (Hazen & Sawyer 2023). Biscayne Bay is not just important to the economy in Miami, but study went on to show that it contributes to 3% of the economic output of the entire state. In 2021, DEP contracted University of Florida to do a visitor use study for all of Florida's Aquatic Preserves. They found that over 16 million people visit and use BBAP annually (Fedler & Stein, 2022). These surveys combined show how important BBAP is to Miami Dade and Florida

PortMiami is one of MDC's leading economic drivers, second only to the Miami-International Airport. Recognized as the "Cruise Capital of the World" and the "Gateway to the Americas", in 2019 the port accommodated an estimated 5.6 million cruise passengers and moved 9.6 million tons of goods (PortMiami, 2019). The port generates about $43 billion annually and accounts for about 334,500 jobs in South Florida. As the closest U.S. East Coast container port to the Panama Canal, PortMiami connects the Americas and serves global markets including Asia, Europe, and Africa. While PortMiami serves the post-PanaMax vessels, the Miami River provides service to smaller vessels traveling between Caribbean ports and is therefore considered an unofficial second port within the Miami area.

The commercial fishing industry, while greatly diminished due to a combination of high waterfront values, flattened prices, and gentrification, still relies on Biscayne Bay not only as the harvest location of many fish species, stone crab, and bait shrimp, but also as the critical habitat necessary to complete the life cycles of many fish and invertebrate species. Commercial fish species that are life stage dependent on Biscayne Bay include ballyhoo; barracuda; several grouper species (black, gag, and red); grunts; hog snapper; several species of jack (crevalle, almaco, yellow); mullet; parrotfish; all species of snapper; spiny lobster; bait shrimp; pink shrimp and white shrimp (SFWMD, et al., 2023). Participation in the commercial fishery sector in Miami-Dade County, as measured by the number of commercial fishing licenses (Saltwater Products Licenses), declined by 54% from the late 1990s to the mid-2010s (Shivlani & Dowdell, 2017).

The recreational boating industry is also an economic driver for the tri-county area, including Miami-Dade, Broward, and Palm Beach counties. According to a report by Murray and Associates (2020) produced for the Marine Industries Association of South Florida, major sectors include manufacturing, wholesale trade, retail trade, dockage,(and marine services, and in the tri-county area represent 38.4 % or $7.187 billion of statewide gross marine sales" Mami-Dade County contributed $1.499 billion in sector sales with a total economic impact of $3.872 billion" (Murray & Associates, 2020). According to FWC Miami Dade has 74,622 registered vessels. (FWC, n.d.)

## 3.5 / Citizen Support Organization

A coalition of local citizens founded the Friends of Biscayne Bay (FOBB) and gained official recognition by Florida in April 2001. FOBB´s stated objective is to support BBAP in its mission to preserve and enhance Biscayne Bay so that its biological and aesthetic values may endure for the enjoyment of future generations. Since its inception, FOBB has worked to support BBAP in securing facilities and funds to accomplish management goals. Prior to the establishment of FOBB, the BBAP manager's office was located within the DERM, PERA at the time, building in downtown Miami, with limited bay access and no room for additional employees. After discovering the Florida Marine Patrol building and dock at Pelican Harbor were unoccupied, FOBB assisted the state in securing the building in 2001, which is now known as the Biscayne Bay Environmental Center and dock. FOBB continues to support BBAP education and outreach initiatives through funding, compensating travel costs, purchasing field supplies, and sponsoring marketing and other identified needs. FOBB runs educational kayak and sailing trips to help inform the community about the aquatic preserve and raise funds. In 2023 they were integral in putting on the first ever Ghost Trap Rodeo in Miami Dade County. The event was able to remove over 2,000 lbs of derelict fishing gear from BBAP. The event was so successful that there are plans to continue it every two years during the Blue Crab fisheries trap closures in July every other year. The organization has filed

its articles of incorporation with the Florida Department of State and re-registers annually as a nonprofit corporation. Members elect four officers (President, Vice President, Secretary, and Treasurer) at the FOBB´s annual January meeting. Officers' duties are defined in their by-laws. The FOBB Board of Directors meets periodically to discuss current issues and events within the aquatic preserve.

## 3.6 / Adjacent Public Lands and Designated Resources

Florida Forever is Florida's conservation and recreation lands acquisition program. It works to conserve natural resources and renew Florida's commitment to protect the state's natural and cultural heritage. The lands acquired have many uses, such as recreational trails, historic sites, and urban service areas. Since its inception in 2001, Florida Forever has purchased more than 907,412 acres of land statewide with an estimated value of $3.3 billion (DEP, n.d.). The Trust for Public Land is a national nonprofit, conservation organization that has preserved land adjacent to BBAP. This organization facilitates public enjoyment of parks, community gardens, historic sites, rural lands, and natural areas. SFWMD is the state agency that has and will continue to purchase lands necessary for the Biscayne Bay Coastal Wetlands projects that are part of CERP. Its mission, in part, is to restore and protect South Florida's water resources and coastal lands from flooding (SFWMD, 2020b). The increased cost of coastal lands may affect the scheduling of these restoration projects.

The MDC Environmentally Endangered Lands (EEL) Program began in 1990. The EEL Program's mission is to identify and protect lands for conservation and preservation purposes. From 1991 to 2020 nearly 20,700 acres were purchased. Additionally, the EEL manages over 2,800 acres of natural lands within MDC Parks, for a total of over 23,500 protected acres (Environmentally Endangered Lands Program, 2020).

### *Northern Biscayne Bay*

Highland Oaks County Park forms the headwaters of the Oleta River and is the northern boundary of BBAP (Chapter 18-18.002, F.A.C.). It is hydrologically connected to BBAP, but bridges block access by water vessels, including boats, kayaks, and canoes. Greynolds and East Greynolds County Parks straddle the Oleta River portion of BBAP. Oleta River State Park forms an important access point to BBAP along both the Oleta River and the northern boundary of the bay proper. At Oleta River State Park, naturalists guide canoe trips through the mangroves that grow along the river. The park offers visitors a variety of recreational services, including a primitive campsite for the Florida Saltwater Circumnavigation Trail, a fishing pier, a swimming beach, and canoe/kayak trails. The park also has a mangrove swamp, two offshore islands, and seagrass beds in the surrounding waters. A concessionaire rents kayaks along both the river and bay portions of BBAP within the park and offers guided tours of aquatic preserve waters.

East of the Oleta River State Park, Haulover County Park and Marina offers five lanes of boat ramps and 144 slips at the marina. A private company operates a dry stack with additional boat spots. Shoreline fishing is popular along a seawall on the bay and within Baker's Haulover Inlet. Boats moor within the park and fish bay waters for bait fish before heading offshore. Three shore-side parks allow visual access to BBAP in North Miami, Miami Shores, and the city of Miami. MDC's Division of Environmental Resources Management (DERM) has placed an artificial reef near the fishing platform. The Miami Shores linear park provides a walkway along three blocks of bay shoreline. Bayview Park is used by area residents to walk their dogs.

Pelican Harbor Marina shares a spoil island connected to the mainland and other islands by the John F. Kennedy/79th St. Causeway with the Biscayne Bay Environmental Center. Pelican Harbor Marina is also the site of one of three Miami-Dade Marine Patrol offices, county fuel docks and a pump-out station, and the Pelican Harbor Seabird Station. The nonprofit seabird station rents property from the county for offices and pens for rehabilitating or permanently housing injured birds.

Miami's Legion and Morningside parks offer boat ramp access along the western shoreline of the bay. Morningside Park offers kayak rentals and was the site of the dedication of the Biscayne Bay Segment of the Florida Saltwater Circumnavigation Trail in April 2007. In support of kayaking, the city launched

kayak areas for both Morningside and Margaret Pace parks, the latter which lies just north of the Venetian Causeway. Historically, Margaret Pace Park has mainly provided visual access to the bay for its users. Between 2010-2020, there has been a steady increase in development of high-rise residential buildings along the bay, which has changed the character of the Edgewater neighborhood of Miami. Visual access to the bay is still the primary use in this area, though the population increase has introduced new uses via Margaret Pace Park. Users may now rent kayaks and jet skis from a private vendor to the south of the park, and overall recreational use of the park has increased.

On the Miami River, Gerry Curtiss Park has boat ramps with wet slips and dry storage. Kayak or canoe launching is possible at some riverside parks including Curtis, Jose Marti, and Sewell. Lummus Park and Pointe Park, in the historic Spring Garden neighborhood, provide visual but no physical access. The Miami River Commission, along with the Trust for Public Land, has promoted increased visual access through the Miami River Greenway Plan. The Miami River Commission also coordinates a 'Miami River Day' during the third or fourth month of the calendar year at Jose Marti Park. In the early 1900s, many visitors to Miami took boats from the city up the Miami River to tourist attractions featuring Seminole or Miccosukee Native Americans (Connolly, 2014). Numerous condominiums have marinas and wet slips along Brickell Avenue. Bayshore Drive, situated to the east of Brickell, provides a bay view of the mangrove shoreline on the western edge of Virginia Key. The Bill Sadowski Critical Wildlife Area is marked by a roadside plaque that explains the Critical Wildlife Area and its history. This road provides visual access to the bay from a walkway and road that line the bay near the condominiums.

The Venetian Causeway connects a series of islands, both natural and created from dredged materials before the 1920s. The easternmost island, Belle Island, is a natural island that had dredged material added. It contains several private marinas that provide access to BBAP. Another area was planned to become a spoil island north of DeLido Island, but the submerged land in the project footprint was spared when a recession began in Miami in 1926. To date, pilings stand around the perimeter of the failed project and concrete slabs lie submerged and were never removed. Coral, sponges and acres of seagrass have colonized the area.

In between the Venetian and MacArthur Causeways, three islands created from dredge spoils (Palm, Hibiscus, and Star Islands), are home to gated communities featuring mansions and celebrity homes. All of these islands created from dredge spoils represent the loss of aquatic habitat within the area that now constitutes BBAP waters. The U.S. Coast Guard Sector Miami is headquartered on a dredged material island south of the MacArthur Causeway, adjacent to Terminal Island. PortMiami offers access to cruise ships as a beginning and ending point rather than as a port of call. Government Cut, which originates from Watson Island in the west and opening to the Atlantic Ocean in the east, is the navigation channel for cargo vessels and cruise ships transit and dock. The Port is county-owned and administered. MDC also acts as a landlord for three cargo shipping terminals. The Biscayne Bay Pilots moor at the eastern end of Lummus and Dodge Islands. These spoil islands were built with bulkhead walls to allow mooring of ocean-going vessels.

The downtown Miami area has changed dramatically throughout Miami's history. The current Biscayne Boulevard was once the bay's shoreline, but massive dredging and filling in the 1920s reclaimed adjacent sovereign submerged lands. Bicentennial Park was previously used for vessel berths and wharfs, a Formula One car street racetrack, and a seasonal venue for visiting tent performances.

Bayfront Park, dedicated in 1925, is the oldest surviving bayside park. Two amphitheaters and several memorials have replaced the original library. A Bay Walk along the park provides visual access. Across the Bay from the mouth of the Miami River is Biscayne Bay´s most protected area. The Bill Sadowski Critical Wildlife Area was designated by the FWC in partnership with Miami. This "No Entry Zone" was designated to offer protection from disturbance to birds that wade at low tide for fish. Because of tidal variability, the most effective way of preventing disturbance is for the area to be removed from on-water visitation. After the area was protected for bird life, the designation was expanded to include protection of manatees and very shallow seagrass flats, where manatees graze. Plant communities on the island include seagrass beds, sand and mud flats, mangrove and herbaceous wetlands, beach dunes and

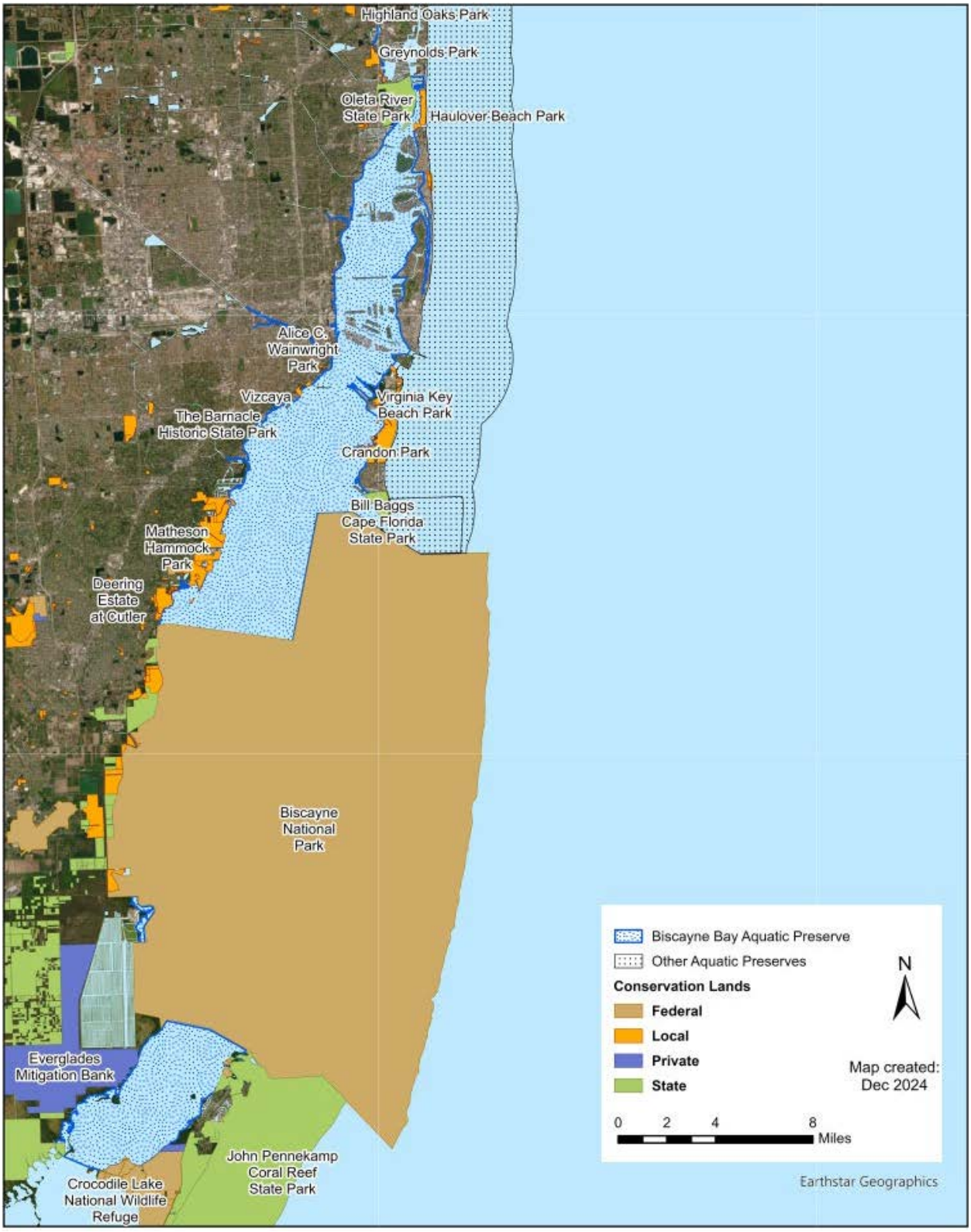
coastal maritime hammock. The area is 700 acres and is a vital resource for wildlife species, including rare, migrating songbirds that travel along the Atlantic coast flyway (Florida Fish and Wildlife Conservation Commission, n.d.)

***Central Biscayne Bay***

The Rickenbacker Causeway, built in 1947, divides North and Central Biscayne Bay and allows water flow from Government Cut to the south, driven by Atlantic Ocean currents. Spoil islands support the causeway's western end and now serve as recreational areas for swimming, sailing, and more. Hobie Beach, a popular dog-friendly swimming spot on Virginia Key, is monitored by the Florida Department of Health's Healthy Beaches program. Virginia Key is also home to the University of Miami's Rosenstiel School of Marine and Atmospheric Science, NOAA offices (Southeast Fisheries Science Center and Atlantic Oceanographic and Meteorological Laboratory), the MAST high school, and the Miami Seaquarium. The Rickenbacker Marina and the City of Miami Marine Stadium are managed by the City of Miami. The original causeway's drawbridge, replaced in 1985, was repurposed as a fishing pier. Across Bear Cut on Key Biscayne's bayside, Crandon Marina faces a monitored mangrove island known for bird roosting and nesting.

Red mangroves line the western shoreline of Key Biscayne, joining Bill Baggs Cape Florida State Park (CFSP), at the southern tip of the island. CFSP is a testament to nature's resilience and the power of community activism in preserving local ecosystems. Originally a privately owned coconut plantation, the land faced significant development pressures in the mid-20th century. Influential journalist Bill Baggs led efforts to protect the park from commercial exploitation, culminating in its establishment as a state park in 1966. Over the decades, the park has undergone a remarkable ecological transformation, with invasive species like the Australian pine removed and native habitats restored, especially following the devastation of Hurricane Andrew in 1992. Today, 99% of the species in CFSP are native, reflecting the success of restoration efforts. Despite challenges, the park remains a vibrant hub for outdoor recreation and ecological study. Community involvement has been key to its success, with programs like "Plant-A-Seed" and "Nature's Hope" engaging locals in conservation and stewardship. As CFSP continues to evolve, managing its resources and funding remains critical to ensuring the park's ecological and recreational value for future generations. BBAP borders the western shore up to the mean high-water line and BNP's northeastern boundary is a few hundred yards south of the island's tip. From Cape Florida, visitors can view the historic stilt houses within the bay, known as Stiltsville, which are included within the national park.

Along BBAP's western shore, mangrove-lined parks begin at the Rickenbacker Causeway with Alice Wainwright Park and Vizcaya Museum and Gardens, then alternate with high-end residential developments, high-density condominiums, and institutions such as Mercy Hospital. The state-owned Vizcaya Museum & Gardens (180 acres) includes some of the oldest red mangroves along the Bay. Vizcaya is a 70-room mansion moved from Spain at the auspices of James Deering, half-brother of Charles Deering of the Deering Estate. Along the waterfront of the bay is David Kennedy Park, which marks the start of the Coconut Grove neighborhood, as well as Kenneth Myers Park, Peacock Park, and the Kampong, which is one of five National Tropical Botanical Gardens and the only one outside of Hawaii. The Kampong is built on the estate of renowned horticulturist, Dr. David Fairchild, who named the garden after the Malay and Javanese shared word for village. The garden is home to many fruit trees and other plants that were originally brought here from Indo-Malaysia. It is regarded for its breathtaking vista of Biscayne Bay and is one of the locations where the groundwork was laid for the makings of




*Map 9 | Conservation lands adjacent to Biscayne Bay Aquatic Preserve*

Everglades National Park by famous conservationists such as Marjorie Stoneman Douglas (National Tropical Botanical Garden, n. d.).

The Barnacle Historic State Park was founded in 1973 to provide access to the unique house of the Commodore Ralph Munroe and unspoiled maritime hammock. The area's offshore islands include Fair Isle and the Dinner Keys. These islands were created when the area was used as a seaplane base for Pan Am beginning in 1931, whose former terminal is now home to the Miami City Hall. Fair Isle was a natural island that was enlarged by dredged material and renamed Grove Isle. The Dinner Key islands underwent exotic plant removal and replanting with mangroves and native plant species in 2007 and 2008. In 2024 there are plans being developed to improve the islands to increase their ability to protect the nearby marina. Thes plans will include nature-based solutions and public access.

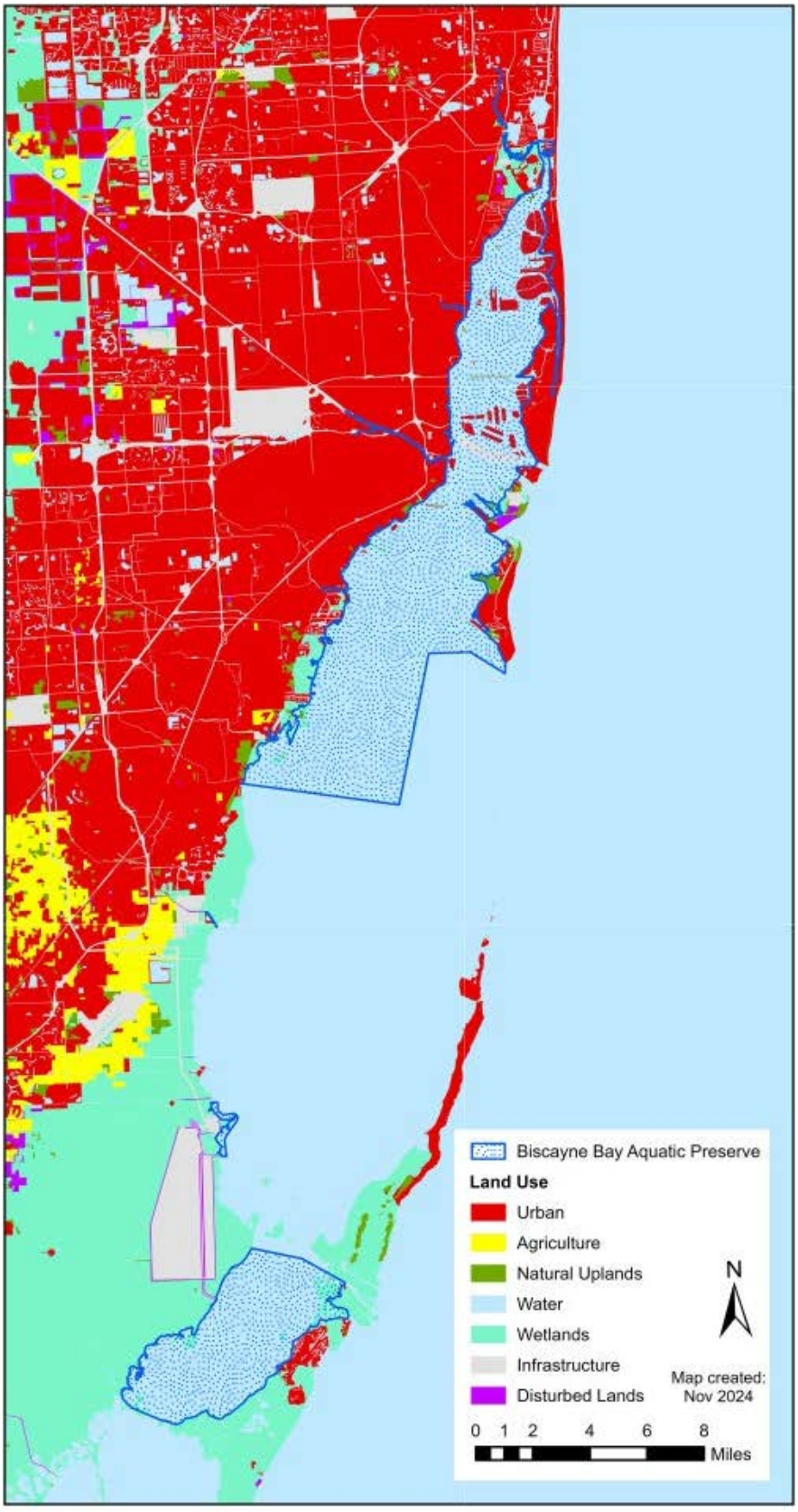
Further south, the Coral Gables Waterway was built through the Atlantic Coastal Ridge. Protected natural areas managed by MDC in this region include Matheson Hammock, R. Hardy Matheson Preserve and Chapman Field, that serve to protect mangrove forests along the bay. Chapman Field was a World War I air station and now serves as a U.S. Department of Agriculture Station for Plant Experimentation. MDC owns ball fields on part of the park and provides access to the bay for kayaks and canoes. The Deering Estate lies just northward of the boundary between BBAP and BNP. Its 458 acres are state-owned but managed by the MDC Environmentally Endangered Lands Program. Part of the estate, Chicken Key, is a mile offshore and serves as an important bird rookery within BBAP. Within its hammocks and pinelands, the park protects several important archaeological sites, including the Old Cutler fossil site (excavated mid-1980) and a shell midden. A three-story wooden building served as the first inn between Coconut Grove and Key West beginning in 1900. James Deering purchased it in 1916 and built a three-story stone house there in 1922. Florida purchased the estate and MDC then added it to the National Register of Historical Places in 1986. The northern eyewall of Hurricane Andrew blew ashore at the Deering Estate to the south in August 1992, particularly damaging the wooden sections of the estate and flooding the wine cellar. People's Dock was rebuilt, then reopened for fishing, canoe and kayak launching, and other public uses. Additions to the Deering Estate and wetlands in the Model Lands Basin of southern MDC are adjacent to Biscayne Bay. The program is administered by DERM, with funding of natural areas provided by the MDC EEL Program and the land management work conducted by the Natural Areas Management division of the Parks and Recreation Department.

BNP's Visitor Center and Headquarters are located at Convoy Point. Two county facilities share boundaries, BNP and BBAP: BNP also has marina facilities and/or primitive campgrounds on three of the barrier islands: Boca Chita, Elliott Key, and Adams Key, which visitors often use to access the aquatic preserve.

***Southern Biscayne Bay***

The portion of Southern Biscayne Bay that lies within BBAP contains Card Sound and Little Card Sound. These two water bodies are separated by a mud shallow called Card Bank but are often classified together as Card Sound. The western shoreline of Card Sound is dominated by the FPL Turkey Point Nuclear Power Plant to the north and wetlands to the south. Florida purchased portions of the adjacent lands through the SFWMD's Model Lands Project. Other lands were purchased by MDC's Environmentally Endangered Lands program. The shoreline in this portion of BBAP is lined with mangroves, but these mangrove populations and the freshwater wetlands nearer to the shoreline show signs of distress because they are cut off from freshwater connections to the Everglades. The CERP C-111 Spreader Canal Project is expected to bring additional freshwater to the Card Sound portion of Biscayne Bay. FPL is assisting the restoration of some of the affected wetlands through placement of culverts through levees as part of a mitigation bank for its past and future impacts. The northern boundary of Card Sound lies at Cutter Bank with a series of keys called the Arsenickers, which are prime bird rookeries.

In Northern Card Sound, Angelfish and other smaller creeks connect the bay to the Atlantic Ocean. Two state parks and a national wildlife refuge either overlap with or border BBAP, protecting a number of the




*Map 10 / Land use adjacent to Biscayne Bay Aquatic Preserve*

islands to the north of Key Largo within the John Pennekamp Coral Reef State Park or as part of the Crocodile Lakes National Wildlife Refuge. Several of these islands are protected by both the John Pennekamp Coral Reef State Park and BBAP. Pennekamp State Park was founded in 1963 as the first undersea park in the U.S. and has expanded to include areas bordering Card Sound as well as the Atlantic Ocean and Largo Sound. Dagny Johnson North Key Largo Botanical State Park, founded in 1982, includes mangroves within BBAP and rockland hammock on BBAP's southeast border. Aside from several islands at the northern part of Key Largo, the Crocodile Lakes National Wildlife Refuge encompasses the Monroe County waters of BBAP and the mangroves on the aquatic preserve's southern boundary. The eastern boundary of the national wildlife refuge is the northernmost section of Key Largo. The Crocodile Lakes National Wildlife Refuge was founded in 1980 and includes 6,700 acres with 650 acres of open water. The southern boundary also includes the Card Sound Road Bridge where Little Card Sound is separated from Barnes Sound.

## 3.7 / Surrounding Land Use

Land use in and adjacent to BBAP can be broadly classified by the following

categories: agricultural, infrastructure, natural uplands, wetlands, water, and residential and commercial. Examples of commercial and residential uses include municipal, business, housing, and industrial. The northern section of the bay is primarily commercial and residential, with numerous state and municipal parks. The northern section has lost its natural shoreline and is now armored with cement and rip rap to create seawalls and stabilize shorelines created through spoil island construction. The central section is surrounded in the north by commercial and residential lands, then to the south, the landscape shifts towards residential, natural, and agricultural surroundings.

Agricultural lands in southern MDC are the most diverse in the U.S., primarily producing row crops, citrus plants, and foliage nurseries, with year-round growing seasons. Agricultural lands provide open space that can allow for wildlife habitat; however, these activities can also contribute to low water quality that enters BBAP through canals.

Water flow from agricultural areas may contain high levels of nutrients and agrochemicals that could cause algal blooms in BBAP. Since Biscayne Bay is phosphorus-limited, these phosphorus inputs are considered the causal agent of some blooms. Lands adjacent to the Card Sound are largely undeveloped with the exception of the Model Land Company Canal and cooling canals that serve the Turkey Point Nuclear Power Plant.

*Photo 6 | A cowfish found near one of BBAP's quadrats used for natural resource monitoring.*

## Chapter 4 / The Biscayne Bay Aquatic Preserve Management Programs and Issues

The work performed by DEP's Office of Resilience and Coastal Protection (ORCP) is divided into components called management programs. In this management plan all site operational activities are explained within the following four management programs: Ecosystem Science, Resource Management, Education and Outreach, and Public Use.

The hallmark of Florida's Aquatic Preserve Program is that each site's natural resource management efforts are in direct response to, and designed for, unique local and regional issues. When issues are addressed by an aquatic preserve it allows for an integrated approach by the staff using principles of the Ecosystem Science, Resource Management, Education and Outreach, and Public Use Programs. This complete treatment of issues provides a mechanism through which the goals, objectives, and strategies associated with an issue have a greater chance of being met. For instance, an aquatic preserve may address declines in water clarity by monitoring levels of turbidity and chlorophyll (Ecosystem Science - research), planting eroded shorelines with marsh vegetation (Resource Management - habitat restoration), creating a display or program on preventing water quality degradation (Education and Outreach), and offering training to municipal officials on retrofitting storm water facilities to increase levels of treatment (Education and Outreach).

Issue-based management is a means through which any number of partners may become involved with an aquatic preserve in addressing an issue. Partnering is a necessity; and by bringing issues into a broad public consciousness partners are welcome to ensure that a particular issue receives input from perspectives that the aquatic preserve may not normally include.

This section will explore issues that impact the management of Biscayne Bay Aquatic Preserve (BBAPs) directly or are of significant local or regional importance that the aquatic preserve's participation in them may prove beneficial. While an issue may be the same from preserve to preserve, the goals, objectives, and strategies employed to address the issue will likely vary depending on the ecological and socioeconomic conditions present within and around a particular aquatic preserve's boundary. In this management plan, BBAPs will characterize each of its issues and delineate the unique goals, objectives, and strategies that will set the framework for meeting the challenges presented by the issues.

Each issue will have associated goals, objectives, and strategies. Goals are broad statements of what the organization plans to do and/or enable in the future. They should address identified needs and advance the mission of the organization. Objectives are a specific statement of expected results that contribute to the associated goal, and strategies are the general means by which the associated objectives will be met. Appendix D contains a summary table of all the goals, objectives and strategies associated with each issue.

## 4.1 / The Ecosystem Science Management Program

The Ecosystem Science Management Program supports science-based management by providing resource mapping, modeling, monitoring, research, and scientific oversight. The primary focus of this program is to support an integrated approach (research, education, and stewardship) for adaptive management of each site's unique natural and cultural resources. ORCP ensures that, when applicable, consistent techniques are used across sites to strengthen Florida's ability to assess the relative condition of coastal and freshwater resources. This enables decision-makers to more effectively prioritize restoration and resource protection goals. In addition, by using the scientific method to create baseline conditions of aquatic habitats, the Ecosystem Science Management Program allows for objective analyses of the changes occurring in the state's natural and cultural resources.

### *4.1.1 / Background of Ecosystem Science at Biscayne Bay Aquatic Preserve*

A large body of scientific research, monitoring data and maps of Biscayne Bay dating back to the early 1900s has been compiled prior to the designation of the Biscayne Bay Aquatic Preserve (BBAP). This research documents numerous changes associated with the development of South Florida which have affected Biscayne Bay. Included among these significant changes are the following: canals dug in the 1900s that drained the Everglades ecosystem that also includes Biscayne Bay; elimination of natural sheet flow (rainwater that flows into the estuary by traveling over natural shoreline) that supplied freshwater to Biscayne Bay; and replacement by a highly spatially concentrated and periodic point source flow through canal mouths. Inlets between barrier islands that were dredged into navigable channels to enhance large vessel access to the mainland also increased the salinity of bay waters. These navigation channels continually require periodic maintenance dredging with subsequent impacts on the bay's ecosystems. Shorelines that were bulkheaded for stabilization to allow for urban development and increased population resulted in the loss of natural water filtration by wetlands and of nursery areas for many bay species. Some threats to Biscayne Bay have been recognized and mitigated. The raw sewage dumped directly into Biscayne Bay since the human population increased, starting in the late 1800s was diverted to a sewage disposal system in 1956.

Starting in the early 1900s through the early 1980s, a substantial amount of research was focused on the northern part of the bay to determine impacts of development and mistreatment of the resource. A multi-day symposium called "Biscayne Bay: Past, Present, and Future" was held in the late 1970s to showcase this body of work and to provide a direction for future research and monitoring. According to the prologue in Biscayne Bay: Past, Present, Future (1976), the symposium grew from evening seminars into an attempt to unify diverse research activities in Biscayne Bay by faculty of the Rosenstiel School of Marine Atmospheric and Earth Science (RSMAS) of the University of Miami (UM). The chair of the UM Research Council appointed a Biscayne Bay Ecology Committee in March 1974, led by Dr. Anitra Thorhaug. Subsequently, Dr. Thorhaug organized a symposium to present all the information known to date about Biscayne Bay and areas that still required more study. Since the 1970s, major restoration projects, such as the Comprehensive Everglades Restoration Plan (CERP), the Biscayne Bay Restoration and Enhancement Program, the Biscayne Bay Coastal Wetlands Project, Biscayne Bay and

Southeastern Everglades Ecosystem Restoration Project, amongst others have been initiated and funnel federal, state and local dollars into developing baseline data in preparation for the restoration of freshwater flow and improvement of water quality of Biscayne Bay. Most of the CERP projects are directed southward, within the boundaries of Biscayne National Park (BNP) and the Card Sound portion of BBAP. Funding has been much less available for research that agencies, universities and organizations are able to conduct in the northern part of Biscayne Bay.

Despite claims in later years that development and hydrological alterations left the northern Biscayne Bay largely lifeless, historic and current research suggests otherwise. While diversity was previously believed to be lower in the North Bay than the South Bay, in 1981, Schroeder found the North Bay yielded more organisms per sample than the south. Schroeder's study also inferred that northern bay stations were quite diverse. The mean number of taxa at the northern sites ranged from 16-311, with an average number of organisms at all sites sampled totaling 1,061. In the southern sites, the mean number of taxa ranged from 18-78 with an average number of organisms at all sites sampled totaling 633. There was no significant seasonal difference between the north and south bay stations (Schroeder, 2003).

Since the 1980s, the health of Biscayne Bay has improved through better management practices including the addition of stormwater filtration systems, heightened public awareness of responsible fertilizer and pesticide use, restoration and enhancement of islands and shorelines, and improved oversight of activities within and adjacent to the bay. The state of resources has improved significantly as a result of improved management practices. From the 1950s to the 1990s, a fair amount of data has been generated in the northern bay. Focuses of past studies conducted in the North Bay include a characterization of benthic habitat type to document seagrass and algae cover, investigation into the species of importance to recreational and commercial industries, and water quality sampling.

Currently, research questions regarding BBAP are driven by the kinds of baseline data needed for key restoration projects. These data are used to determine the preserve's restoration success by identifying flora and fauna serving as indicator species (those that illustrate ecosystem changes). The northern bay is in need of frequent monitoring, frequently failing to meet water quality standards, caused by impacts from coastal development, concerns remain that minimal data collection may make it difficult for managers to detect degrees of decline in ecosystem function or shifts in species composition in the northern bay. BBAP aims to address cumulative impacts from coastal construction and to employ adaptive management strategies to protect natural resources.

Today, BBAP actively fosters strong working partnerships with multiple agencies and scientists who are involved in natural resource management, research, ecosystem monitoring, habitat restoration, mapping, and modeling within Biscayne Bay. Leading governmental partner agencies include the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service & Atlantic Oceanographic and Meteorological Laboratory, BNP, United States Army Corps of Engineers (Corps), United States Geological Survey (USGS), U.S. Environmental Protection Agency (EPA), US Fish and Wildlife Service (USFWS), Florida Sea Grant, South Florida Water Management District (SFWMD), Florida Fish and Wildlife Conservation Commission (FWC), Miami-Dade County (MDC) Permitting, MDC Division of Environmental Resources Management (DERM), The Deering Estate, Florida Keys National Marine Sanctuary (FKMNS), DEP's Coral Reef Conservation Program (CRCP), state parks. universities and non-profit organizations include UM RSMAS, Florida International University (FIU), Nova Southeastern University, Tropical Audubon Society, Trust for Public Land , Marine Animal Rescue Society, Pelican Harbor Seabird Station, Miami Waterkeeper, Fish and Wildlife Research Institute, and Miami Dade College. The support offered by these entities greatly enhances the BBAP's ability to manage resources effectively by providing the breadth of research and monitoring currently and historically performed in Biscayne Bay.

BBAP supports DEP's Florida CRCP, which is also overseen by ORCP. Information collected from these agencies and programs laid the foundation for the ecosystem science program at BBAP. BBAP's staff and financial resources face a unique set of challenges, managing an expansive geographic coverage area in Monroe County & Miami-Dade County, the most populous county in the state, which make fostering partnerships with agencies especially important. In addition to obtaining data from partnership

organizations, staff reviews scientific literature, participates in conferences, coordinates meetings and supports venues that feature work within and surrounding BBAP.

### *Mapping*

Documented mapping efforts in South Florida date back to 1770-1876 (Roland, n.d.). Aerial photographs taken of Biscayne Bay date back to the 1920s and presumably were used for mapping purposes. Seagrasses within Biscayne Bay were mapped and characterized by Zieman (1982) for the USFWS as part of a larger project within South Florida. The first large-scale mapping project to document submerged aquatic resources in the Bay was conducted by Peter Harlem in 1974. He created aerial photographs depicting historical changes in northern Biscayne Bay from 1925 to 1976 (Harlem, 1979). Other large scale mapping projects followed began in the early 1980s when DERM produced a map of benthic communities in the bay. These studies were based on extensive field work using staff surveys that physically identified community types instead of using high resolution photography, which is often used today to achieve the same information. Seven biological cover classes were defined and mapped: sparse and dense hard bottom communities, turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), shoal grass (*Halodule wrightii*), mixed grasses, and algae.

Since the 1980s, mapping has used digitized images and Geographic Information System (GIS) software to depict natural resources in layers. In 1995, Sargent mapped South Florida's seagrass communities using aerial photography to categorize seagrass types and ranked counties with most heavily scarred seagrass beds in order to propose ways to decrease this kind of habitat destruction. As part of a benthic mapping project, DEP's Coral Reef Conservation Program contracted Nova Southeastern University to map its coverage area, designated in 2024 as the Kristin Jacobs Coral Aquatic Preserve, overlapping the Biscayne Bay-Cape Florida to Monroe County Line Aquatic Preserve and the Bill Baggs Cape Florida State Park offshore from Key Biscayne. Ongoing collaborations between the multiple agencies have produced many digitized layers of GIS data, with less specific detail than DERM's 1983 map.

Mapping methods have evolved within the past several decades. Between the 1980s to the 1990s, an era of high-resolution aerial photography began to replace physical surveys of submerged lands to document benthic cover. Since then, remote sensing technology has provided immense benefits to large scale environmental mapping of shallow water habitats, water column imaging, and bathymetry via high resolution spatial sensors. In 2021, BBAP contracted Kent State University to conduct benthic habitat coverage mapping via satellite imagery produced multispectral imaging. Ground truthing of the habitat for the mapping project was conducted and assisted by UM, DERM, and provided BBAP benthic habitat assessments. Data from this project was not reliable but produced protocols that can be replicated in the future. During the next 10 years BBAP will use this protocol and drones to create these maps. Spatiotemporal results generated from Sentinel 2A/B MSI images revealed six components including benthic algae (Halimeda), substrate turbidity, cyanobacterial plankton, seagrass and algal plankton. These methods coupled with field observations proved effective at partitioning benthic cover from water column signals.

### *Monitoring*

In 1979, DERM's Surface Water Quality Monitoring Program was established to collect baseline data and create a routine surface water quality sampling program for Biscayne Bay and its watershed. This program began with 48 stations, and since then, has expanded to 105 stations located in the bay as well as major drainage canals and major tributaries leading into the bay (MDC, 2017). Consistent use of the same monitoring stations and measurements of the same parameters allow scientists and managers to document any changes in water quality and to base future management decisions on interpreted results. DERM's surface water quality monitoring integrates with seagrass monitoring and has contributed to understanding the changes in these communities within Biscayne Bay. In addition to water quality monitoring, DERM began to study the surface of bottom sediments (epibenthic monitoring) in 1985 via seagrass transects at 12 fixed stations in order to show changes in existing seagrass species composition. In 1999, 100 additional stations were added from the Miami River basin southward, (including Card Sound) for visual density monitoring. During the growing season, each station is randomly sampled in one of its twelve subplots using Braun-Blanquet techniques (the most commonly

used method to determine vegetation composition and cover of benthic sediments). In 2021, with support from a DEP Resilient Florida Program grant, DERM altered and expanded their water quality monitoring program by a large precent and it is actively growing.

Monitoring of physical parameters, such as depth, temperature, salinity, specific conductance, pH, DO (Dissolved Oxygen), and turbidity, utilizes data sondes that measure conductivity, temperature, DO, turbidity and tidal height, allowing for continuous collection of water quality data in Biscayne Bay waters. BNP has monitored water quality data at six stations since 1990. In 1997, 12 additional data sondes were added to support a contract with the Corps to collect data that would be used to develop a computerized model of the bay's circulation. Additional monitoring and assessment programs on fish, invertebrates, and vegetative cover within BBAP and other areas affected by CERP involves coordination with NOAA, USGS, as well as other Restoration, Coordination and Verification (RECOVER) members. Today, NOAA conducts field sampling twice a year in the wet and dry seasons along the shoreline in central to southern Biscayne Bay with the goal of determining what species of fish, crabs and other organisms live in the bay´s benthic habitats. Since 2012, NOAA along with the National Park Service and UM RSMAS have monitored salinity regimes, along with submerged aquatic vegetation cover and presence of associated fish and invertebrate species for the Integrated Biscayne Bay Ecological Assessment and Monitoring Project. Forty-seven sites are monitored twice a year along the western shoreline of southern and central Biscayne Bay. Connections between CERP implementation of nearshore, freshwater dispersion and its influence on habitat usage by fish and invertebrates associated with vegetated areas drives the project's goals to provide a data-driven, ecological assessment on CERP's adaptive management implementation and changes over time.

FIU's Southeast Environmental Research Center (SERC) began the South Florida Coastal Water Quality Monitoring Network in 1991, with five monitoring stations in Biscayne Bay, as a part of a larger study with 177 stations reaching around the bottom of the peninsula to Southwest Florida (Boyer & Briceno, 2008). This monitoring project characterizes the status and trends in water quality of Florida Bay, and has expanded to cover most of southeast and southwest Florida, including BBAP. The network provides an overview of trends in South Florida coastal waters. The SFWMD funded this monitoring effort that was initially managed by FIU SERC. However, in 2008 the SFWMD concluded there was some duplication of effort, as it was funding both DERM and SERC to conduct water quality sampling in Biscayne Bay. DERM was selected to continue the monitoring, and several sites were removed from the northern part of Biscayne Bay to compensate. Data from the northern and central sections of BBAP are archived and available for use, but no further data have been collected since 2008. SERC's monthly grab samples were tested for ten chemical parameters; phytoplankton biomass measured using chlorophyll a, and four field parameters measured at the sites. SERC had posted summaries of their data on-line and copied the aquatic preserve on their Quarterly Reports to SFWMD. Biscayne Bay's 25 sites were partitioned into six Zones of Similar Influence with two stations in Card Sound. SERC researchers have published numerous papers based on their data, but due to the small sample size, spatial resolution for North Bay is not available.

***Research Coordination***

BBAP collects published research results and reports from South Florida agencies and universities that explore natural resource issues within the Bay and its watershed. BBAP requests published results from partner agencies. UM's RSMAS has produced several works relating to the bay, including technical bulletins and a historical collection of references of Biscayne Bay, as well as a room dedicated to very dated studies from the turn of the 19th century. In addition to this, a bibliography of the marine environment within the bay was published (Cantillo et al., 2000). This bibliography provides managers and researchers with a quick reference guide to peer-reviewed work published on Biscayne Bay along with the sampling date. NOAA's Miami Regional Library at the Atlantic Oceanographic Meteorological Laboratory on Virginia Key houses a data recovery program that searches for older documents and data that would otherwise be lost to the scientific community. The program is known as the Coastal Estuarine Data Archaeology and Rescue. BBAP staff regularly access this online resource to obtain historic Biscayne Bay scientific data that dates back several decades.

The Statewide Ecosystem Assessment of Coastal and Aquatic Resources (SEACAR) is a collaborative process involving local, state and federal natural resource managers, data providers, researchers and partners. SEACAR's goal is to identify and assess ecological indicators and better understand the status of aquatic resources throughout the ORCP's managed areas. SEACAR informs and helps develop planning and restoration tools through collaborative efforts. These collaborative teams are composed of local, state, and federal natural resource managers, data providers, researchers and partners. Current knowledge and scientific data obtained from monitoring programs around Biscayne Bay is used to identify ecological indicators and assist in the analysis of ecosystem status and trends.

Graduate students at FIU and UM RSMAS, along with professors, frequently utilize Biscayne Bay for field research and at the same time produce important research that contributes to BBAP management success. USGS's South Florida Information Access website compiles publications, data, metadata, and other information about BBAP and other natural areas of South Florida. BBAP staff can interpret data and metadata in order to create maps and contribute to reports, publications, and public interest meetings. The USGS's South Florida Ecosystem History Project was designed to integrate studies from several researchers compiling data from terrestrial, marine, and freshwater ecosystems within South Florida. The goal of this project is to provide information about the bay's recent ecosystem history. The USGS South Florida Ecosystem History Online Database contains data on site locations, field information, water chemistry and salinity, vegetation information, and biotic occurrence tables of organisms inhabiting Biscayne Bay sediments, such as foraminifera, mollusks, ostracods, pollen, dinoflagellates, and diatoms.

### *4.1.2 / Current Status of Ecosystem Science at Biscayne Bay Aquatic Preserve*

#### *Mapping*

Using GIS files accessible on DEP's and other local, state, and federal agencies' websites, BBAP staff creates resource maps to use in support of comment letters to DEP's Environmental Resource Permitting program, in educational/outreach programs for the general public, or for addressing public inquiries.

The Surface and Groundwater Quality Viewer provides data from DERM's long-term surface water and groundwater quality monitoring programs intended to characterize county-wide, larger-scale patterns and temporal trends in water quality and help determine background conditions and ranges of normal variability in water quality (Miami- Dade County, 2021).

Modeling can be used as an environmental assessment tool and to support sustainable natural resource management. Additionally, existing data, such as rainfall or water quality parameters, can predict changes in a system over time or under changing circumstances. A model was developed as part of CERP by NOAA representatives, SFWMD, DERM, and USFWS. It's related ecological attributes of the Bay to outside forcing functions, identified as water management, watershed development, and sea-level rise and showed the effects that a change in water flow can have on Biscayne Bay, adjacent lands, and the species that reside there (Browder et al., 2005). Some concepts emerging from the model relate to roseate spoonbill (*Platalea ajaja*) habitat and the impacts of changes in timing, location, and volume of water flow. Though areas studied in this modeling project focused on the southern portion of Biscayne Bay, applications for future models could potentially apply to areas within the northern bay. BBAP staff attended a meeting sponsored by the SFWMD concerning modeling efforts for Biscayne Bay in 2007 and discussed modelling deficits. In 2014, USGS developed and calibrated a coupled surface water/groundwater model of the urban areas of Miami-Dade County. This model examined the hydrologic conditions in urban Miami-Dade County and the effect of groundwater pumpage and increased sea level on canal leakage and regional groundwater flow (Hughes & White, 2016). In 2019, USGS developed the Biscayne and Southern Everglades Coastal Transport (BISECT) model, combining a surface water and groundwater model application to simulate past, present, and future hydrological conditions in Biscayne Bay. Future management considerations should consider water quality models for Biscayne Bay. However, the high cost of modeling projects places limits on agencies that can conduct large scale modeling tasks.

Several Biscayne Bay and related watershed models were created to answer key questions, including

the sources and quantities of freshwater delivered to Biscayne Bay, (groundwater seepage, rainfall, canal outflow, stormwater runoff, etc.). Other models simulate salinity patterns, precipitation, and the hydrodynamics (how water moves) of the bay, such as water circulation and water residence times within particular basins (Wolfe, 2007; Lohmann et al., 2012). Predictions from models developed to illustrate how groundwater moves into the bay and resulting salinity patterns have significant uncertainties due to the Biscayne Aquifer, known to be highly porous with many cavities where water may travel at different speeds. The primary or secondary purpose of most Biscayne Bay models is the prediction of changes resulting from the implementation of CERP projects designed to restore freshwater sheetflow to southern and central Biscayne Bay. The Corps developed the Biscayne Bay Hydrodynamic Model Phase I that models hydrodynamics and salinity in Biscayne Bay.

The Biscayne Bay Box Model simulates salinity regimes in the bay and was expanded to include mass balance calculations of total phosphorus and dissolved inorganic nitrogen. The three-dimensional finite-element hydrodynamic code (TABS-MDS) also simulates salinity regimes and is considered a more complex model (Marshall & Nuttle, 2011). DERM´s Stormwater Model examines stormwater and flood regimes in the county. A Groundwater Discharge to Biscayne Bay Model developed by USGS simulates groundwater discharge to Biscayne Bay. Dr. John Wang of RSMAS created the South Biscayne Bay Hydrodynamic Model to illustrate salinity variability due to tides, wind and freshwater input (Wand, Luo, & Ault, 2003). Other uses might include forecasting the fate and transport of suspended or dissolved matter. The North Biscayne Bay Hydrodynamic model, also developed by Wang, models flow of water in north Biscayne Bay due to tides, wind, and freshwater input. Florida Atlantic University in cooperation with SFWMD developed the South Miami-Dade County Groundwater Flow Model to support the Lower East Coast Water Supply Plan by explaining modeling groundwater and wetland flows, as well as groundwater quarry interaction.

The North Miami-Dade County Groundwater Flow Model (also known as Version 3.0 of the Lake Belt Groundwater flow model) developed by the SFWMD supports the Lower East Coast Water Supply Plan and the Water Preserve Area Analyses for CERP. It models groundwater and wetland flow and groundwater quarry interactions. The SFWMD developed the South Florida Water Management Model that simulated responses to different regional water management strategies. The Integrated Wetlands Treatment Model developed by the University of Florida, in cooperation with SFWMD, simulates spatial and temporal dynamics of surface and shallow groundwater hydrology and water quality, thus examining the effects of spatial land use configurations, development intensities, and wetland network arrangements. BNP, MDC and the Corps are updating the existing hydrodynamic and salinity transport model. The hydrodynamic data collection program was developed to better understand circulation patterns within Biscayne Bay as part of CERP. Collected data validates models used for the CERP Biscayne Bay Coastal Wetlands project and provides information for the RECOVER monitoring and assessment plan. The revised hydrodynamic model will reflect three-dimensional salinity conditions and will, in turn, help to determine the importance of freshwater inflow on salinity and circulation patterns in Biscayne Bay. In 2020, scientists from RSMAS and FIU created a model evaluating the resilience of seagrass communities exposed to pulsed freshwater discharges in Biscayne Bay. Combining remote sensing and population modelling approaches, it provides evaluation and predictive tools that can be used by managers to track seagrass stress response at seascape levels (Stipek et al., 2020).

A long-standing objective of Biscayne Bay's scientific community has been to define a water budget that would quantify the amount of freshwater entering the bay from sheetflow, rainfall, canals, groundwater seepage, and stormwater runoff. A water budget would take into account how much water could be stored in the aquifer versus how much is moved to surface waters. Submerged groundwater springs can likely be explained by the occurrence of preferential pathways through limestone that are created when water dissolves the rock along its fractures. This can increase the overall rate of transmissivity of the aquifer or the rate at which water moves through it. Biscayne Bay's aquifer is unconfined meaning that it is not bound on the top by a confining or semi-confining unit. Because of this, withdrawals from an unconfined aquifer lower the water table by dewatering pores in the limestone; however, pores will refill if the water table is allowed to rise. When canals are drawn down during the wet season the water table is lowered, and the aquifer is not given an opportunity to recharge. Canals are in direct hydraulic

connection with the highly permeable Biscayne Aquifer as they recharge the aquifer during the dry season and drain the aquifer during the wet season (Langevin, 1999).

***Seagrass Monitoring***

Seagrasses and macroalgae communities exist throughout Biscayne Bay. DERM's Benthic Habitat Monitoring Program collects water and seagrass samples from basins within BBAP and analyzes for a variety of chemical, physical and biological parameters. DERM's design includes two levels of SAV monitoring. The first (Level 1 sampling) consists of sampling fixed locations throughout the bay, which helps identify trends in vegetation cover. The second (Level 2 sampling) consists of stratified random sampling methods that provide status, trend, and spatial data of benthic communities of the central and southern bay. Stratified random sampling divides the study population in the different sections, or strata, and looks at each stratum independently. In September 1985, a series of fixed transects were positioned throughout the bay, and initially, sampling was conducted quarterly at 12 sites. Three additional sites were added in 1989, two in Manatee Bay and one in Barnes Sound. Currently, sampling occurs annually during June at 10 of the original 12 sites. Monitoring stations, located near Black Ledge and Turkey Point, were discontinued in 1996. DERM 's SAV monitoring program in Northeast Florida Bay incorporated three stations added in 1989, and since 2010, sampling is conducted at these sites on a semiannual basis in May and November. Sampling parameters include seagrass shoots, blade density, standing crop biomass by species, and seagrass composition along a 45 m transect. Level 2 sampling began in 1999. It consists of stratified random sampling similar to the methods currently used in Florida Bay and FKNMS. The monitoring network consists of 101 stratified random sites sampled annually using modified Braun-Blanquet cover-abundance scale, which describes the quantities and types of vegetation that cover an area. Frequency, abundance, and density of vegetation are calculated for each site. BBAP staff use this information to observe any shifts in species composition or irregular water quality that exceeds standards, such as elevated levels of chlorophyll a. The Biscayne Bay Report Card produced by MDC reports indicators of habitat quality (seagrasses, macroalgae, and marine sponges). Seagrass and macroalgae habitat scores are combined and reported as "submerged aquatic vegetation" or SAV. The data collected for this report is part of DERM's Benthic Habitat Monitoring Program.


*Map 11 | Current submerged aquatic vegetation monitoring sites in Biscayne Bay Aquatic Preserve*

The Shallow Water Positioning System (SWaPS) is an innovative survey method developed by scientists from NOAA's National Geodetic Survey to establish the precise position of objects and organisms in shallow-water environments and provide a permanent, geocoded visual record of the bottom. Currently

*Photo 7 | BBAP staff members conduct natural resource monitoring surveys to better understand areas that are in desperate need of natural resource restoration efforts. Here a staff member examines a small patch of seagrass within an algae dominated area.*

SWaPS programs are monitoring coral reefs, seagrass communities, and damage assessments, such as seagrass scars and ship groundings. SWaPS provide research opportunities to quantify patterns of damage and recovery on shallow coastal habitats (NOAA, n.d.-a). SWaPS use a GPS receiver centered over a digital video or still camera suspended in a glass enclosure, providing a clear view of the bay bottom. The digital images obtained are encoded with GPS position, time, date, depth, heading, and pitch and roll, providing an immediate permanent archive. Post-processing the GPS data allows the user to recover the same position again with a high level of accuracy. SWaPS are available in three survey platforms including boat, remote, and diver platforms, that can access different types of habitats under different field conditions. The advantages of using a program like SWaPS include the ability to survey large areas rapidly without the need to deploy divers or specialized field personnel with a permanent photographic or video log of the assessment (NOAA, n.d.-a). The goal of the Biscayne Bay SwaPS Project is to develop and implement a monitoring program to survey shallow, near-shore benthic habitats. These critical habitats have been underrepresented in previous and ongoing monitoring efforts due to the difficult boat access in shallow areas of depth less than three feet. The location of these habitats makes them susceptible to potential changes in freshwater deliveries as proposed through CERP. In 2008, a team of researchers conducted video monitoring surveys of nearshore benthic habitats of western Biscayne Bay using SWaPS. The goal of the project was to document the abundance and distribution of benthic organisms in shallow habitats in Biscayne Bay. The surveys showed species distributions are influenced by tolerances to salinity. Seagrass species with relatively high tolerance for low salinity (*Halodule wrightii* and *Ruppia maritima*) tend to have high abundance in areas influenced by outputs, while species with relatively limited tolerance for low salinity (*Thalassia testudinum*) tend to increase in abundance further from outputs (Lirman et al., 2008) Images collected with SWaPS are valuable archives that can provide the baseline information needed to evaluate long-term patterns of environmental change.

In 2015, NOAA designated Biscayne Bay and its adjacent reef tract as the Southeast region's Habitat Focus Areas. These Habitat Focus Areas are identified by experts as places where NOAA can increase the effectiveness of its science and coordination efforts to better protect highly valued natural resources

and habitats at risk. The goals of the Biscayne Bay Habitat Focus Area are to understand and manage major sources of nutrients that contribute significantly to algal blooms in Biscayne Bay, improve freshwater inflows to improve conditions in western nearshore Biscayne Bay, and support and enhance recovery of protected species and their habitats. This effort also promotes sustainable fisheries through protection and restoration of their habitats and also increases public awareness of the ecological, economic, and social benefits of the bay (NOAA, 2019).

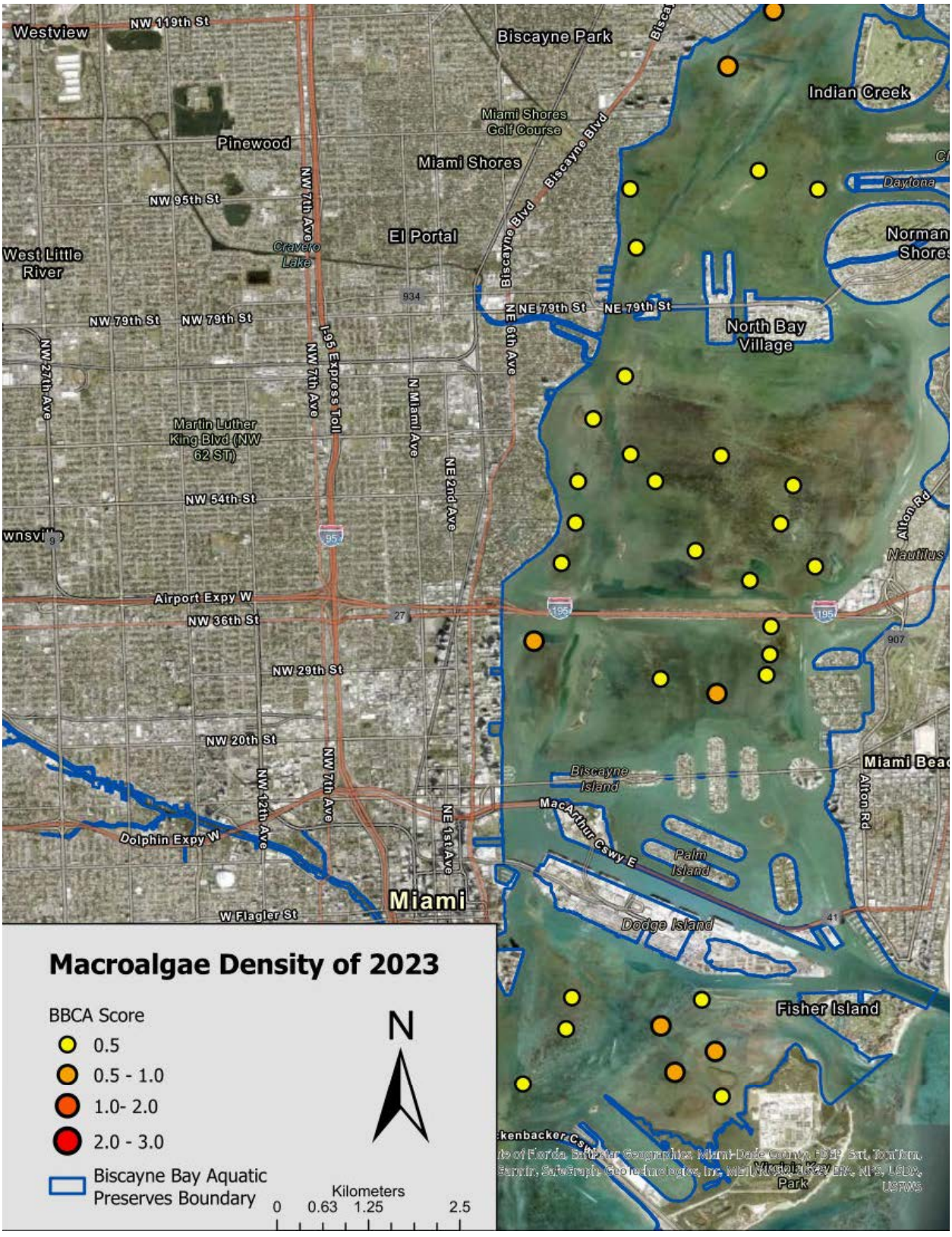
Abundance and distribution of SAV communities of Western Biscayne Bay have been studied to determine their human and natural drivers. Nitrogen (N) and Phosphorous (P) ratios in seagrass tissue suggest that Biscayne Bay receives high N inputs and is P-limited. Data suggest that increased salinities will increase seagrass abundance and support codominance by *Halodule* and *Thalassia* but raise concerns that high N availability and increases in P may shift the ecosystem from seagrass-dominated to algal-dominated communities with increased freshwater inputs (Lirman et al., 2014).

### *Sediment Monitoring*

Monitoring of the sediments in Biscayne Bay is another important way for scientists and managers to gather data on the historical conditions in the bay. This is helpful when determining freshwater input restoration targets, as well as identifying the potential threats to the bay's ecology. The use of foraminifera, a class of microscopic, shelled protists (single-celled organisms), can be used as bioindicators of coastal pollution. Foraminifera have short lifespans and are among the last to disappear from the site they inhabit, thus they are a good environmental indicator species. Foraminifera remain well-preserved in the sedimentary record, are widely distributed, and are cost-effective to sample with minimal impact to the environment. They are commonly referred to as "forams" and studies of foram assemblages (more than one species lives in a community) date back from the 1940s through the present. Studies have provided information on historic salinities in the Bay and changes over time, as well as heavy metal contaminants from industrial activities (polychlorinated biphenyls) and agricultural runoff (pesticides). Deformities of the foram's shell can indicate presence of pollutants. The Foraminifera in Reef Assessment and Monitoring Index provides resource managers with an independent measure of coral populations to determine whether or not water quality in an area is suitable for coral growth or recovery. This index is being adapted so that it can be used as a resource assessment tool in a subtropical estuary such as Biscayne Bay. In the future, a comprehensive document might be produced to indicate changes that have occurred in Biscayne Bay over the past six or seven decades and provide a baseline as CERP projects move forward. The Southeast Florida water and sediment sampling plan selected 10 sampling sites (Oleta River, Haulover Inlet, Government Cut, Norris Cut, Snapper Creek, Virginia Key Beach, Deering Estate, Chapman Field, Chicken Key, and Cape Florida) within the north, south and central parts of the Biscayne Bay subregion were selected for their uniqueness and habitat quality, such as areas adjacent to five state parks, the state critical wildlife area, and dense mangrove forests and seagrass beds. Many sites were sited adjacent to stations monitored by various agencies because of the added benefit of having long-term water quality and/or submerged aquatic vegetation datasets (U.S. Department of the Interior, 2010).

### *Epibenthic Monitoring*

Epibenthic organisms are those that live near the surface of bay bottom sediments. While some seagrass maps and maps of the bay bottom might sometimes describe areas without seagrass, macroalgae, or coral as "barren," this is hardly the case. Over 500 species of marine worms make their home in the sediments of Biscayne Bay as do many other organisms seeking shelter such as some species of fish, crabs, and rays. Other organisms find the food they need as they stir up the sediments, such as nurse sharks and rays. NOAA's Integrated Biscayne Bay Ecological Assessment and Monitoring Project (IBBEAM) currently conducts field sampling twice a year in the wet (July-Sept.) and dry (Jan.-April) seasons at 47 sites located between Shoal Point and Turkey Point along the shoreline in central to southern Biscayne Bay as part of an epibenthic monitoring program (NOAA's Southeast Fisheries Science Center, 2020). The goal of the program is to be able to determine what species of fish, crabs, and other organisms live along the shoreline and are able to survive at salinities that range from zero to 35 parts per thousand (ocean salinity). When the water control structures within the canals along the




*Map 12 | Macroalgae monitoring in northern Biscayne Bay Aquatic Preserve.*

central-southern shoreline of the bay are opened, the freshwater pulse can turn the bay's salinity from 30-35 parts per thousand to zero in a matter of minutes, creating a salinity regime that is inhospitable for many larval and adult stages of fish and invertebrates.

***Bird Monitoring***

Hydrological changes within a watershed can stress native bird species as wetlands that drain too quickly are unable to maintain ample food supplies for wading birds. This can lead to diminished or failed reproductive efforts. Other anthropological activities have more direct and immediate consequences on these native bird communities. Therefore monitoring, education and maintenance of their natural habitats are reasonable steps in addressing many of the anthropological issues facing wading and diving bird colonies. Efforts to provide the public with information on safe wildlife viewing procedures and proper boating distances is of great importance.

Prior to 1900, it was an annual tradition in the United States to hunt birds each Christmas during the annual "Christmas 'Side Hunt.'" Ornithologist Frank Chapman proposed a new tradition on Christmas day in 1900 – a Christmas Bird Census. Since then, the annual count that takes place across the country is known as the Christmas Bird Count (Audubon, n.d.). Northern Biscayne Bay has historically been a part of the count—from the years 1982 through 2002. Tropical Audubon Society member Robert Kelley, who is thought to have bridged two generations of bird conservationists in South Florida, led the Miami team who ventured into Biscayne Bay by boat to conduct the count. Specifically, volunteers traveled to Virginia Key and the Little River to document endangered species, such as the peregrine falcon (*Falco peregrinus*) and the bald eagle (*Haliaeetus leucocephalus*), as well as threatened species, such as piping plover (*Charadrius melodus*), black skimmer (*Rynchops niger*) and the tricolored heron (*Egretta tricolor*). This effort was brought to an end shortly before Kelley's passing. Since 2010 BBAP staff have participated in the count by boat as weather permitted.

*Photo 8 | Mangroves and other native flora provide habitat for nesting and roosting birds, like this male magnificent frigatebird (Fregata magnificens).*

Water birds are an ecologically important component of the coastal ecosystems in which they inhabit. They aid in nutrient transfer between marine and terrestrial ecosystems, serve as a control on fish populations through predator-prey interactions, and can serve as bioindicators of ecological health. Historically, Bird Key, has served as a rookery and roosting habitat for many species of water birds. In 2019, this rookery collapsed for unknown reasons. BBAP and FWC has documented a rookery shift to nearby Mangrove Island that is owned by the City of Miami Parks. The remaining islands within northern Biscayne Bay are spoil islands and are used less frequently by water birds.

Beginning in 2016, BBAP staff have participated in FWC's Winter Shorebird Survey in February, which is a single day statewide survey of shorebirds and seabirds in Florida. In early 2020 BBAP initiated monthly bird monitoring on 4 islands in northern Biscayne Bay. Following FWC guidance in 2024 these surveys

were switched from roosting to nesting surveys. In response to stakeholder concern and data collected from these surveys BBAP has purchased six buoys that state “Caution Bird Nesting” to place around the island to help reduce disruptions to the nesting colonies.

***Monitoring of Marine Reptiles and Mammals***

MDC Parks and Recreation Department conducts Sea Turtle Monitoring. No documented sea turtle activity exists prior to 1980, largely due to the lack of available beach nesting habitat. In 1979, the Parks and Recreation Department’s Sea Turtle Conservation Program began a comprehensive beach renourishment project. After that time, sea turtle activity was more abundant than today. The program documents roughly 600 nests on the County’s beaches every year (Miami-Dade Sea Turtle Conservation Program, n.d). The FWC delegates authority for sea turtle monitoring to County staff. Staff walk the beaches of Key Biscayne that are not scoured by industrial machines each day during nesting season to remove seagrasses and other natural material, mark where nests are located and monitor nest progress. The Marjorie Stoneman Douglas Biscayne Nature Center on the Atlantic Ocean side of Key Biscayne rescues hatchlings where there is heavy public access and incubates the eggs and subsequently releases them during moonlit walks that are available to the public on a first come, first-served basis. The Miami Seaquarium accepts sea turtles reported as injured within Biscayne Bay and near shore waters and attempts to rehabilitate them. Bill Baggs Cape Florida State Park, located at the southern tip of Key Biscayne and bordered by BBAP, is the preferred location for sea turtle release, once turtles are rehabilitated at an approved facility, such as the Miami Seaquarium in Miami-Dade County.

*Photo 9 | Dolphins are a common sight in Biscayne Bay.*

NOAA’s Southeast Fisheries Science Center (SEFSC) conducts a bottlenose dolphin (Tursiops truncatus), monitoring program in Biscayne Bay, using photo-identification techniques to observe natural markings on animal dorsal fins to identify individuals over time. This information helps determine residency patterns and abundance of bottlenose dolphins residing in Biscayne Bay (SEFSC, 2021). in August 1990, Dr. Jenny Litz and Dr. Joe Contillo from NOAA initiated a study that identified a total of 180 individuals from 390 sightings while conducting surveys. Of these individuals, approximately 75% are considered to be full time residents of Biscayne Bay. The study area runs from Haulover Inlet, south to Card Sound Bridge, encompassing an area of approximately 250 square miles. The behavioral studies component includes observing and monitoring habitat use, movement patterns, and other behaviors

exhibited by Biscayne Bay bottlenose populations. A program called FinBase allows scientists to compare dolphin dorsal fin images from the photo-ID projects in adjoining study areas to determine the extent of animal ranges.

***Water Management***

In 2009, the EPA made a formal determination that numeric nutrient criteria are necessary for estuarine and coastal waters and proposed criteria and a method of sub-sectioning waterbodies shortly thereafter. DEP launched a collaborative effort to develop scientifically defensible and protective criteria for marine and estuarine waters. Physical and chemical factors, such as hydrogeology and geologic history, were included for which criteria were established; other parameters, such as nutrients, salinity, and dissolved oxygen and regional models were considered (Frydenborg, n.d.). The agencies have held public meetings in various parts of south Florida and other cities throughout the state. MDC, DERM, FIU, SERC, and BNP were the primary suppliers of data sets used by Dr. Henry Briceno of FIU in deriving protective nutrient criteria for Biscayne Bay. The Florida Marine Numeric Nutrient Criteria Technical Advisory Committee supplied a technical supporting document to DEP for review. Originally, Florida was divided into eco-regions. southwest and southeast Florida was considered one unit for which criteria would be derived. Scientists and managers in MDC, however, made a case to consider Biscayne Bay (and other coastal systems) apart from each other based on geology and historic nutrient data. Because of Biscayne Bay's limestone foundation and historically oligotrophic nutrient conditions set it apart from other eco-regions, Briceno, from FIU, used datasets from local partners to justify this decision and proceeded to divide the bay into sub-regions.

In the northern part of BBAP, where nutrient loading from anthropogenic inputs has historically been high, the median total phosphorus value was found to be less than 10 parts per billion. The highest total phosphorus in Biscayne Bay is about 12 parts per billion falling into the 75th percentile of the dataset, Phosphorus values in Biscayne Bay are phosphorus-limited and rival those of the Everglades restoration with values at or below 8 parts per billion (Briceno et al., 2010).

In response to the high pollution levels the EPA declared Biscayne Bay an impaired waterbody in 2017 requiring the state of Florida to study the water body and take action to improve its water quality. DEP developed nutrient criterion for the bay from the existing conditions between 1995 and 2009. It was demonstrated that the bay supported heathy communities during this period therefore being a appropriate standard. From this investigation DEP decided to set numeric nutrient criteria for Total Nitrogen, Total Phosphorus, and chlorophyll a. The specific criteria vary throughout the estuarine nutrient regions in the bay. The state and MDC chose to address the nutrient problem through a Reasonable Assurance Plan (RAP). With state guidance, MDC started the RAP process in 2022 and the county submitted a RAP Plan of Study in 2024. The Biscayne Bay Commission was created by Florida Governor DeSantis in 2021 to monitor the natural resources within Biscayne Bay. The goal of the commission is to "unite all governmental agencies, businesses, and residents in the area to speak with one voice on bay issues; to develop coordinated plans, priorities, programs, and projects that might substantially improve the bay area; and to act as the principal advocate and watchdog to ensure that bay projects are funded and implemented in a proper and timely manner." (s. 163.11, F.S.).

The commission is comprised of nine members who are responsible for holding quarterly meetings throughout the year and publishing semi-annual reports. DEP aids in the facilitation of Commission meetings and coordination of its member entities and representatives. The commission is charged with adopting a "coordinated strategic plan for improvement of Biscayne Bay and the surrounding areas, addressing environmental, economic, social, recreational and aesthetic issues" (s. 161.11, F.S.). This first strategic plan focuses on water quality and natural system restoration and is intended to be paired with initiatives prioritized by the Biscayne Bay Task Force, which was developed by MDC and to ensure proper and timely completion of the RAP.

An aspect of water management that must be addressed in Biscayne Bay and other coastal areas in South Florida is the quantity of freshwater available for the protection and restoration of water bodies. Protecting volumes of freshwater from consumptive uses is the jurisdiction of the SFWMD. Water needed for CERP projects is in need of protection from consumptive uses that compete with restoration goals.

Different levels of protection from consumptive use that water bodies can receive include the designation of minimum flows and levels (MFLs), restricted allocation areas (RAA), and water reservations. The Biscayne Aquifer has already been afforded a minimum flows and level designation which is protection from further withdrawals that will cause “significant harm” to the water resources of the area per 373.042 and 373.0421, F. S.

***Support***

BBAP staff provides support for research performed by public agencies and by private groups desiring to propose mitigation projects within the aquatic preserve. BBAP will conduct site surveys for regulatory staff headquartered in West Palm Beach at DEP’s Southeast District Office. The BBAP manager has also supported the teacher training efforts of the Coral Reef Conservation Program’s Awareness and Appreciation Coordinator by providing a presentation on the role of and connections between estuaries and coral reefs. BBAP supports numerous nonprofits in Biscayne Bay by hosting public marine debris clean ups and helping to provide water samples when necessary.

***Water Quality Monitoring***

Long-term monitoring of water quality provides necessary data for staff to evaluate the status and trends within the bay. In 2019, BBAP staff established a water quality monitoring program to enhance the ecosystem level approach to understanding the seagrass die-off in the Julia Tuttle Basin. This was done by creating two additional data streams: the first through monthly WQ bottle grabs and the other through continuous monitoring with data loggers. Using DEP WQ protocols, BBAP selected 16 sites within Northern Biscayne Bay to collect monthly water quality samples that are sent to DEP’s Division of Environmental Assessment and Restoration (DEAR) laboratory. Site selection was influenced primarily by sourcing pollutants in and around the Julia Tuttle Basin to determine possible causes for the seagrass decline. All samples are collected one foot from the bottom. Some sites have historical data from DERM or USGS.

DEAR analyzes 39 parameters including: chlorophyll-*a*, total suspended solids, total organic carbon, dissolved organic carbon, four nutrients (ammonia-N, NO2NO3-N, Kjeldahl nitrogen, total-P), two artificial sweeteners (sucralose, acesulfame K), six pharmaceuticals (acetaminophen, carbamazepine, hydrocodone, ibuprofen, naproxen, primidone), fifteen herbicides/fungicides (AMPA, endothall, glufosinate, glyphosate, 2 4-d, bentazon, diuron, fenuron, fluridone, imazapyr, linuron, pyraclostrobin, triclopyr, mandestrobin, MCPP) and eight insecticides (imidacloprid, acetamiprid, afidopyropen, benzofindifupyr, clothianidin, dinotefuran, thimethoxam, tolfenpyrad).

BBAP simultaneously initiated a continuous datasonde logging program at three sites within the Julia Tuttle Basin, one by the salinity control structure in the Little River and two within the seagrass shoal.

BBAP received an EPA grant for water quality monitoring in Northern Biscayne Bay, with relation to Lake Okeechobee discharge, in October 2019. The funding allowed for a Water Quality Specialist staff member as well as supplies funding for more datasondes and accessories. BBAP staff were able to purchase six more datasondes, which were used to create four more sites within the Miami River and its outflow basin, the Rickenbacker Basin. In March 2021, the two sites within the Miami River were established successfully and approval from FWC for piling usage for the two sites in the Rickenbacker basin was granted. The new datasondes were also used to upgrade the sites in the Julia Tuttle Basin to newer datasondes. Along with the continuous monitoring, in April 2021, BBAP staff started collecting water samples at three sites within the Miami River to be sent to DEAR labs. In summer 2021, seven additional WQ sampling sites were established within the Miami River and Rickenbacker Basin.

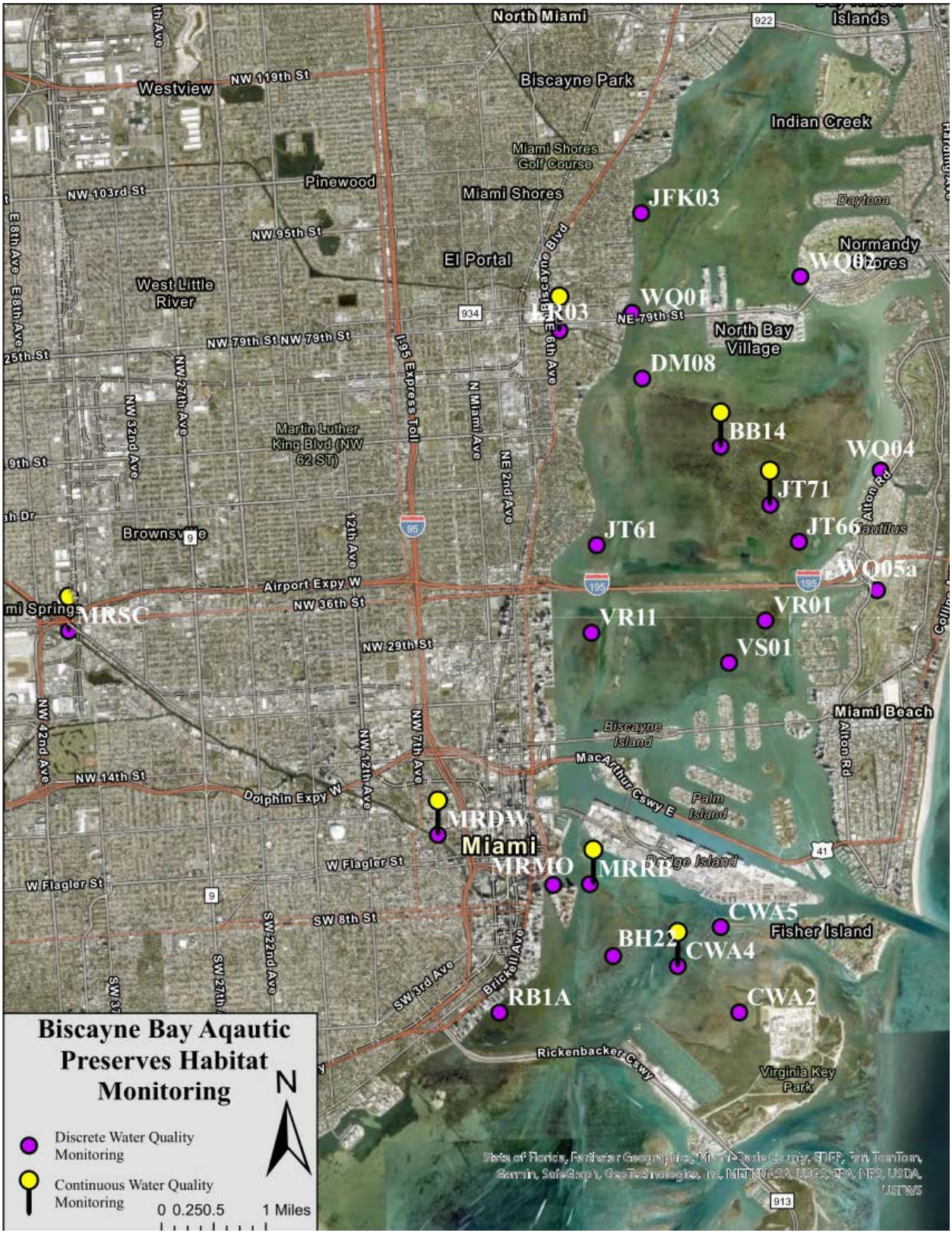
*Photo 10 | BBAP staff conducting water quality monitoring on a quiet morning in the bay*

The data from the datasondes is collected in 15-minute intervals for nine parameters (water temperature (°C), specific conductivity (mS/cm), salinity (psu), dissolved oxygen (%), dissolved oxygen (mg/L), depth (m), pH, turbidity (NTUFNU), and chlorophyll (RFU and ug/L) and Blue-Green Algae (RFU and ug/L)) using protocols established by the National Estuarine Research Reserve's System-Wide Monitoring Program. This program is paired with the North Biscayne Bay Water Quality Program and relates to the benthic data collected in the North Biscayne Bay Seagrass Loss Monitoring Program (DEP & South Florida Regional Planning Council, 2020).

The Water Quality Specialist is responsible for site establishments, all calibrations, deployments and maintenance of the datasondes as well as quality control and quality assurance (QAQC) of the data. All data collected through the continuous monitoring program undergoes a three-step QAQC protocol quarterly and is publicly available on the DEP-hosted Aquatic Preserve Data Portal. The monthly water quality bottle grab data undergoes QAQC monthly by DEAR and the water quality specialist and is publicly available through SEACAR and the Watershed Information Network (WIN). Data from WIN influences the assessments that establish water bodies under the Florida Impaired Waters Rule .

BBAP staff also obtain access to data through established partnerships with agencies that collect and/or fund water quality monitoring programs within Biscayne Bay from the Rickenbacker Causeway, south to Card Sound, focusing on CERP restoration. Research, however, does not spatially represent all Biscayne Bay. Although water quality and benthic monitoring is strong in the northern portion, little is known about larger ecosystem dynamics.

Improving Biscayne Bay's water quality will require significant reductions in the levels of pollutants within its watershed. Groundwater quality within the Biscayne Aquifer must also be improved given that the aquifer is the bay's watershed. Currently, there are programs in place to protect Biscayne Bay's natural resources from industrial contaminants from marinas and other water-dependent activities, as well as inland industrial sites and nonpoint-sources of pollution. Thes programs include Florida's Protecting Florida Together Biscayne Bay Grant, septic to sewer conversion programs, and DEP's Clean Marina




*Map 13/ Water quality monitoring sites of Biscayne Bay Aquatic Preserve*

program. The Environmental Resources Management's Restoration and Enhancement Section manages a Biscayne Bay restoration program (MDC, 2014). Upon request, DERM provides water quality and epibenthic data measured from its own monitoring stations throughout Biscayne Bay.

DERM visits its 105 stations during the first week of each month for their Bay Run sampling program. Twenty-four parameters including chlorophyll a (CHLa), color, turbidity, total Kjeldahl nitrogen (TKN) and orthophosphate (TPO4) sampled bimonthly; as well as coliforms (total and fecal), total ammonia (TNH3), nitrite+nitrate (NOx), and total phosphorus (TP), sampled monthly. Additional field parameters measured on site or through laboratory analysis of grab samples include dissolved oxygen (DO), salinity, temperature, specific conductance, pH, photosynthetically active radiation (PAR), turbidity and apparent watercolor. Most analyses are performed on samples taken at one meter's depth, but some samples are duplicated at the surface and bottom of the water column.

Continuous work on water quality is conducted as part of the DERM's National Pollution Discharge Elimination System monitoring program. This program provides water quality monitoring of nutrients, chlorophyll, and fecal coliform monthly at 87 designated sampling sites around Biscayne Bay and drainage creeks/canals. DERM also conducts annual sampling for potential contamination associated with pesticides and organic contaminants. The MDC also cites several possible methods to improve water quality, including "development and use of best practices, improvements in pollution prevention technology, air and water quality treatment, land-use and stormwater regulations and environmental remediation and restoration" (Troxler et al., 2017).

Samples are collected in the vicinity of the Miami Beach barrier islands, within BBAP. Sites closer to shore are used characterize the effects Miami Beach storm drains have on BBAP water quality. Storm drains provide flood relief in the City of Miami Beach by draining directly into Biscayne Bay. Miami environmental staff has undertaken a "Drains to Biscayne Bay" campaign to remind citizens about the debris and contaminants that make their way into the bay.

Miami Waterkeeper, a non-profit organization that works out of Biscayne Bay, initiated water quality monitoring in 2019 to collect data on fecal coliforms. They collect data through the bay weekly and input the information into the Swim Guide app for the public to determine the safety of popular swimming locations. After the August 2020 fish kill in Biscayne Bay, the Waterkeeper facilitated daily partnership meetings with local agencies and universities. The purpose of the meetings was initially for transparency in data and observations between agencies and evolved (as the meeting frequency decreased) into a working group to understand and prevent fish kills within BBAP. In early 2021, the monthly "fish kill partnership" meetings transitioned into a "science collaboration group" meetings to share and synchronize research efforts within the bay. These meeting continue to be an important way to increase communication amongst managers, scientists, and stakeholders in the bay.

#### *4.1.3 / Ecosystem Science Issue / Issue One: Water Quality*

Water quality has improved substantially since the mid to late 20$^{th}$ century when rampant dredging and filling and open dumping of sewage and waste was the normal practice. However, in the last 40 years, water quality has been substantially altered and in decline due to increased urban development, growing populations, hydrologic changes, water management practices, and adjacent land uses, particularly in Northern Biscayne Bay. The water quality in Biscayne Bay has been significantly affected by coastal and watershed development. In August of 2019, a grand jury held by the Miami-Dade State Attorney's Office forewarned that Biscayne Bay was at a "tipping point" and that without corrective action, the bay would surely suffer from irreversible damage (FIU Institute of Environment, 2020).

Biscayne Bay receives considerable amounts of nutrients, trace metals, organic chemicals and particulates from stormwater runoff, canal discharge, and other sources. Pressures such as proximity to urban development, agricultural and stormwater runoff, septic tank vulnerability, nutrient concentration shifts, marine debris and contaminants, and sewer overflows have led to water quality varying significantly throughout the bay. While some measures have been taken to address specific water and sediment quality related problems including turbidity, sewage main breaks, inputs of nutrients, and residual and persistent contaminants, they still need to be closely monitored to ensure they do not

continue to degrade water quality in the bay. Areas in the northern and the western central half of the bay received fair or poor grades from the Health-of-Biscayne-Bay–Report-Card-Program because they failed to meet local, state, and federal standards for recreational uses and propagation of fish and wildlife (Cava, 2020). Water quality of the Little River as it enters Biscayne Bay has exceeded the numeric nutrient criteria for both chlorophyll *a* and phosphorus for the bay nearly every year during the past 20 years, causing eutrophication (Millette et al., 2019). In 2018 and 2019, high levels of bacteria led to beach closures and public health concerns. These bacterial levels were associated with a number of sources including sewage and septic tank leaks, algae that washed up on beaches, and animal feces (MDC, 2019). These seagrass die-offs were associated with excess nutrients in the water leading to a phase shift from a seagrass-dominated habitat to algae-dominated with increased turbidity (FIU Institute of Environment, 2020).

While nutrients are key to the growth and development of marine life, excess nutrients in the water can degrade bay water quality. Sustained declines in water quality, seagrass die-offs, and recent fish kills indicate that urgent action is needed to decrease nutrient loading in the bay (Biscayne Bay Marine Health Summit, 2020). Water quality stressors have contributed to loss of wetland and seagrass communities, which have caused a negative feedback loop contributing to further physical and ecological changes in the bay's water quality. In 2019, a Miami-Dade study reported a significant decline in seagrass meadows over the last decade occurring in three main regions of the bay: Barnes Sound and Manatee Bay basins, the central portion of Biscayne Bay near Coral Gables, and basins north of Rickenbacker Causeway. NOAA recently designated Biscayne Bay as one of their new "Habitat Focus Areas", prompted by concerns of declining water quality in the bay (FIU Institute of Environment, 2020). Protecting water quality in Biscayne Bay is key to supporting the overall health of the bay's ecosystem; therefore, efforts are now focused on helping to mitigate the effects of water quality stressors.

Other water quality concerns relate to the quantity, timing, and distribution of fresh water currently received by Biscayne Bay from natural sheetflow, groundwater, and tributary inputs, often in the form of pulsed, point source discharges accompanied by debris, contaminants, yard and pet waste, and nutrients from fertilizers. Timing and distribution of this much needed freshwater also adds to water quality concerns. BBAP will remain engaged throughout the planning and implementation processes that are part of Comprehensive Everglades Restoration Plan (CERP). Data collected as part of CERP's Monitoring and Assessment Program and other key programs provide insights as to the current status of the ecosystem by evaluating, among other things, species present that might indicate salinity levels. With the initiation of the of the CERP Biscayne Bay Coastal Wetlands project in 2023 and salinity levels decreasing in an attempt to restore a lower salinity environment in the near shore area, scientists expect to see a shift back to the kinds of species that require lower salinities to thrive (SFWMD, 2024).

MDC DERM still possesses water quality since 1979 and benthic monitoring data since 1985, providing information about the bay's overall health and the obstacles it faces.  MDC DERM still possesses water quality data since 1979 and benthic monitoring data since 1985, providing information about the bay's overall health and the obstacles it faces. Providing the general public with this kind of information - those residents that live inland as well as along the water's edge - is challenging for many reasons. Not all of this material is available in other languages, such as Spanish or Haitian Creole and not all information has been presented in a format that is easy to understand. It is important for residents to know how to become stewards of their local natural resources regardless of their proximity to the water.

Since 2018, BBAP has worked with internal and applied for external funding sources to help provide and expand equipment and staff resources to monitor water quality in BBAP. DEP's CRCP, DEAR, and Office of Ecosystem Accountability and Transparency all provided loans for existing equipment for funding for new purchases of continuously monitoring datasondes. In 2019, BBAP was awarded a three-year Environmental Protection Agency grant to fund a Water Quality Specialist OPS position and purchase equipment to study water quality issues via continuous monitoring. This allowed for the purchase of a suite of new datasondes, replacing some older previously loaned models. Further funding was acquired from the Friends of Biscayne Bay for a final donation. In 2021, Governor DeSantis implemented and funded a new $20 million Biscayne Bay grant program to address water quality related issues and their

impacts on natural resources. This funding has helped convert septic systems to sewer, reduce untreated runoff into the bay, and funded research to advance the community's knowledge on factors affecting bay health.

### *Issue One: Water Quality*

**Goal 1:** Maintain and improve water quality within and entering the preserve to meet natural resources needs.

**Objective 1:** Support local, state, and federal efforts to continue and expand monitoring and research programs, produce analyses of data, define gaps in watershed water quality restoration, identify management strategies, and enact policies to address those gaps in Biscayne Bay.

**Integrated Strategies:**

1. Support, engage, and incorporate the work of county, municipality, and state staff to compile, summarize, and analyze all local agency water quality data.
2. Identify sources of pollutants and turbidity impacting BBAP and its tributaries, with specific focus on the Miami River and Little River.
3. Promote the use of acceptable water quality monitoring standards that enable municipalities to accept data from more sources to increase data volume and reporting speed.
4. Facilitate discussions to develop Total Maximum Daily Load (TMDL) levels, Reasonable Assurance Plans (RAP), and/or Basin Management Action Plans (BMAP) to focus limited local and state resources directly on measures that will improve water quality for Biscayne Bay and its tributaries.
5. Increase public and stakeholder access to historical and current data and resource information.
6. Engage local entities in discussions on matters impacting water quality in the bay, such as wastewater overflows, water quality improvement efforts, septic-sewer conversion, seagrass restoration efforts, and nutrient reduction loads.
7. Enhance citizen science water quality monitoring networks by integrating volunteers into the data collection process to build appreciation for the benefits of restoration, enhancement, and management of natural resources.
8. Encourage municipal groups to record and maintain their water quality data in the Watershed Information Network

**Performance Measures:**

1. Track meetings with county and local governments to discuss and implement a program to analyze point source stormwater discharge from the Miami Beach drainage system (e.g., stormwater runoff, fertilizer use, and upland activities contributing to water degradation).
2. Create and maintain GIS maps of water quality monitoring sites from all partners to identify problem areas and potential sources of pollution.
3. Monitor the number of public presentations delivered where access to existing websites and other historical data and resource information is shared. This includes public presentations, professional lectures, bay-related committee meetings, and similar venues.
4. Maintain and expand BBAP's discreet and continuous water quality monitoring networks

**Objective 2:** Reduce water quality impacts to surface water and groundwater caused by stormwater

within the watershed.

**Integrated Strategies:**

1. Support stormwater system retrofitting at the municipal, county, and state levels, and facilitate dialogue to encourage implementation.
2. Partner with the DEP Coral Reef Conservation Program's watershed management project to target stormwater management issues and implement relevant best management practices.
3. Collaborate with local municipalities and partner agencies to develop and distribute uniform messaging for public stormwater education initiatives.

**Performance Measures:**

1. Track meetings with municipalities bordering Biscayne Bay or located inland to discuss efforts to mitigate water discharge impacts, septic system overflows, and wastewater leaks. Compile and disseminate meeting minutes and participants' deliverables.
2. Document the number of collaborative meetings conducted with the DEP Coral Reef Conservation Program, the identification and adoption of at least three best management practices for stormwater management, and the development of joint reports or action plans addressing stormwater impacts on coral reefs.
3. Measure the development and dissemination of uniform public stormwater education materials by tracking the number of finalized educational resources (e.g., brochures, social media posts, or videos) and evaluate their reach using public engagement metrics such as social media shares, event attendance, or survey responses.

**Objective 3:** Reduce water quality impacts to surface water and groundwater caused by septic system sources within the watershed.

**Integrated Strategies:**

1. Support the conversion of existing septic tanks to sewer systems at the municipal, county, and state levels, and facilitate dialogue to encourage implementation.
2. Facilitate and engage in public awareness efforts to educate residents about septic systems and the impacts of faulty systems on Biscayne Bay's water quality.

**Performance Measures:**

1. Track meetings with municipalities bordering Biscayne Bay or those inland to discuss efforts to discourage the creation of new septic systems. Collaborate with municipalities to develop outreach materials explaining the environmental impacts of septic systems and the benefits of converting to sewer systems.
2. Measure the effectiveness of public awareness efforts by tracking the number of outreach events conducted, the materials distributed (e.g., brochures, social media posts), and engagement metrics (e.g., attendance at events, survey responses, or social media interactions).

**Objective 4:** Work with city, county, and municipal agencies to preserve and restore natural shorelines and enhance armored shorelines adjacent to the aquatic preserve to maintain or restore water quality natural resources, and public access.

**Integrated Strategies:**

1. Coordinate with government agencies and private landholders to identify and support the acquisition of lands (volunteer buyouts) that directly benefit the preserve's natural resources and enhance ecosystem services for the community.
2. Support the regulatory permitting process by informing regulatory staff about resources present in the aquatic preserve.
3. Engage the community in managing natural resources by involving them in existing projects (e.g., adopt-an-island program) and implementing new efforts that integrate marine debris removal, wildlife surveys, and habitat restoration projects (e.g., exotic plant removal).
4. Develop partnerships with governmental agencies and non-governmental organizations to secure funding for designing and conducting habitat restoration and enhancement projects within BBAP.
5. Collaborate with existing programs, such as DEP's Clean Boater, Marina, and Boatyard Programs, to incorporate marine debris and pollution removal into natural resource enhancement and management efforts.
6. Promote the inclusion of public access and education in new and existing living shoreline projects.

**Performance Measures:**

1. Create and maintain a map of lands suitable for acquisition to directly benefit the preserve's natural resources.
2. Track public involvement in projects such as adopt-an-island, marine debris removal, wildlife surveys, and habitat restoration.
3. Develop a guide for ecologically acceptable living shoreline designs that comply with the Biscayne Bay Aquatic Preserve Act restrictions and regulations.
4. Generate a map of existing living shorelines and areas suitable for future shoreline projects, in coordination with other organizations.
5. Engage DEP and county regulatory staff on BBAP-specific issues through joint classroom and in-water training at least once per year to streamline permitting and ensure critical information about natural resources is shared.

**Goal 2:** Increase public and industry awareness about water quality issues in BBAP and what actions can be taken to improve water quality.

**Objective 1:** Inform the public and partners about water quality conditions within BBAP.

**Integrated Strategy:**

1. Develop a BBAP annual report for Biscayne Bay with easy-to-understand and pertinent information about the health of Biscayne Bay, focusing on water quality, submerged aquatic vegetation, island management, and potentially other parameters such as species abundance and diversity if data is available.
2. Collaborate with local and state agencies to translate and distribute important water quality information to the public at outreach events, prioritizing underserved communities.
3. Create outreach materials that explain how individual actions affect BBAP, both negatively and positively, and highlight ways people can help BBAP in their daily lives.
4. Leverage new technology to design outreach materials that effectively describe the water quality challenges BBAP faces.

**Performance Measures:**

1. Produce an annual BBAP report for Biscayne Bay summarizing key metrics, including water quality, submerged aquatic vegetation, island management, and other relevant data.
2. Track and document collaboration with local and state agencies to translate, disseminate, and distribute water quality materials at outreach events, focusing on reaching underserved communities.
3. Update the BBAP website semiannually to display the latest six months of water quality conditions, including analyzed trends and findings.
4. Design and implement outreach materials and campaigns that show how individual actions impact BBAP and offer actionable steps the public can take to improve water quality.

## 4.2 / The Resource Management Program

The Resource Management Program addresses how ORCP manages BBAP and its resources. The primary concept of BBAP Resource Management projects and activities are guided by ORCP's mission statement: "Conserving, protecting, restoring, and improving the resilience of Florida's coastal and aquatic resources for the benefit of people and the environment." ORCP's sites accomplish resource management by physically conducting management activities on the resources for which they have direct management responsibility, and by influencing the activities of others within and adjacent to their managed areas and within their watershed. Watershed and adjacent area management activities, and the resultant changes in environmental conditions, affect the condition and management of the resources within their boundaries. ORCP managed areas are especially sensitive to upstream activities affecting water quality and quantity. ORCP works to ensure that the most effective and efficient techniques used in management activities are used consistently within our sites, throughout our program and, when possible, throughout the state. The strongly integrated Ecosystem Science, Education and Outreach and Public Use Programs, provide guidance and support to the Resource Management Program. These programs work together to provide direction to the various agencies that manage adjacent properties, our partners and our stakeholders. BBAP also collaborates with these groups by reviewing relevant protected area management plans. The sound science provided by the Ecosystem Science Program is critical in the development of effective management projects and decisions. The nature and condition of natural within BBAP are diverse. This section explains the history and current status of our Resource Management efforts.

### *4.2.1 / Background of Resource Management at Biscayne Bay Aquatic Preserve*

**Miami-Dade County Biscayne Bay Management Plan**

Past resource management efforts include the Biscayne Bay Management Plan adopted by the MDC Commissioners in 1981. This plan was developed by DERM and the County Planning Department and included areas extending to the north of the BBAP but did not include Card Sound. In 1983, the Florida Board of Trustees of the Internal Improvement Trust Fund (the Trustees) signed a Management Agreement with MDC for the latter to develop a management plan for the portion of BBAP to the north of BNP. This area excluded both Card Sound and the offshore areas of the Biscayne Bay Cape Florida to Monroe County Line Aquatic Preserve. A BBAP Management Plan was completed and submitted to the state of Florida in 1986 but was never adopted. One of the recommendations from MDC's Biscayne Bay Management Plan was the formation of the Biscayne Bay Management Committee to oversee bay restoration and Bay Management Programs. The Biscayne Bay Management Commission had thirteen to fifteen members including citizens and local, state, and federal agency representatives from its formation in 1981 until its sunset in 1993. The beginning of the Biscayne Bay Restoration and Enhancement Program, coordinated by DERM, coincided with management plan formation. During the previous two decades, this program prioritized and accomplished Biscayne Bay Restoration and Enhancement Program projects with funding from MDC, the state of Florida, Florida Inland Navigation District (FIND), and SFWMD. Completed projects, as outlined by DERM, include the following: identifying shoreline areas that need stabilization or wave energy abatement, mapping benthic communities,

attaching riprap to public shorelines, identifying sources of turbidity, planting seagrasses, and filling deep propeller scars in seagrass beds. Some continuing projects include improving public awareness, improving bay access, obtaining baseline data on fisheries and fisheries pathology, monitoring existing mitigation and restoration efforts, developing a fisheries management program, obtaining baseline water chemistry and circulation data, stabilizing shorelines, obtaining baseline data on water epidemiology and pathology, planting mangroves, and installing artificial reefs. Revision of BNP's 1983 General Management Plan began in 2000 and has gone through several public comment periods. The final BNP General Management Plan and Environmental Impact Statement were released in April 2015.

***Card Sound Management Plan***

The Biscayne Bay Card Sound Aquatic Preserve Management Plan developed was produced in 1991, in order to establish management guidelines for the Card Sound portion of BBAP but was never fully approved. The plan stated that "on site management will be directed toward the maintenance of existing or essentially natural conditions and restoring damaged or degraded areas", as mentioned in Chapter 18-18, Florida Administrative Code (Florida Department of Natural Resource Management, 1991). The plan also explained the responsibilities of various agencies in the management of Card Sound. The plan called for the protection of natural resources and traditional uses through management and protection of the preserve. Due to limited funding and staffing, many objectives have not been achieved through BBAP efforts, instead relying on the resources of other agencies. The majority of research that occurs in the Card Sound region is not conducted through BBAP, but instead through other natural resource management agencies, such as SFWMD, USGS, and CERP.

***Biscayne Bay Surface Water Improvement Management Plan***

The SFWMD developed the Biscayne Bay Surface Water Improvement and Management Plan (SWIM) and subsequently the State approved it in 1988. It addresses protection and enhancement of water quality through a variety of management strategies. The plan was most recently approved and updated with support from local, state and federal agencies in 1995. The plan has three goals: improve water quality, improve hydrology, and improve biological resources (Alleman, 1995). While portions of the original plan have been incorporated, the newest version replaces the 1988 plan. The purpose of this plan is to evaluate the effectiveness of initial strategies, identify new issues and opportunities facing the bay, and develop goals, objectives, strategies, and projects to address these items. Solutions may involve continuing current efforts, changing ongoing projects, or initiating new actions. The 1995 plan consists of two volumes, including the Planning Document and Technical Supporting Document, including appendices.

***Management Plans of Adjacent Public Lands***

The following plans for state and federally managed areas help BBAP staff understand how the public uses natural areas, how these lands change over time, and how they are managed and also suggest routes to improved coordination of protected areas. Oleta River and Bill Baggs Cape Florida State Parks have approved management plans. Oleta River's plan was last revised in 2022. Bill Baggs Cape Florida's plan was last updated in October 2012, with the next management plan update under development. BNP's Final General Management Plan/Environmental Impact Statement was completed in 2015 and is the primary management document for the park. The Record of Decision was signed in August 2015, allowing the management plan to be implemented. The 2015 General Management Plan does not describe how particular programs are to be prioritized or implemented. Instead, those decisions stem from future strategic, and implementation plans that are based on goals, future conditions, and appropriate types of activities approved in the General Management Plan. The interpretative themes of the General Management Plan based on the park's purpose and significance include biological uniqueness, biological diversity, cultural significance, and endangered national park resources. As of the writing of this management plan, no additional planning documents have been released.

***Interagency Coordination***

Governor Chiles (1991-1998) formed the Governor's Commission for a Sustainable South Florida that created the Central and South Florida Project Restudy, a forerunner of the CERP, in the 1990s. The

South Florida Ecosystem Restoration Task Force was formed by interagency agreement in 1993 and was formalized by Congress in the 1996 Water Resources Development Act [Subsection 528(f) of Public Law 104-303]. A Florida-based Working Group was established by the South Florida Ecosystem Restoration Task Force in accordance with Section 528(f)(2)(d) of the Water Resources Development Act of 1996. This Florida-based group has 25 members representing tribal, local, state and federal entities. The duties of the working group are to assist the Task Force in its efforts to coordinate the development of consistent policies, strategies, plans, programs, projects, activities, and priorities addressing the restoration, preservation, and protection of the South Florida ecosystem.

### *4.2.2 / Current Status of Resource Management at Biscayne Bay Aquatic Preserve*

#### *Listed Species/Critical Habitat Management*

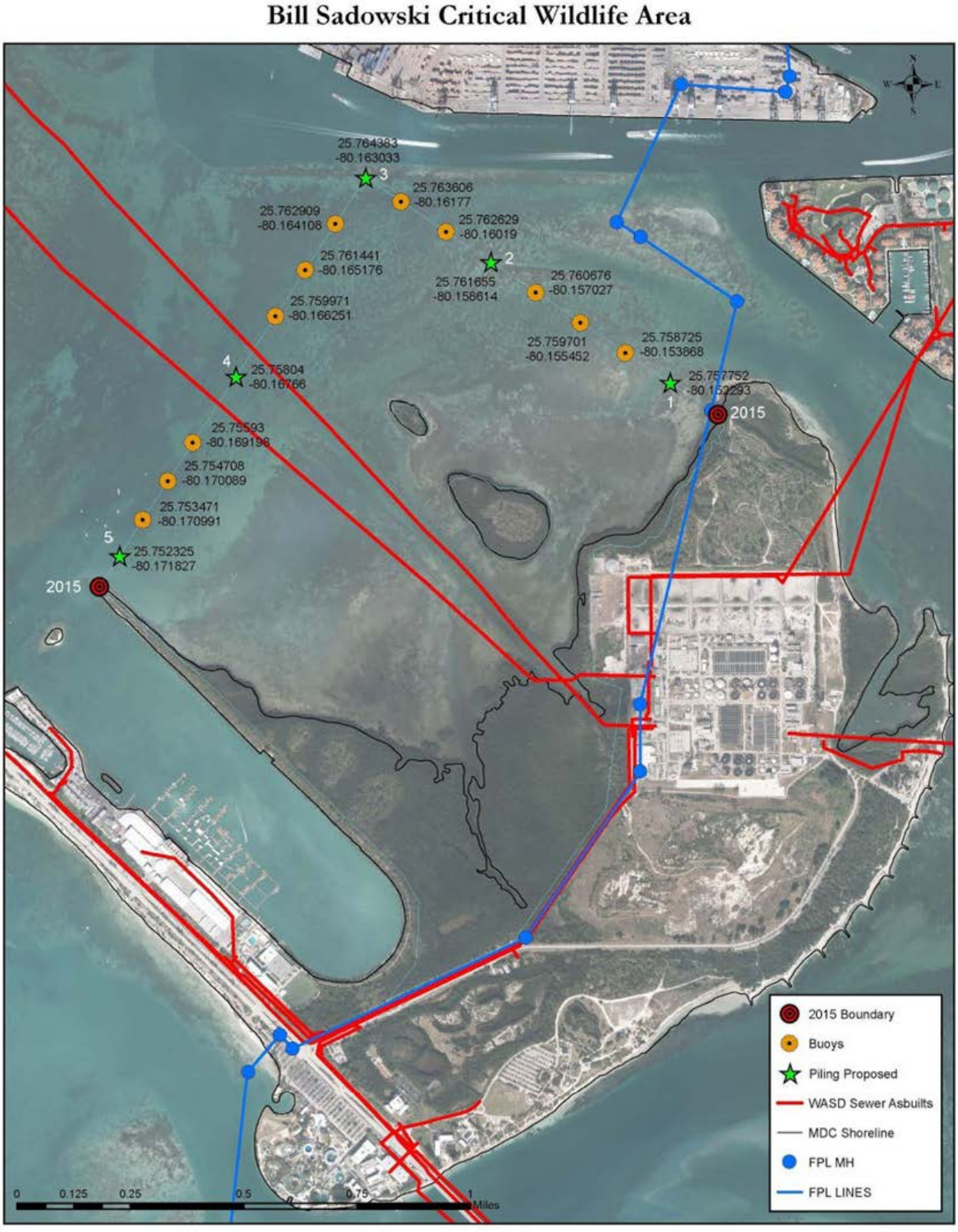
There are more than 62 species that can be found on a protected species list - whether state or federal - whose habitat is either Biscayne Bay or the bay's coastal wetlands or uplands (including barrier islands). At the federal level, species are either classified as Endangered or Threatened under the Endangered Species Act of 1973. At the state level, species are listed as Threatened. Federally listed species living within BBAP include the Florida manatee, (*Trichechus manatus latirostris*), American crocodile, (*Crocodylus acutus*), smalltooth sawfish (*Pristis pectinata*), green turtle (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricate*), Key Largo cotton mouse (*Peromyscus gossypinus allapaticola*), Key Largo woodrat (*Neotoma floridana smalli*), wood stork (*Mycteria americana*), least tern (*Sterna antillarum*), loggerhead sea turtle (*Caretta caretta*), Kemp's ridley (*Lepidochelys kempi*), and piping plover (*Charadrius melodus*). Sea turtles, once abundant in the bay, were hunted in large numbers in the 1800s and became federally protected in 1973 with the passage of the ESA. Marine turtles are also protected by the state through Florida's Marine Turtle Protection Act (379. 2431, F.S.).

Manatees are protected federally by the Endangered Species Act, as well as the Marine Mammal Protection Act, and at the state level by the Florida Manatee Sanctuary Act. In 2017, the U.S. Fish and Wildlife Service (USFWS) issued a final decision downlisting the West Indian manatee from endangered to threatened, citing habitat improvement and a population expansion (an estimated 6,620 in 2017 compared to only a few hundred individuals in the 1970s). In the past decade, yearly manatee mortality rates averaged between 400-500 per year. In 2021, FWC reported a record 1100 manatee deaths, though only 31 of those occurred in MDC. (FWC Final Manatee Mortality Table by County, 2021). Mortality data can be found on FWC's website: https://myfwc.com/research/manatee/rescue-mortality-response/statistics/mortality/. MDC comparatively has a low mortality rate caused by watercraft, yet the FWC consistently reports that about one quarter of all mortality each year is attributed to watercraft injuries. BBAP personnel have attended the Manatee Awareness Group coalition since 2003. The BBAP manager has served as chair for the quarterly meetings, which rotate between MDC, Broward, and Palm Beach counties. Federal, state, local and municipal law enforcement agencies, namely FWC, join marine industries, agencies, educators, non-profit organizations and education groups to look at issues involving enforcement, education and awareness and mortality data. Fish and Wildlife Research Institute provides mortality information and detailed necropsy reports for deaths occurring within BBAP. Manatee synoptic surveys are conducted by FWC, and local surveys are conducted in MDC, Broward and Palm Beach counties according to the requirements of local manatee protection plans or through their respective county management plans. BBAP staff review data and information about topics, such as rules for how protected species will be listed by FWC. The data is available from the updating of the DERM Manatee Protection Plan. The state and county approved the original Manatee Protection Plan in 1995. Between 2007 and 2009, the plan underwent a review by a committee convened by county commissioners pursuant to a local ordinance. BBAP personnel participate in and encourage others to record and report all manatee sightings to DERM for incorporation into their database. The MDC Manatee Protection Plan considers Biscayne Bay and its tributaries essential habitat for the West Indian manatee because these provide foraging areas in seagrass beds, warm water refugia during cold fronts, freshwater sources, other aggregation sites, and travel corridors between these areas.

*Photo 11 | Manatees do not discriminate against the kind of vegetation that they eat. Adult manatees can weigh in excess of 2,000 lbs and eat 10% of their body weight each day.*

Critical habitat for the American crocodile includes Card Sound in northern Key Largo, where BBAP overlaps with the 6,600 acres of the Crocodile Lakes National Wildlife Refuge (established in 1980). Crocodile Lakes National Wildlife Refuge focuses its management efforts on habitat restoration and enhancement in order to sustain the diverse array of resident and migratory wildlife. Management programs include hammock restoration, crocodile habitat enhancement, and Key Largo woodrat captive breeding. Critical nesting habitat exists within Florida Power and Light's Turkey Point Nuclear Plant's cooling canal system and is largely responsible for the crocodile's comeback over the past 30 years. Florida Power and Light provides reports to the federal government several times a year to report on the number of adults, nests, and hatchlings as well as any deaths attributed to human causes.

The Bill Sadowski Critical Wildlife Area (CWA) is located on the western side of Virginia Key and comprises 700 acres designated by the Florida FWC as a year-round no-entry zone. It contains BBAP's largest remaining portion of unaltered mangrove forest and relatively unaltered submerged lands. The Bill Sadowski CWA was initially set aside in 1991 to protect wading and shorebird habitat by the Florida Game and Freshwater Fish Commission and the City of Miami, which holds deeds to some of the submerged lands. This critical nursery habitat is utilized by many species of fish, marine mammals, and invertebrates to feed, seek refuge, spawn, mate, or give birth to their young. CWAs are established under Florida Administration Code 68A-14 to protect important wildlife concentrations from human disturbance during critical periods of their life cycles, such as nesting. The Bill Sadowski CWA is one of the last remaining protected stopovers for birds migrating along the Atlantic Migratory Flyway. As one of the state's few marine CWAs, the reason for its establishment was expanded to include shallow seagrass beds important to manatees in addition to serving as critical bird habitat. The area was named for Bill Sadowski, a Miami native who died in an airplane crash while serving as the Secretary of the Florida Department of Community Affairs.




*Map 14 | Bill Sadowski Critical Wildlife Area with waterway markers*

BBAP staff jointly manages this area with FWC regional biologists who are headquartered in Palm Beach County. With support from the regional biologist, BBAP obtained a five-year permit in 2010 from FWC to conduct semi-annual bird and wildlife surveys in partnership with the Tropical Audubon Society within the boundaries of this year-round no-entry zone to determine what species of birds are using this area and their activities there (nesting, feeding, roosting, etc). Staff is keenly aware that while surveys are necessary to ensure this area continues to function as a sanctuary for a variety of species, it is also important to minimize time spent in the CWA. Wildlife counts, water quality data, as well as seagrass data will be collected during the surveys. Law enforcement consistently informs BBAP staff about violators of the no-entry rule that protects this area. Jet skis, motorboats, kayakers, and commercial and recreational fishermen and their gear are often observed in the CWA. Previous wildlife surveys performed by land documented the negative impacts that even passive recreational traffic can have on CWA wildlife. When a powerboat or jet ski comes through, birds are flushed but may return to the area, despite having their behavior altered. Kayakers and canoeists observed in the area cause birds to flush, and the paddlers' long-term presence is said to flush the birds and keep them away from feeding and nesting areas. In order to maintain essentially natural areas and restore degraded areas, BBAP is committed to working with the public and seeks the cooperation of citizens and municipalities in order to help conserve the resources found in the CWA. It is the goal of BBAP to work with the public so that it understands the responsibility to protect the resources that come with public use and enjoyment of Biscayne Bay, including abiding by established no-entry zone rules. The City of Miami and community stakeholders have also engaged in the process to develop a revised master plan of Virginia Key to ensure that plans will cause minimal impact on the relatively natural setting of this coastal barrier island and the CWA.

Card Sound provides a protected area that is home to over 100 plant and animal species that are rare, endangered, or species of special concern. Card Sound encompasses 17,000 acres of seagrass meadows, hard bottom communities, and mangrove wetlands that are connected to a greater system of protected waters and lands in South Florida. These waters are so important that they were included in an area designated as a sanctuary for the spiny lobster (*Panulirus argus*), in order to protect nursery habitat and enhance other fisheries. Known as the Biscayne Bay-Card Sound Spiny Lobster Sanctuary, this area encompasses all of Card Sound, Biscayne National Park's inshore waters, and all of BBAP south and due east of Matheson Hammock Park. Seagrass beds and mangrove-lined shores that occur throughout BBAP and Card Sound in particular are prime feeding areas for wading birds, juvenile fish, invertebrates, manatees, and sea turtles.

***Stranding Response***

BBAP relies on Marine Animal Rescue Society (MARS), a local non-profit that responds to calls of distressed and stranded marine animals reported within the preserve, including dolphins, whales, and manatees. MARS is permitted through USFWS to rescue and/or transport injured manatees to rehabilitation centers, including the Miami Seaquarium, and to assist with FWC's Manatee Carcass Salvage Program. NOAA permits MARS to rescue, transport, rehabilitate, research and release stranded cetaceans found within or near Biscayne Bay. MARS holds an agreement with RSMAS to use a portion of its Virginia Key property as a rehabilitation center. A temporary pool is erected for the duration of the rehabilitation to bring the stranded dolphins or whales back to health in order to be released back into their natural environment. Founded in 1996, MARS is dedicated to the conservation of marine mammals through rescue, rehabilitation, research, and education. In addition to reaching 1,500 students and adults annually, MARS provides training to the law enforcement community and to the public at large on rescue and rehabilitation basics. BBAP personnel attend MARS trainings and presentations and receive reports on manatee and cetacean strandings within the preserve.

***Habitat Restoration and Enhancement***

Intertidal areas of disturbance are areas prone to nuisance plant species establishment. Mangrove shorelines and areas that experience disturbance are vulnerable to invasion by exotic plant species. The 200 feet (60.7 meters) of shoreline at the BBEC, where BBAP offices are located, has the invasive species of Brazilian pepper (*Schinus terebenthifolius*), seaside mahoe (*Thespia populnea*), umbrella tree (*Schefflera actinophylla*), and Australian pines (*Causurina equisetifolia*) growing alongside the naturally

occurring mangroves, including red (*Rhizophora mangle*), white (*Laguncularia racemosa*), black (*Avicennia germinans*), as well as half flower (*Scaevola taccada*). Staff remove these invasive trees and chemically treats them to prevent their re-growth without harming the adjacent water resources. These invasive species are expanding their ranges through efficient reproduction and seed dispersal. The Florida Exotic Pest Plant Council lists these species as the most serious threats to native vegetation.

There are three naturally occurring and more than 30 man-made islands in Biscayne Bay. The man-made islands were created in the early 1900s as a result of dredging operations to create the Atlantic Intracoastal Waterway (AIWW) and other navigable channels and harbors. The spoil material that was extracted from the dredged areas was used to create what are regarded as "spoil" islands located near the AIWW. Most of the islands are in public ownership, either by an adjacent municipality, the county, or the state. These islands offer habitat for wildlife and birds, but eroding shorelines, exotic vegetation, and debris washing ashore have degraded the habitat services that they provide and have also decreased the public's ability to recreate on them. Through financial support from the FIND Waterways Assistance Program, DERM 's Biscayne Bay Environmental Enhancement Trust Fund, DEP and SFWMD, restoration of these islands has been ongoing for nearly 30 years. DERM 's restoration expert makes use of readily available material, such as limestone boulders, for shoreline stabilization or to fill a large dredge hole that would otherwise need to be disposed of. Specialized techniques have been developed to allow for mangrove fringe to grow along the islands, and DERM is renowned across the state and the nation for its expertise and success in island restoration. DERM has actively engaged local residents, students, universities, and organizations to not only achieve restoration goals but also to foster a sense of stewardship and ownership of their natural resources for years to come. Maintenance of these islands is largely contracted by DERM to outside sources, but not all islands are continuously monitored for trash and debris. In 2015, the Adopt-An-Island program was implemented to encourage environmental stewardship from the public on the spoil islands. Through this free program, BBAP staff engage members of the public to adopt an island in Biscayne Bay. In the agreement between ORCP and the adopting organization, responsibilities include performing four cleanups per year and tracking data on the marine debris composition. Adopting groups are in charge of organizing their own cleanups and transportation to and from the islands. On each adopted island, a sign with the adopting group's name is installed to advertise for the program and the adopting group. This program could be expanded in the future to include species identification of plants and animals on and near the adopted island, giving the adopting groups and their volunteers information to engage with island visitors.

In the first ten years of DERM's Biscayne Bay Restoration and Enhancement Division Biscayne Bay Wetlands Restoration program, approximately 300 acres of wetlands at ten coastal sites have been restored and enhanced (Milano, 1999b). In 2007, DERM initiated several restoration efforts including projects on the Dinner Key Island and in the mangroves of Chapman Field and Virginia Key. Exotics were removed from five islands at Dinner Key and were replanted with mangroves. BBAP personnel recruited volunteers to help with the restoration projects, and also provided feedback to DEP's Environmental Resource Permitting (ERP) program at DEP's Southeast District. It is through coordination with DEP's ERP program that seagrass restoration projects are implemented in BBAP. Current and historic budget levels do not allow for restoration projects both in terms of limited staff and time, as well as limited funds to administer and later monitor restoration. Instead, staff coordinate with staff from the Southeast District to suggest mitigation projects to benefit seagrass communities when unauthorized impacts occur.

The Jobs and Dollars Report (2011) presents the concept of coastal habitat restoration as a job-creating, economy-boosting enterprise that also returns otherwise disturbed or impacted areas to some level of ecological function. It is estimated that restoration projects can yield 30 jobs for each million dollars invested, twice as many as the oil, gas, and road construction industries combined. Coastal counties provided half of the U.S. gross domestic product in 2007 and claimed 40% of the nation's jobs. The report also cited Everglades-specific economic benefits to South Florida where water conveyance systems constructed almost a century ago to drain the Everglades led to the loss of more than half of South Florida's wetlands. Beyond the ecological benefits to Everglades restoration, citizens in the region directly benefit through protection of water supply and reduction of future costs of water purification by allowing natural aquifer recharge. Additional benefits stem from increased property values due to higher

water quality in waterways and groundwater, as well as more fishing, hunting, and tourism as wildlife populations increase. Jobs would increase in various sectors to the tune of 440,000 over the next 50 years. All of these benefits equate to a 4:1 benefit-to-cost ratio in terms of benefits provided to ecosystems and society per cost incurred.

***Permitting and Enforcement***

BBAP staff works with DEP's Southeast District Office and DERM's permitting staff to conduct joint site visits when a summary of the biological resources in an area are relevant to the review of a coastal construction application. DERM and FWC partner to obtain funding and hire contractors to remove derelict vessels from BBAP, both in the northern part of the bay and in Card Sound. BBAP staff works closely with the lead FWC officer who responds to reports of derelict vessels and has created a list of vessels that must be removed in cases where the owner cannot be found and held accountable. BBAP staff cooperates with municipal, local, state and federal officers by meeting monthly through the Marine Advisory Support Team, coordinated by the county's marine patrol lieutenant. At these meetings parties discuss relevant Biscayne Bay protection issues, including human health, safety, and natural resources. BBAP staff is currently training marine enforcement officers about the law for seagrass protection in aquatic preserves. Officers are interested in understanding more about distinguishing between new and old scars, how to identify seagrass species, where seagrasses are located, and what areas of the bay can be patrolled because of the threat of repetitive propeller scar injury.

*Photo 12 | A derelict vessel caught in a mangrove forest*

BNP rangers and biologists worked together to maintain a program to reduce recidivism of on-water offenders charged with fisheries, speeding or other violations within the boundaries of the national park. The program contains information on how to identify fish species to reduce incidents of recreational fishers mistaking their catch for a species legal to catch at a particular size, as well as how fishing regulations support the future of fishing in Biscayne Bay. The program also features a segment on responsible angling techniques to increase efficiency and reduce impacts to fish. The class is offered in English and Spanish on weekends and is free to anyone in the community who would like to join for their

own information. At the ranger's discretion, the offender can choose to take the class and pay a reduced fee relative to the fines that would have been imposed by the violation. This program was devised in coordination with the United States Attorney's Office that would otherwise prosecute the offenders but has agreed to have offenders take part in this program. BNP staff has documented a nearly zero percent recidivism rate, indicating that the class is changing the behavior of those fishing or speeding within the national park boundaries. BBAP staff will work with BNP staff and rangers as well as state enforcement agencies to encourage offenders outside park boundaries to participate in this class as a way of avoiding financial penalties and/or court appearances.

***Mitigation***

Impacts to natural resources must be avoided or minimized by applicants wishing to construct within the preserve (Chapter 18-20 F.A.C.). Construction often causes degradation or complete removal of the resources that occur within BBAP, and these impacts must be mitigated in order to maintain resource health. In situations where resources are negatively impacted, BBAP staff should recommend mitigation options (e.g., land acquisition, habitat and hydrologic restoration, water quality improvement projects, shoreline stabilization with native plants, planting of emergent and submerged vegetation) that would directly benefit the quality of the natural resources within the preserve.

Construction associated with PortMiami has caused the largest impacts to BBAP. The original port was located on spoil areas on the bay's western shoreline, but in the 1960's the port moved operations to spoil islands between the mainland and the barrier islands of Miami Beach and Fisher Island. As greater amounts of habitat were impacted through enlarging the spoil islands by bulkheading and filling, and through deepening and widening the access channels, the PortMiami Mangrove and Seagrass Mitigation Project was initiated. By 1983, 251 acres of the bay had been impacted with 81 acres of seagrasses lost. In 2003, the Corps predicted that the cumulative natural resource impacts were 349.9 acres total with 251 acres of seagrass lost. Including the Phase III expansion projects that were authorized by the Water Resources Development Act in 2007, the totals are anticipated to rise to 415.6 acres of total impact and 257.3 acres of seagrass impact (The Corps, 2003; Table 23, p. 98). New dredging to increase the depths of the channel from 42 feet to 50 feet to accommodate larger vessels was proposed in 2010. This project sought to offset impacts to the bay through mitigation projects. However, mitigation for some of the resulting impacts has never been successfully demonstrated.

In order to improve navigation and safety for the post-Panamax mega-ships, the Port of Miami underwent additional dredging between November 20, 2013, and March 16, 2015 (Miller et. al., 2016). It is estimated that about 4.39 million cubic meters of dredged material from pipeline, backhoe, and clamshell dredges were deposited at a permitted site about 2.4km east-southeast of the dredged site and at depths between 120-240 m (Miller et al., 2016). PortMiami bisects the Florida Reef Tract and is surrounded by ESA-designated critical habitat for the ESA-listed staghorn (*Acropora cervicornis*) and elkhorn (*Acropora palmata*) corals (Cunning et. al., 2019). Critical habitat is defined as any area containing the physical and biological features essential for the species' survival. It is estimated that hundreds of thousands to millions of corals, including those species protected by the ESA, were directly impacted by the dredging project. This far exceeds the estimated impacts included in the project's EIS. Studies are still exploring the long-term impact from the dredging project's sedimentation on the site's species. Though much of the early literature focuses on coral loss, other important species have been impacted by this most recent PortMiami expansion.

BBAP staff continues to work with the DEP's ERP program to minimize and avoid impacts to resources in the bay. Common impacts include damage to seagrasses, macroalgae, mudflats, listed species and other species as mentioned in Chapter 18-18, F.A.C. BBAP personnel have also evaluated proposals from applicants for mitigation, visited sites where mitigation is proposed, and evaluated sites for their appropriateness as potential mitigation sites. BBAP staff regularly writes comment letters and corresponds with regulators from the state, county, and federal agencies with permitting delegations, such as the state's delegation of authority to DERM to permit single family docks within the BBAP.

### *Incident Response*

Most incidents in the preserve involve unlawful speed of vessels traversing the bay and causing accidents, potential permit noncompliance violations, and environmental emergencies, such as downed planes, sunken vessels, and sea wall collapses. Depending on the reported incident, BBAP staff coordinate with DEP, FWC, SFWMD compliance and enforcement staff, or MDC Parks and Recreation Department. Maintaining a strong partnership with compliance and enforcement staff is critical to the success of incident response within the preserve. BBAP staff also encourage stewardship among homeowners, who often serve as the eyes and ears of the preserve. Future coordination with law enforcement officials will help BBAP staff document additional incidents and incident locations within the preserve that are not reported. Identified trends will be documented and discussed with law enforcement officials for localized support. In the case of large-scale incidents, the State Warning Point Hotline notifies DEP's Bureau of Emergency Response district offices when an incident occurs within their district. One DEP Coral Reef Conservation Program staff person is the lead contact for the BBAP office and receives notices when there is an environmental emergency, such as a vessel grounding or boat fire within the BBAP and Coral Reef Conservation Program boundaries.

### *Miami-Dade County Comprehensive Development Master Plan and Land Uses*

MDC's Comprehensive Development Master Plan is developed by its planning department. Development of the Master Plan includes considerable public input from the Citizen's Advisory Task Force, which was originally adopted in 1975 with the purpose of guiding development within the county. MDC and Monroe counties are required by the Local Government Comprehensive Planning and Land Development Regulation Act to have a comprehensive management plan with elements relating to different governmental functions (e.g., housing, physical facilities, conservation, land use, coastal zone protection, etc.). Each plan, in effect, is intended to guide the future development of each respective county. Cities and counties are to adopt land development regulations and conform to the criteria, policies, and practices of their comprehensive plans, which must be updated periodically as required by statute.

MDC's original plan did not contain a coastal element. A separate coastal management element first appeared in the 1988 Comprehensive Development Master Plan pursuant to the Growth Management Act of 1985 that required all local governments to include such an element if they about the Atlantic Ocean or include waters of the State where marine species of vegetation constitute the dominant plant community. In addition, a storm water management plan has been developed by MDC to help address concerns with impaired waters under the DEP's Total Maximum Daily Load (TMDL) program. The TMDL program employs a watershed management approach to address impaired waterbodies; a five-phase cycle is rotated through all basins in the state over a five-year period. The first phase includes a preliminary assessment of the basin based on available data.

DEP staff reach out to local governments and other agencies to obtain relevant data. During Phase 2, a strategic monitoring and assessment phase, impairment is verified and lists of impaired waters are developed, and waters to be delisted are noted and submitted to the EPA for approval. In Phase 3, TMDLs are developed and adopted, and in Phase 4 a Basin Management Action Plan (BMAP) is prepared. The final Phase 5 implements TMDLs. Wagner Creek is the first waterbody listed for the Biscayne Bay region and its impairment for fecal coliform (bacteria found in human and animal excrement) is being addressed in a Basin Management Plan. In 2012, TMDLs were finalized to address impairment for the Miami River, Miami Canal, Little River and Biscayne Canal—all for levels of fecal coliform that exceed state standards. In 2024 DEP conducted an impairment assessment of Biscayne Bay leading to changes in impaired WBIDs, large portions of the bay remained impaired for nutrients (Florida Department of Environmental Protection, 2024).

Additionally, several canals in south MDC are impaired because of levels of mercury, dissolved oxygen, and/or fecal coliform. DEP provides an interactive map highlighting all Impaired waters, TMDLs and BMAPs in the state, both adopted and pending: https://floridadep.gov/dear/water-quality-restoration/content/impaired-waters-tmdls-and-basin-management-action-plans. DEP created the Fecal Indicator Toolkit for restoring bacteria-impaired waters, as well as a fecal coliform guidance document

*Photo 13 | Balancing coastal construction projects with environmental protection to minimize impacts helps maintain the health of Biscayne Bay's natural communities.*

that assists stakeholders in addressing fecal coliform impairments and restoring water quality. One goal of the BBAP management plan is to provide guidance to county governments during their planning process, or as comprehensive plans are revised, toward developing local planning criteria and standards that will be consistent with the objectives of the program.

The MDC Comprehensive Development Master Plan Land Use Policy 3E mandated the South MDC Watershed Study and Plan, adopted in 1996. It was supported by the South Florida Regional Planning Council, MDC, and SFWMD, in order to maintain the health of Biscayne Bay and other natural areas of southern MDC. The study and plan were presented to the County Commission in 2007 and referred for review to the County Planning Department. The study portion reviewed population projections, land uses, water quality and supply, transportation options, economics, and natural resources for the southern part of the county. The plan produced recommendations for planning decisions running through 2050. Other land use planning initiatives include the Strategic Regional Policy Plan for South Florida promoting sustainability, connectivity, and responsibility authored by the South Florida Regional Planning Council. Revitalizing South Florida's Urban Core developed by South Florida Regional Planning Council, and the MRC's Urban Infill Plan are previous planning efforts. BNP and the TPL are collaborating on a Biscayne Bay Greenprint Map with recommendations for purchase or conservation of lands near the bay. In 1990, MDC voters approved a property tax increase to acquire, protect, and manage environmentally endangered lands through the creation of the Environmentally Endangered Lands Program. This program considers sites proposed for acquisition with the goal to help protect, restore, and conserve the air, water, land, and ecosystem resources of MDC. Over 20,700 acres of rockridge pineland, tropical hardwood hammock, salt marsh, mangrove and riverfront are preserved through this program (MDC Environmentally Endangered Lands Program [EEL], 2020).

***Cultural Resources***

The cultural resources adjacent to BBAP are managed by their respective agencies. Previous documents showing cultural resources within BBAP only depict those resources on the shorelines adjacent to the water. BNP has documented marine archaeological sites and has begun interpreting some of them as a maritime trail. Due to close proximity with BNP, there is a high possibility of additional cultural resources within BBAP submerged lands. Additional research is needed to perform a submerged cultural resource inventory in order to locate and begin to protect these resources. There are over two dozen archeological sites are listed in the Florida Master Site File, which is the state's inventory of historical and cultural resources. There are 26 bridges listed in the Florida Master Site File. No land clearing or ground disturbance, above or below the ordinary high-water line, will be undertaken by staff until the Division of Historical Resources has provided a review and recommendations for the proposed activity.

*Photo 14 | Sea level rise threatens to exacerbate existing issues within BBAP and introduces new challenges as surrounding communities look to the bay to develop adaptation solutions.*

***Sea Level Rise***

Global and regional change events, both naturally occurring and human-influenced, have the potential to cause significant detrimental impacts to the ecological integrity of BBAP. \According to the NOAA Coastal Services Center's report on its joint collaboration with MDC's Office of Sustainability (n.d.), MDC is particularly vulnerable to sea level rise because of its highly populated cities and low-lying topography. In order to adapt to the changes that sea level rise will bring to this heavily populated, ecologically important area, MDC recognizes the need for a cohesive approach to planning.

As sea level rise continues, BBAP can anticipate significant and potentially catastrophic changes to the natural habitats and wildlife within the region. Priority concerns include protected species that depend upon beach habitats for nesting (e.g., loggerhead sea turtle) and resting, foraging and nesting (e.g. shorebirds including the least tern). Also of concern is the anticipated loss of emergent wetlands as the migration of marine wetlands continues to track rising sea levels until reaching a static urban boundary. Implementation of the Biscayne Bay Coastal Wetlands Project, a division of the Corps-led Comprehensive Everglades Restoration Project (CERP), is one defense against effects of sea level rise and saltwater intrusion in particular. The projects will help maintain lower salinities along the nearshore areas of Biscayne Bay which may stave off the effects of sea level rise by creating freshwater sheetflow that will permeate nearshore areas.

***Catastrophic Events***

In addition to long-term sea level rise, short-term catastrophic events such as periodic hurricanes and

algal blooms could impact natural resources within BBAP. Barrier islands such as Virginia Key, Key Biscayne, and the beaches as well as nearshore areas along Biscayne Bay are particularly vulnerable to the effects of hurricanes. Recent studies suggest that while global climate change may decrease the overall number of hurricanes, the number of extreme, and more damaging, hurricanes will increase (Bender et al. 2010). Therefore, BBAP may suffer periodic, but significant, storm damage in the future. BBAP will continue to work with USFWS to promote the living shorelines program in Miami-Dade County, as natural shorelines will provide the best defense against extreme hurricanes.

Not only do catastrophic events impact coastal systems, but red tides and other harmful algal blooms can have a significant effect on wildlife. In 1996, a severe red tide event resulted in the mass mortality of over 150 West Indian manatees, an endangered species. The active 2005 hurricane season, in conjunction with road construction that incorporated mulched mangroves along the causeways leading to the Florida Keys, were the cause of a cyanobacterial bloom (*Syncheccocus sp.*) in Florida Bay, Card Sound and Southern Biscayne Bay that persisted for two years before chlorophyll levels returned to background levels (Rudnick, 2007). In 2018, red tide cells from a massive red tide event that originated on the west coast of Florida reached MDC. It is believed that these red tide cells were picked up by the Florida Loop Current and were detected in MDC waters. Since 1953, there have only been eight other reported red tide blooms on the east coast of Florida. (Krimsky, 2018). In August 2020, high water temperatures (estimated 90 degrees Fahrenheit) and low dissolved oxygen levels in Biscayne Bay caused a widespread mortality event — reported from the Northern BBAP boundary to Virginia Key — that impacted both fish and other marine species (Miami Waterkeeper, 2020). On August 12, 2020, Pelican Harbor reported a ray aggregation, thought to be a response to the low oxygen levels. A rapid response team was mobilized among various agencies, and a die-off was avoided. Conditions improved for a few days, but on August 20, 2020, citizens began reporting a yellow-brown foam developing on the water's surface, which was later reported as an algal bloom. This algal bloom was concentrated in the northern section of BBAP, though it was present throughout much of the same areas of the bay that experienced the fish kill. Multiple agencies responded to both the fish kill and the algal bloom events, including NOAA, DEP, DERM, City of Miami, North Bay Village, Miami Shores, the City of Miami Beach, and educational partners University of Miami (UM) and Florida International University (FIU).

The severe cold event observed in January 2010, when temperatures in South Florida's coastal areas dropped to temperatures of 30 to 40 degrees Fahrenheit, resulted in 197 confirmed manatee deaths across the state and mass mortality of cold susceptible fishes and reptiles. Ecological changes resulting from the cold events warrant close observation and monitoring to improve understanding of coastal processes and to determine appropriate responses. Biscayne Bay tributaries, both natural (Miami River and Little River) and artificial (Coral Gables waterway), serve as critical habitat for manatees per the FWC's state protection plan, and during colder winter months serve as much-needed warm water refuges in particular. These tributaries are heavily used by recreational and commercial vessels, including cargo vessels in the Miami River, where balancing manatee protection and user needs is particularly challenging.

The Deepwater Horizon oil disaster in the Gulf of Mexico, which began in April 2010, is an example of a regional catastrophic event with the potential for significant environmental effects within BBAP and adjacent coastal areas. Oil disasters can result in loss of emergent wetlands (e.g. saltmarsh and mangroves) and submerged habitats (e.g. seagrass and corals), mortality of marine mammals and sea turtles, and long-term lethal and sub-lethal effects to estuarine organisms at various life stages. The potential loss of coastal wetlands off the Southeast Florida coast related to the oil disaster event amplifies the need to sustain and restore remaining intact wetland ecosystems that can help sustain wildlife. ORCP served as the designated office within DEP to carry out the response to the Deepwater Horizon event. Under the guidance of ORCP's director, the Governor´s designated Trustee for the State of Florida, ORCP staff carried out pre-event and post-event water and sediment sampling activities. BBAP staff in particular worked with MDC DERM and BNP staff to identify areas most vulnerable to oil and continue to work with the United States Coast Guard in their maintenance of an index of South Florida coastal environments and wildlife vulnerable in the event of another oil disaster. The country of Cuba, which is 94 miles from Southern Monroe County, approved permits to drill for offshore oil in the

early 2000s, which caused concern in the region because of potential dire consequences for the Florida Keys, Biscayne Bay, and Everglades and Biscayne National Parks should there be a disastrous oil spill or release there. To date, Cuba is reported to have ceased offshore oil exploration, but oil industry experts believe that there are oil reserves in this area. In early 2021, the Bahamas moved forward with plans to begin its own exploratory drilling, once again raising concerns not only for Southeastern Florida, but the entire region (NPR, 2021).

#### *4.2.3 / Resource Management Issue / Issue Two: Natural and Cultural Resource Protection*

In order to effectively manage BBAP's natural resources, one must have a baseline understanding of habitat distribution, species (that depend on these habitats) composition and abundance (including salinity and temperature ranges), and updated maps to graphically represent these parameters and how they change over time. Addressing issues such as marine debris and pollution are important in improving the overall health of Biscayne Bay. Marine debris presents a real and chronic threat to wildlife and public safety. Entanglement and ingestion of toxins from marine debris can cause immediate or prolonged injury to all marine animals. The presence of debris detracts from the aesthetic value of natural landscapes. Marine debris can include paper and plastic products, construction debris, derelict vessels, and derelict fisheries gear. There are two sources of marine debris: the actions that take place on land (land-based sources), and the actions that take place in waterways and the marine environment (water-based sources). It is estimated that 80% of marine debris is from land-based sources (Biscayne Bay Task Force, 2020). Significant change events such as sea level rise and climate change may drastically alter the status of Biscayne Bay's benthic community and may have regional impacts, such as affecting drinking water supply. Research suggests that submerged aquatic vegetation (SAV), which represents less than 0.5% of the ocean floor, sequesters up to 70% of the earth's carbon dioxide emissions for hundreds or thousands of years, beyond the decadal scale of rainforest trees (Nelleman et al., 2009). Within the past decade, the scientific community began to better understand and quantify the role that coastal and submerged plants such as seagrasses, mangroves, and other tidal wetlands play in sequestering and storing carbon. These ecosystems are being lost at a rate faster than rainforests. Catastrophic events such as oil disasters and harmful algal blooms are also major issues that could affect the health of Biscayne Bay's natural resources. BBAP's natural resources sites include FWC's Critical Wildlife Area, Chicken Key, Arch Creek, and Cutler Wetlands.

Biscayne Bay has several cultural resources, which include archaeological and historical sites representing tangible but irreplaceable elements of the State's past. BBAP's cultural resources include Miami Circle, Arch Creek, the Deering Estate, and the Miami Marine Stadium. These resources are fragile and limited, and they cannot be regenerated or fully restored once they are disturbed or destroyed. Today, many of these sites are being impacted statewide by beach erosion, coastal development, dredging, human recreational activities, and other impacts. BBAP's ability to protect, preserve, and promote these unique resources for the public benefit can be improved with better management policies and monitoring practices.

Managing nearly 70,000 acres of submerged lands across two counties poses a challenge to natural and cultural resource monitoring in the bay. Fostering partnerships that exist between all levels of government agencies, universities and colleges, and non-profit organizations that are Biscayne Bay stakeholders is essential to be able to leverage BBAP staff time and funds to effectively maintain levels of community outreach and to obtain critical ecosystem science information that is used to make management decisions about the current and future health of Biscayne Bay. One of the greatest obstacles to natural resources management of the BBAP is the lack of awareness of the existence of the aquatic preserve among Miami-Dade County residents. While staff have demonstrated an increase in awareness about the preserve through community outreach endeavors, greater awareness of the preserve and the level of protection they are afforded this unique ecosystem may translate into greater stewardship of its resources. Fostering appreciation, awareness, and understanding of the importance of Biscayne Bay's resources in people's quality of life is paramount to successful management of the preserve.

### *Issue Two: Natural and Cultural Resource Protection*

**Goal 1:** Document and preserve the natural resources within the preserve.

**Objective 1:** Establish a baseline and/or add to the knowledge base of the current location, composition and abundance of the various habitat types and associated fauna, with specific focus on seagrass habitats.

**Integrated Strategies:**

1. Capture aerial photography/satellite imagery of BBAP for use in BBAP's website, creation of integrative maps, future restoration plans, survey efforts, and identification of critical habitat areas.
2. Conduct wildlife and ground truthing surveys of seagrass areas, particularly those areas that have not been evaluated in over ten years.
3. Support invasive exotic plant and animal eradication, such as lionfish and Brazilian pepper (*Schinus terebenthifolius*), by advertising exotic plant and animal removal volunteer activities.
4. Facilitate awareness of the critical role natural resources play in the protection of Biscayne Bay and is surrounding communities.

**Performance Measures**:

1. Partner with FWC and other local, state, and federal agencies and organizations to conduct the Natural Resource Workshop wherein marine law enforcement learn about the importance of coastal wetlands and reefs and their ecological and economic value, marine mammal rescue basics, and their role in protecting these resources.
2. Remove invasive species from BBAP and track numbers of species removed.
3. Participate in outreach activities targeting visitors to BBAP.

**Objective 2:** Maintain a comprehensive monitoring program in Biscayne Bay, with particular focus on the northern bay, to include monitoring of existing sites and include additional sites as needed.

**Integrated Strategies:** (Ecosystem Science)

1. Assess and maintain the number of epibenthic monitoring sites within the preserve boundaries.
2. Develop partnerships with other governmental agencies and non-governmental organizations to design and conduct habitat restoration and enhancement projects within BBAP.
3. Maintain equipment and acquire new equipment to aid in the mapping and monitoring of benthic resources so that data can be incorporated into BBAP's learning pages, spatial data dashboards, and data repositories for access by BBAP staff and agency partners.

**Performance Measures:**

1. Track meetings with university faculty and staff as well as local, state, and federal partners to determine how to recreate key research projects undertaken in Biscayne Bay that provided critical information regarding abundance, diversity, and composition of species to compare and contrast with past and present conditions.
2. Acquire and maintained equipment to aid in mapping and monitoring efforts.

**Objective 3:** Work with local governments and nonprofits to create a comprehensive marine debris prevention, reduction, and removal program within BBAP.

**Integrated Strategies:**

1. Develop collaborative campaigns with partner agencies to inform the public on ways to properly and improperly dispose of trash and the impacts of littering and marine debris to the health and management of Biscayne Bay. Incorporate "Leave No Trace" principles in campaign.
2. Coordinate with partner agencies to conduct an analysis of marine debris in Biscayne Bay.
3. Assist partner agencies in evaluating existing stormwater outfall systems throughout the county

to determine their effectiveness at preventing debris from entering Biscayne Bay.

**Performance Measures:**

1. Create a program with municipalities to decrease the amount of trash pollution entering Biscayne Bay from land-based trash sources.
2. Develop a set of policies to reduce marine debris being created on the spoil islands in BBAP.

**Goal 2:** Educate the public on the importance of BBAP's natural resources and history and cultural resources to the public.

**Objective 1:** Partner with other agencies and/or non-governmental organizations to promote greater understanding and interpretation of cultural and natural resources including threats to those resources that businesses, residents, and visitors can minimize.

**Integrated Strategies:**

1. Provide environmental education events and materials related to the historical and cultural importance of outstanding cultural and natural resource sites.
2. Engage the community in the management of natural resources by expanding the adopt-an-island program and/or implementing an adopt-a-shoreline program that integrates marine debris removal, wildlife surveys, and habitat restoration/enhancement projects, including invasive plant removal.
3. Collaborate with law enforcement and government agencies' regulatory staff to reduce the incidence of non-compliant or illegitimate businesses operating in or on Biscayne Bay.
4. Facilitate greater presence at municipal and county waterfront-related committees that address alterations to Biscayne Bay shorelines.
5. Coordinate with DEP staff, law enforcement, and local and state staff to educate magistrates and judges to prevent the dismissal of environmental violations, such as manatee zone or fisheries infractions.
6. Continue dialogue with area colleges and universities to promote science and research addressing long-standing questions about the health of Biscayne Bay and its supported flora and fauna.

**Performance Measures:**

1. Participate in Marine Advisory Support Team meetings to coordinate with marine law enforcement and stakeholders on critical issues impacting natural resources and human health and safety in Biscayne Bay and its tributaries.
2. Track coordination with agencies and non-governmental organizations managing natural areas along Biscayne Bay to encourage the integration of BBAP-related information into presentations, tours, and other outreach activities.
3. Collaborate with agencies and non-governmental organizations managing visitor centers to quantify the number of visitors exposed to educational messages about BBAP.
4. Maintain or replace aquatic preserve signage at outstanding cultural sites such as the Miami Circle, Arch Creek, the Deering Estate, and the Miami Marine Stadium as needed.
5. Maintain or replace aquatic preserve signage at outstanding natural resource sites, including FWC's Critical Wildlife Area, Chicken Key, Arch Creek, and Cutler Wetlands as needed.

**Objective 2:** Partner with state, county and municipal parks to incorporate information about BBAP history and resources into guided tours, signage, staff training, and promotional materials.

**Integrated Strategies:**

1. Create materials highlighting the natural and cultural resources of Biscayne Bay to share with ecotour guides.
2. Encourage tour guides and county and municipal park staff to include information about the natural and cultural resources of Biscayne Bay in their tours of BBAP.
3. Organize events in southern Biscayne Bay to allow visitors to experience healthy marine communities and educate them on the importance of proper ecological functioning.

**Performance Measures:**

1. Participate in meetings hosted by the City of Miami, City of Miami Beach, Miami-Dade County, the Miami River Commission, and other agencies or organizations to discuss the natural and cultural resources of the bay.
2. Engage senior county and city park staff managing natural areas along Biscayne Bay to encourage the integration of BBAP natural and cultural resource information into presentations, tours, and outreach activities. Collaborate with parks to track attendance and infer the number of visitors exposed to BBAP educational messages.
3. Develop a presentation about the natural and cultural resources of Biscayne Bay to motivate ecotour guides to incorporate this information into their activities.

#### *4.2.4 / Resource Management Issue / Issue Three: Habitat Loss*

The uplands surrounding Biscayne Bay have changed dramatically in the past century. Natural tributaries were channelized, and additional canals were dug to drain the Everglades, resulting in pulsed-point sources of freshwater. Two inlets were created through north and south Miami Beach barrier islands which altered the natural circulation patterns in northern Biscayne Bay. There are now compartments or basins separated by causeways in the northern part of Biscayne Bay. Over time wetlands were filled and shorelines bulkheaded so that business and residences could be constructed. Raw sewage was emptied into the bay for a period of time until it was diverted to a sewage treatment plant in the early 1950s. Dredging operations that excavated seagrasses and created causeways and spoil islands deepened parts of the bay, resulting in a loss of natural benthic communities and increased turbidity. There are many threats still facing coastal wetlands (e.g. seagrasses, mangroves, and hard bottom communities). Hydrological changes, water management practices, upland development, aged infrastructure, coastal construction, maintenance of waterways, land-based sources of pollution and other activities result in the loss of these habitats through direct and indirect impacts, with resources being impacted at a rate faster than they can be recovered due to logistical and financial circumstances. Excess nutrients can lead to a shift from a seagrass-dominated habitat with clear water, low turbidity, and low levels of algae in the water column, to an algae-based ecosystem that is turbid and reduces habitat essential for fish, birds, marine mammals, and other marine species. While large coverage of seagrasses occurs in central and southern Biscayne Bay, seagrass losses over the past decade span the north, central, and southern regions of the bay. In the south, Barnes Sound and Manatee Bay basins have experienced a decrease in seagrass of approximately 93 percent; however, water quality improvement and habitat recovery are possible (Bague et al. 2020). Recent surveys conducted by the DEP Biscayne Bay Aquatic Preserve have identified healthy areas of seagrass and hard bottom ecosystems throughout the basins, indicating the potential for these habitats to recover following significant loss.

**Goal 1:** Protect Biscayne Bay from impacts related to land use changes that disrupt the ecological functions of natural resources within ORCP's purview.

**Objective 1:** Participate in the regulatory process with partner agencies to reduce the impacts of coastal construction on Biscayne Bay and its resources

**Integrated Strategies:**

1. Analyze the direct impacts of coastal construction projects to develop effective avoidance and minimization criteria.
2. Collaborate with local, state, and federal agencies to conduct marine habitat restoration projects and employ non-regulatory methodologies to reduce impacts on existing marine habitats.
3. Organize and conduct training sessions for on-site field surveys with DEP's Southeast District office staff and SFWMD, as appropriate.
4. Review Comprehensive Development Master Plans and management plans of adjacent managed areas to identify areas for alignment with BBAP goals.
5. Coordinate with local, state, and federal agencies on applications for proposed construction projects by providing biological survey information or supporting public interest projects.
6. Engage with Miami-Dade County staff and leadership to facilitate restoration-focused permits for filling seagrass scars and evaluate other habitat restoration opportunities in areas with minimal benthic resources.
7. Advise municipal, local, and state government agencies on the appropriate use of available fill material for restoration projects.
8. Communicate with environmental consultants, bayfront homeowners, environmental regulatory staff, and the USFWS to educate them about the effects of creating new shorelines on existing habitats.

**Performance Measures:**

1. Acquire high-resolution aerial photography, satellite images, and digital photos to track changes and assess cumulative impacts to natural resources, such as seagrass loss around pilings, shoreline erosion, and propeller damage in Biscayne Bay's coastline and benthic community.
2. Develop, maintain, and update a master document and GIS project layers to catalog current and past mitigation projects in BBAP, ensuring this information is accessible to other agencies, the public, and stakeholders.
3. Organize a meeting with municipal, county, state, and/or federal regulatory staff and resource managers to discuss implementing the USFWS Living Shorelines program. Disseminate meeting minutes and participant deliverables.
4. Partner with regulatory agencies to create a GIS layer mapping past and present mitigation and restoration-related projects to monitor progress over time.

**Objective 2:** Describe and/or quantify function of ecological services provided by coastal habitats.

**Integrated Strategies:**

1. Quantify and enhance understanding of native biodiversity and ecosystem integrity within BBAP boundaries.
2. Investigate the form, function, and interactions between flora and fauna within BBAP boundaries, including the stresses experienced at the habitat or organism level.
3. Participate in discussions with resource agencies and non-governmental organizations at the Marine Health Summit to evaluate ongoing research on potential environmental stressors in the bay and their effects on human health.
4. Share knowledge about ecosystem services provided by coastal habitats with the public and students, from grade school through university.
5. Promote awareness of the value of mangroves, seagrass, sediment, and benthic communities through a homeowner education campaign.
6. Educate visitors and residents of Miami-Dade County on the location and ecological services

provided by lesser-known natural resources such as seagrasses, sediment, and benthic communities in the bay to address misconceptions about creating new habitats versus preserving existing ones.

**Performance Measures:**

1. Collaborate with agencies, universities, and non-governmental organizations to compile data and/or conduct a literature review on historical and current levels of biodiversity and coastal habitat resiliency. Synthesize this information for public and professional presentations.
2. Document participation in professional conferences and meetings where the ecological value of BBAP's resources is highlighted, and management and protection efforts are discussed.
3. Record involvement in outreach events that emphasize BBAP's natural resources, including interactive activities. Partner with volunteers and other organizations to facilitate multilingual information exchange for non-English-speaking residents.

**Objective 3:** Protect the natural resources by reducing harmful and illegal activities.

**Integrated Strategies:**

1. Coordinate with enforcement and permitting agencies through training opportunities, monthly meetings, and other venues to exchange natural resource information and address roadblocks to effective enforcement of environmental violations.
2. Collaborate with FWC, local governments, and law enforcement to review outcomes of pilot mooring projects and facilitate management of existing mooring areas to reduce impacts on the benthic community and water quality.
3. Work with law enforcement and partnering resource agencies to mitigate the number of derelict and "at-risk" vessels within BBAP boundaries.
4. Support resource agencies and law enforcement efforts to address derelict and/or illegal fisheries gear and harvesting activities through coordination and information sharing.

**Performance Measures:**

1. Provide contact information for reporting natural resource issues, such as derelict vessels, groundings, oil slicks, and marine dumping, during every presentation offered to stakeholders and user groups.
2. Organize annual meetings to share the latest science and best practices for conducting coastal construction projects that minimize seagrass impacts.
3. Develop and update a GIS layer identifying seagrass scars and other impacted areas that could benefit from mitigation opportunities.

**Objective 4:** Protect and restore seagrass areas.

**Integrated Strategies:** (Ecosystem Science)

1. Work with law enforcement to encourage enforcement of the seagrass law, prohibiting destruction of seagrasses, in aquatic preserve.
2. Work with other agencies to respond to vessel groundings and quantify injuries through the use of surveys and GPS technology to map location, size, and volume of injury.
3. Work with law enforcement and governmental agencies to facilitate an agreement between tow boat operators and DEP and/or relevant agencies to report grounded vessels to BBAP staff.
4. Develop partnerships with other governmental agencies and non-governmental organizations to

procure funding to design and conduct habitat restoration and enhancement projects within BBAP.

5. Partner with other resource agencies to confirm the success or failure of restoration techniques used in current and previously completed projects.
6. Facilitate emergency meetings in partnership with FWC, the county, universities and other agencies when support is needed to track algal blooms, groundings, injured wildlife, or other natural resource-related impacts.

**Performance Measures:**

1. Track the number of acres of seagrass and mangrove habitat restored, or restoration of substrate so that it is suitable for seagrasses or mangroves.
2. Conduct annual seagrass monitoring to maintain an up-to-date seagrass monitoring program database, and review and analyze data, as time and funding allow.

**Objective 5:** Mitigate the impacts of erosion.

**Integrated Strategies:**

1. Identify sedimentation and eutrophication "hot spot" areas within the bay through ongoing water quality fieldwork in collaboration with partner organizations.
2. Raise public awareness about the effects of erosion by assisting partner organizations in outreach efforts.
3. Promote resilient and/or living shorelines to protect upland communities from storm surges and mitigate coastal erosion.
4. Engage environmental consultants, bayfront homeowners, environmental regulatory staff, and the United States Fish and Wildlife Service to advance the Living Shorelines program.

**Performance Measures:**

1. Develop a document identifying sedimentation and eutrophication "hot spot" areas to prioritize locations for habitat restoration.
2. Convene discussions with DEP's Southeast Permitting District to evaluate the potential applications of living seawall structures.

**Objective 6:** Help identify suitable locations for habitat migration of mangrove and seagrass species.

**Integrated Strategies:**

1. Promote research that will help identify the best areas for restoring mangrove shorelines and identify how that process will proceed.
2. Raise awareness about the importance of living and sloped shorelines with a focus on the effects of sea level rise on seagrass communities.

**Performance Measures:**

1. Work with partners to discuss potential implementation of parcel buyout programs (land acquisition) to create wetland green spaces and living shorelines (bioremediation, stormwater and flooding risk reduction).
2. Assist with efforts for exotic removals and native plantings.

**Objective 7:** Understand and ensure adaptability and responsiveness to changing precipitation patterns and upland freshwater delivery in delivery of freshwater to Biscayne Bay to maintain salinity levels.

**Integrated Strategy:**

1. Aid partner organizations with the development of response plans for reducing stratification and deoxygenation from increased temperature events.

**Performance Measure:**

1. Produce response plans to environmental disasters, including but not limited to fish kills and

hurricanes, and ensure that they are publicly available.

## 4.3 / The Education and Outreach Management Program

The Education and Outreach Management Program components an essential management tool used to increase public awareness and promote informed stewardship by local communities. Education programs include on and off-site education and training activities. These activities include field studies for students and teachers; the development and distribution of media; the distribution of information at local events; the recruitment and management of volunteers; and training workshops for local citizens and decision-makers. The design and implementation of education programs incorporates the strategic targeting of select audiences. These audiences include all ages and walks of life; however, each represents key stakeholders and decision-makers. These efforts by the Education and Outreach Program allow the aquatic preserve to build and maintain relationships and convey knowledge to the community, invaluable components to successful management.

### *4.3.1 / Background of Education and Outreach at Biscayne Bay Aquatic Preserve*

Prior to 2003 no formal education or outreach program existed in BBAP, and other agencies were conducted environmental education about Biscayne Bay. In response to a need for education and outreach about Biscayne Bay, SFWMD sponsored a local non-profit group named Citizens for a Better South Florida (CBSF) to form the Biscayne Bay Environmental Education Alliance (The Alliance). The Alliance is no longer active, but BBAP staff have access to the information that was compiled by CBSF. The Alliance was an initiative “to dedicated to raising awareness about issues affecting Biscayne Bay” by focusing “on education and outreach programs” (Cortada, n.d.). CBSF defined five target audiences as: local students and educators, public officials, bay users (particularly boaters), tourists, and MDC residents, especially minority communities.” BBAP continues to use information collected from these programs in order to accommodate a variety of educational programs within the area. Educational programs involving Biscayne Bay have also been developed by the national, state, and local parks located on and around Biscayne Bay. Programs at the Marjory Stoneman Douglas Biscayne Nature Center include overnight camping, traveling trunks, backpacks, and classroom visits. Biscayne Nature Center is also instrumental in reaching fifth grade students, teachers, and members of the general public with information about seagrass, mangroves, other habitats and species found in Biscayne Bay. They offer programs specifically designed for minorities and physically or mentally challenged individuals. Other programming that educates the public about Biscayne Bay includes ranger programs at Oleta River and Bill Baggs Cape Florida State Parks, summer camp experiences with the Frost Science Museum, and MDC Parks and Recreation Department. In addition, MDC Parks and Recreation Department sponsors the Eco-Adventure Program, which provides access to the bay on guided canoe or kayak trips. Beginning in 1996, FWC produced the “Biscayne Bay Boating and Angling Guide” with both English and Spanish versions. The guide depicts boat ramps, marinas, artificial reefs, manatee slow speed zones and other information to further resource protection within the bay. FWC also provides brochures explaining Biscayne Bay habitats and animals, including the manatee, seagrasses, and mangroves. BBAP houses these brochures and pamphlets at its office library for distribution at educational and outreach events.

Educational programs, such as the previous Biscayne Bay-focused EcoMariner program, address responsible boating. EcoMariner was a web-based educational tool used by boaters interested in coursework that fosters a better understanding of the local ecosystem. EcoMariner educated boaters on impacts they can cause and promotes stewardship of natural resources, but currently does not have a class specific to Biscayne Bay.

BBAP previously offered educational opportunities such as the Florida Master Naturalist Courses. These courses are designed by the University of Florida and help participants learn about bay area habitats and species through forums and coursework. This course aims to promote awareness, understanding, and respect of Florida's natural world among Florida's citizens and visitors (UF/IFAS, n.d.). BBAP staff have

created other educational opportunities for citizens, including the Junior Biologist kids' educational day camps and the Green Below the Blue: Marine Plant Identification classes to promote stewardship of the bay's natural environments and educate communities of all ages on BBAP's species. BBAP will continue education and outreach programs to increase awareness and appreciation of Biscayne Bay and encourage stewardship of the bay's resources.

### *4.3.2 / Current Status of Education and Outreach at Biscayne Bay Aquatic Preserve*

#### *Education*

BBAP's Education and Outreach program consists of three target audiences: adults, youth, and educators (both formal and informal). Adults are taught about bay-area habitats and species through team-taught outreach booths. Educators participate in workshops about Biscayne Bay that emphasize how the educator can bring Biscayne Bay into their classrooms. This "Train-the-Trainer" program has a multiplier effect for the aquatic preserve. Future goals include expansion of the Biscayne Bay specific curricula and offering trainings for primary and secondary educators. Additional materials need to be adapted to Biscayne Bay by aquatic preserve staff or interns. Youth receive "hands-on" training by aquatic preserve staff with water quality instruments along with specimen collection methods at the BBEC. Nature Links is a program that is stationed at Shake-a-Leg, a sailing club in Coconut Grove geared toward providing access to the bay for children and adults with physical limitations. Nature Links is the first program of its kind that provides environmental education for public school students who are developmentally delayed and offers students internships and volunteering opportunities. The goal is to place students exiting the program, geared for older high school students, in jobs that facilitate teaching others about nature or supporting natural habitats, such as employment in local or state parks. Staff has joined Nature Links students on seagrass walks and boat rides at the BBAP office as well as at Shake-a-Leg and has coordinated with other state partners to facilitate learning experiences for the students.

BBAP personnel continue to rely on partnerships to participate in outreach programs. MDC coordinates and publicizes environmental education events within the community. Aquatic preserve staff increases their effectiveness by participating in member outreach events, including MDC DERM's Baynanza clean-up day, the Miami River Day, and numerous Earth Day events. BBAP personnel partner with organizations including agencies, not-for-profit, consultants, user groups, and formal and informal educators when invited to provide more individualized programs. At outreach events, BBAP personnel and volunteers challenge youth to participate in a learning game about Biscayne Bay, such as spinning a wheel with pictures of plants or animals in the bay and answering a question about the organism. Staff also uses hands-on learning by incorporating live organisms into outreach curriculum at events and in schools. Youth are rewarded for their participation with an "Aquatic Preserves are Exceptional" coloring book. Adults are often drawn in by aerial photography displays or other eye-catching imagery. Motivated adults may sign up to receive periodic email announcements about upcoming events. BNP, the Fish and Wildlife Research Institute, CBSF, and BBAP developed and printed a Spanish language version of a map, "Discover Biscayne Bay." The Southeast Florida Public Area Managers created and printed the "South Florida Nature Guide: Discover the Hidden Treasures", specifically designed for South Florida visitors. Both publications are housed within the BBEC library and distributed at local events throughout the community.

#### *Community Engagement*

Community engagement is achieved through participation of staff on teams and advisory panels and at neighborhood special events. BBAP personnel and volunteers have participated in events in El Portal, North Bay Village, Little Haiti, Little River, Miami Beach, North Miami, Morningside, Coconut Grove and City of Miami, and Surfside within recent years. Adults of all ages are the primary audience for presentations that are offered to the community, which are designed to be family friendly. Presentations can be arranged in response to an invitation from an organization, such as an environmental organization, user group, or civic association, or in coordination with a community-centered event, such as Baynanza. The county focuses its environmental protection education efforts on the bay during the annual Baynanza festival, which includes a shoreline cleanup that draws thousands of community volunteers (Miami-Dade County, 2014). Baynanza began as a daylong, bay-wide cleanup effort in 1982

and is still an annual event hosted and sponsored by DERM. Baynanza now features an events calendar that spans from March to April, coinciding with Seagrass Awareness Month. Seagrass Awareness Month was declared by the Florida Governor and grew out of projects initiated in the Florida Keys by the Seagrass Outreach Partnership that BBAP staff has supported. Since 2003, BBAP personnel have hosted a site for the International Coastal Cleanup at BBEC and Pelican Harbor Marina. Volunteers record trash on data cards as they remove debris from the mangroves and riprap on the same day as individuals from countries around the world. The Ocean Conservancy compiles the debris data collected globally and issues reports emphasizing reuse, recycling, and reduction.

*Photo 15 | Several times each year staff will host about a dozen students as part of Fairchild Botanic Garden's Environmental Immersion Day, part of their world-renowned event to increase students' interest in science from all grade levels in the county.*

***Marketing***

BBAP utilizes a government website under ORCP, which is currently being updated for the 50th anniversary of the Aquatic Preserve Act in 2025. Through this online presence, information about Biscayne Bay Aquatic Preserve resources, initiatives, and opportunities for volunteer involvement are accessible to the public. BBAP has long been engaged in a variety of community outreach events aimed at raising awareness and educating the public about the ecological importance of Biscayne Bay and its ecosystems. These efforts include attending outreach events where those who recreate in Biscayne Bay are likely to attend such as the Miami and Fort Lauderdale Boat Shows, the Deering Estate Seafood Festival, and other grassroots events focused on preserving its natural beauty. BBAP has also been active in marine debris reduction through our Adopt-An-Island Program and as site captains for Miami-Dade County's Baynanza and International Coastal Cleanup Day events.

In addition to these efforts, BBAP collaborated with the organization Leave No Trace, local city governments and Miami-Dade County government offices, and local stakeholders during a week-long Leave No Trace initiative designed to foster better stewardship of our marine environment. The week included a workshop to educate participants on responsible practices, a cleanup event at Pelican Harbor Marina, and an outreach campaign to engage boaters at local ramps, encouraging them to take their

trash back to marinas equipped with dumpsters. Participants also took part in a trivia event focused on the principles of Leave No Trace, reinforcing the importance of minimizing human impact on our natural resources.

***Volunteers***

The Friends of Biscayne Bay, Inc., BBAP's Citizen Support Organization, meets monthly to discuss current issues and events related to Biscayne Bay and raises funds to support the management programs of the aquatic preserve. Membership is offered to local citizens who would like to be contacted about upcoming events or to receive newsletters once one is developed, likely by volunteers or interns. In addition to Friends of Biscayne Bay, there are two major categories of volunteers at the BBAP - student interns and general volunteers. Student interns attend one of the local colleges or universities and receive credit for the hours they volunteer through their classes or institutions for "service learning". Service learning is a hands-on way of learning and providing a service that offers more to the student than volunteering (which tends to only benefit the organization with little room for career development). It also offers more to the agency than an internship (which tends to fit the student's needs without a strong focus on meeting the agency's goals). Service learning also promotes civic engagement as part of the philosophy of hands-on work experience to increase participation in, and awareness of, issues facing the student's community. BBAP internship projects include education and outreach or resource management components and are assigned according to the student's skill level and number of hours to be completed. Students interview with the Environmental Specialist II before placement and are mentored throughout their tenure. General volunteers attend organized events, such as coastal clean-ups and habitat restoration projects, as either individuals or as members of groups such as school and community clubs. All volunteers are asked to complete individual State of Florida Volunteer Applications as an individual or as a member of a group in order to be covered by workers' compensation and liability insurance. Those who volunteer on more than one occasion receive a copy of the BBAP Volunteer Guide. Repeat volunteers are awarded certificates to recognize the various levels of effort they have dedicated to the aquatic preserve each year. Increasing contact with volunteers and members of the public is coordinated through the Friends of Biscayne Bay website the group has where activities and events can be posted. Another way of keeping stakeholders engaged, informed and active, is through the Friends of Biscayne Bay's social media, where pictures can be showcased, and activities advertised.

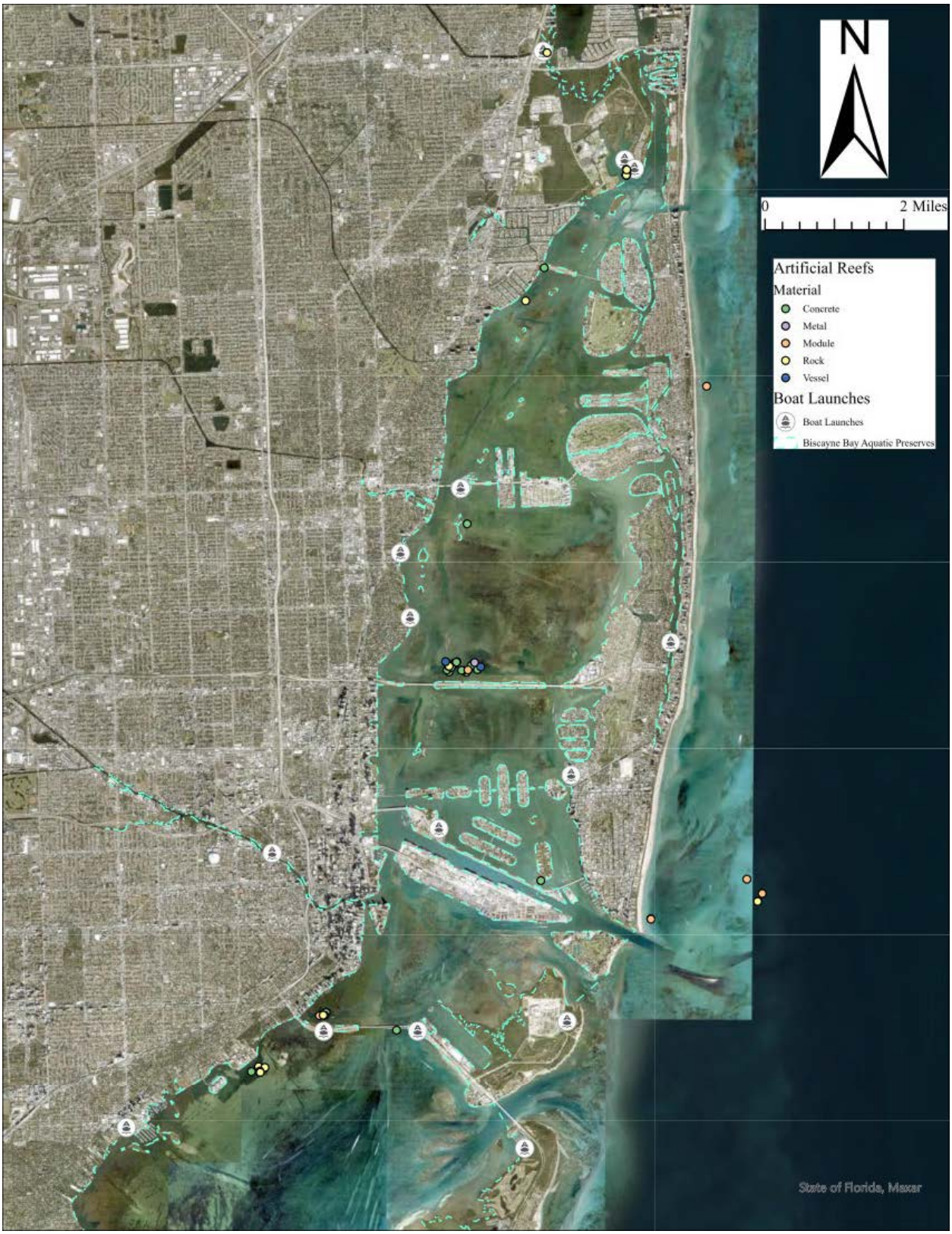
### *4.3.3 / Education and Outreach Issue / Issue Four: Public Awareness, Access and Use*

There is a perception that Biscayne Bay is difficult to access, and to better understand this issue a study was conducted by TPL that took aim at determining how best and where to increase public access to the bay. This document can be revisited for potential solutions. TPL's Biscayne Bay Access Plan provides an example of the importance of maintaining public submerged lands. The authors reference a 1947 Miami Herald article in which a private landowner's fight with the City of Miami is examined. The landowner contended that he ought to be able to purchase 1,400 acres of publicly owned submerged lands to be able to expand this property at the mouth of the Miami River. His argument was that the city had not used the land for municipal purposes as intended by the Florida Legislature when it deeded the bay bottom to the municipality. But the city retorted by stating, as reported by the Miami Herald, that municipal purposes "…include even the important right merely to sit in beautiful Bayfront Park and look over the waters of Biscayne Bay. If private ownership …were recognized, it is contended that the bay would be filled in and hotels, apartments and stores built on islands, thereby depriving the public of enjoyment of the bay" (TPL, n.d.).

Existing access to Biscayne Bay such as kayak launches, and boat ramps should be maintained and improved. These facilities are very important to registered boaters who do not or cannot keep their vessel or personal watercraft at a marina or dry dock storage and should be expanded and maintained where possible. Ensuring that operators of motorized vessels know Biscayne Bay's waters and applicable laws and have appropriate access to the waterway is essential in balancing responsible use with environmental protection.

*Photo 16 | Kayaking is a popular way to enjoy the bay. Vendors rent kayaks at various points throughout BBAP. Here, kayakers in north BBAP.*

Additionally, visual access to Biscayne Bay should be improved. Per Trust for Public Land's Biscayne Bay Access Plan (TPL, n.d.) there are a multitude of ways to go about doing this, from encouraging end-of-street parks being created using dead-end right-of-way that otherwise may sit unkempt or taking the opportunity to use existing infrastructure along developed and natural shorelines to provide seating and activities that can be enjoyed at the water's edge. Promoting low-impact, passive use of the preserve is a means to not only allow citizens to intimately explore parts of Biscayne Bay otherwise inaccessible by some motor craft—either due to noise flushing wildlife or draft limits in shallow water habitat—but to develop an awareness and appreciation of the bay's resources in a way that many citizens and visitors often overlook or do not consider. While Biscayne Bay is an international boating and sailing destination, it is less known for its waterway birding trails, presence of resident marine mammals, or elusive yet fascinating marine invertebrates. Increased or enhanced public access should be accompanied by increased access to information on how to responsibly enjoy Biscayne Bay. Public presentations, various training opportunities, education targeted at user groups, and youth education play a role in fostering stewardship of the bay's resources. Residents and visitors alike should have physical access to the bay as well as access to information about what the bay needs to thrive and endure and what role one plays in supporting the bay's future health. The balance between public use and long-term protection and management of BBAP so that its ecological and aesthetic values may endure is a difficult one to maintain. While access to Biscayne Bay can always be improved, BBAP has a responsibility to ensure that access is balanced with the ecological needs of Biscayne Bay.




*Map 15 | Artificial reefs and public access points in north Biscayne Bay Aquatic Preserve*

### *Issue Four: Public Awareness, Access and Use*

**Goal 1:** Maintain a safe environment for Biscayne Bay's wildlife, habitats, and user groups.

**Objective 1: I**dentify human use conflicts with natural resources.

**Integrated Strategies:**

1. Collaborate with regulatory staff, law enforcement, legal staff, and resource management teams from other agencies to address non-water-dependent, potentially illegal, or resource-harming activities in BBAP.
2. Provide Biscayne Bay-specific boater education and safety programs.
3. Deliver formal and informal outreach activities in counties BBAP serves, with a focus on underserved communities, to promote awareness and stewardship of BBAP's natural resources.
4. Support the distribution of BBAP materials at venues such as the Frost Science Museum, Bill Baggs State Park Visitor Center, and other locations to educate the visiting public about BBAP resources.
5. Utilize innovative technologies to create video footage of healthy marine habitats in Biscayne Bay, providing interactive educational experiences for residents of MDC with limited bay access.

**Performance Measures:**

1. Engage senior county and city park staff who manage natural areas along Biscayne Bay to integrate BBAP-related information into presentations, tours, and outreach activities. Track park attendance to estimate the number of visitors exposed to BBAP educational messages.
2. Organize natural resource protection workshops every two years for marine law enforcement officers, resource managers, and park staff in collaboration with government and non-governmental organizations.
3. Facilitate education opportunities specific to Biscayne Bay by partnering with national parks, the National Parks Conservation Association, and other stakeholders to reach both residents and visitors to Miami-Dade County.
4. Form a committee of law enforcement, resource managers, regulatory staff, and stakeholders to identify non-water-dependent, potentially illegal, and/or harmful activities in BBAP and establish protocols for addressing them.

**Objective 2:** Reduce the amount of debris, contaminants, and resource injuries associated with user group activities.

**Integrated Strategies:**

1. Determine effectiveness and management practices of mooring fields and potentially create new mooring fields to better protect resources from direct impacts (anchors) and indirect impacts (dumping of sewage).
2. Improve understanding and coordination with consumptive use impacts from fisheries such as shrimping, crabbing, and others that employ gear and methods regarding the potential impacts to Biscayne Bay resources.
3. Identify hotspots of vessel impacts in order to direct management measures more efficiently.
4. Identify methods to reduce and eliminate buildup of trash on spoil islands.

**Performance Measures:**

1. Schedule and coordinate annual workshops with the assistance of Florida Sea Grant, marine industries, non-profit organizations and agency partners to provide citizens with information related to recreational and commercial fishing gear, vessel impacts, and other threats to the marine environment. Track the number of meetings and participants who attend planning and informational workshops.

2. Create and implement a unified strategy with all the island owners to tackle the trash problems on the islands

**Objective 3: I**dentify ways to increase and enhance effective on-water law enforcement patrols in BBAP.

**Integrated Strategies:**

1. Promote awareness of proper boating practices to reduce propeller scarring in seagrass and other benthic communities.
1. Coordinate increasing or replacing regulatory signage and buoys, so they are correct, well-maintained, and enforceable.
2. Partner with other agencies and organizations to identify funding sources to conduct more targeted marine law enforcement.
3. Work with ORCP legal staff, law enforcement, and local and state legal staff to implement a class such as that is run by Biscayne National Park where on-water citations for violations related to speed zones and safety issues can result in reduced financial restitution if the offender participates in a class designed to educate him/ her and prevent future offenses.

**Performance Measures:**

1. Coordinate with FWC and other local, state and federal agencies and non-governmental organizations to host quarterly coordination meetings and conduct natural resource workshops every two years wherein marine law enforcement learn about the ecological and economic value of coastal wetlands, seagrass, and reef habitat; marine mammal rescue basics; and law enforcement's role in protecting these resources. Track the number of participants and measure knowledge gained through post-program surveys.
2. Meet with law enforcement agencies to identify what resources are needed, financial or otherwise, that would promote increased on-water presence in BBAP.

## 4.4 / The Public Use Management Program

The Public Use Management Program addresses the delivery and management of public use opportunities at the aquatic preserve. The components of this program focus on providing the public recreational opportunities within the site's boundaries which are compatible with resource management objectives. The goal for public access management in ORCP managed areas is to promote and manage public use of our preserves and reserves that supports the research, education, and stewardship mission of ORCP.

While access by the general public has always been a priority, the conservation of ORCP's sites is the primary management concern for ORCP. It is essential for staff to analyze existing public uses and define management strategies that balance these activities where compatible in a manner that protects natural, cultural and aesthetic resources. This requires gathering existing information on use, needs, and opportunities, as well as a thorough consideration of the existing and potential impacts to critical upland, wetland and submerged habitats. This includes the coordination of visitor program planning with social science research. One of ORCP's critical management challenges during the next 10 years is balancing anticipated increases in public use with the need to ensure preservation of site resources. This section explains the history and current status of our Public Use efforts.

### *4.4.1 / Background of Public Use at Biscayne Bay Aquatic Preserve*

Water-dependent activities within BBAP are extremely popular with residents and visitors alike. Recreational fishing, nature photography, and nature and wildlife viewing are popular activities and power boats, sail boats, kayaks and personal watercraft (PWC) are all commonly found in BBAP. As the resident population within southwest Florida continues to rise and more people are vacationing within the region, the number of vessels utilizing the coastal waters is also rising. Increasing threats, such as propeller scarring and turbidity from boaters has been harmful to seagrass beds. This is caused by improper boating techniques which led to the passing of legislation (§253.04(3)(a), F.S.) making it illegal to cause destruction to seagrass beds in aquatic preserves. Irresponsible fishing practices have also left

a mark on the environment through fishing line, hooks, lures, bobbers, nets and other items entangled and left in mangroves and other habitats. Often the uniqueness of an area can lead to its own demise, as increased activity places pressure on the very resources that originally drew people to the area. Complete knowledge of all current and proposed activities taking place within the aquatic preserve is essential for proper management

A report was commissioned by the Florida Legislature and the SFWMD to study the status of Biscayne Bay access. The report was undertaken by TPL and was titled “Get Your Feet Wet… The Plan to Discover Biscayne Bay--A Public Access Plan for Biscayne Bay.” The plan highlights impediments to resident and visitor access to the bay and recommends the necessary steps to increase access, which is defined as both visual and physical contact. The plan is the result of a two-year planning process, which involved an advisory council of almost three dozen local civic, business, agency, and community leaders, as well as public meetings, workshops, and research.

***Public Access***

Public fora were held in 1982 by DERM and were planned annually to update the public about new information acquired each year. .Since 2017, the Biscayne Bay Marine Health summit has served as a forum to address the public about all activities occurring in Biscayne Bay. DERM’s Biscayne Bay Restoration and Enhancement Program addressed access with a proposed County Urban Waterfront Project. The County created a Shoreline Review Committee to balance development with bay access and to recommend setbacks from the bay’s shoreline. Several proposals for bay walks or greenways along the aquatic preserve were initiated by the county, the City of Miami, the Miami River Commission, and TPL. BBAP staff served on the Biscayne Bay Public Access Plan Advisory Plan in 2005 which produced "Get Your Feet Wet: The Public Access Plan for Biscayne Bay." The plan explored non-conventional access to the bay, such as providing visual access at street ends that lead to the bay.

***Boating/Moorings***

BBAP and other DEP staff served as advisory members for the Dinner Key Mooring Plan in the Coconut Grove area of Miami. BBAP personnel also provided MDC Environmental Resource Personnel comments when the plan was submitted for permitting. MDC’s Manatee Protection Plan Included Marine Facility Siting Criteria, and DERM developed a Marine Facilities Annual Operating Permit system in 1989. The permit system ensures that marine facilities are following Best Management Practices developed by DERM for marine facilities. The high number of boaters presents a threat to the submerged resources of Biscayne Bay. Mooring fields help guard against that threat by giving boaters a safe place to anchor their boats instead of inadvertently damaging coral reefs or seagrass beds with anchors. BBAP staff provide guidance for the development of additional mooring fields to accommodate the high number of boaters.

***Interpretation/Signage***

Miami-Dade is the county with the greatest number of total vessels registered in Florida (FWC Commission Boating and Waterways Section, 2013). The areas with the highest concentrations of recreational boating in Miami-Dade County are mostly within the boundaries of Biscayne Bay Aquatic Preserve. The most popular boating destinations include Key Biscayne and Bakers Haulover Inlet. (Garcia, 2015). Areas of speed boat traffic are concentrated throughout the northern part of BBAP and include the Port of Miami, the Intracoastal Waterway, Miami Beach, and Government Cut (Gorzelany, 2009). Educational, non-regulatory signage on boat ramps and in marinas is historically a popular method for organizations and agencies to communicate with boaters.

The aquatic preserve managers in the 1990s worked with four MDC marina managers and received funding from FIND to place environmental education signs at boat ramps adjacent to the aquatic preserve. The signs were double-sided, one side English and the other Spanish, and they explained how to “Be a Better Boater”, what manatees are, and the importance of seagrasses. Future projects include working with the marina managers to replace these signs. In 2015, a graduate student at UM RSMAS evaluated the effectiveness of marine signages within BBAP. The study recommended that BBAP’s resources should focus not only on educational signs to educate boaters, but also on other forms of communications, such as internet campaigns and partnerships with other government agencies, as well

as news and weather stations (Garcia, 2015).

### 4.4.2 / Current Status of Public Use at Biscayne Bay Aquatic Preserve

#### Public Access

BBAP staff served on the Biscayne Bay Public Access Plan Advisory Team with 30 community members from agencies, non- and for-profit groups. TPL and the South Florida Regional Planning Council coordinated the meetings in 2005. “Get your Feet Wet: The Public Access Plan for Biscayne Bay” explored non-conventional access to the bay, such as providing visual access at street ends that lead to the bay and was produced with seven recommended initial actions and five goals. One of those recommendations was to create water trails for non-motorized boats, and in 2007 the DEP Office of Greenways and Trails dedicated the Biscayne Bay section of the Florida Circumnavigational Saltwater Paddling Trail. Access points for canoes have also been created at the Deering Estate and at the C-100 canal mouth near where BBAP meets BNP. Towards the northern end of the Aquatic Preserve, canoes and kayaks can be launched from East Greynolds County Park, and the concessionaire at Oleta River State Park rents kayaks from two different park locations. This allows people to paddle on the Oleta River below towering red mangroves as well as in the more open waters of the bay. Guided canoe or kayak trips are provided by the County Eco-Adventures program and involve trips inside BBAP from Key Biscayne to Matheson Hammock County Park and Preserve. The Wildlife Research Team, which has volunteered with BBAP, uses its 35 canoes for clean-ups in shallow mangrove creeks that motorized vessels cannot access.

In 2005, the City of Miami mayor launched “Miami 21,” a planning program that called for the revitalization of the city’s parks. One of the four main themes of the plan encouraging people to get outdoors in the 21st Century is called “Nature.” There are five specific plans to be developed to re-master park space that fronts on Biscayne Bay including: Bicentennial/Museum Park, Bayfront Park, Downtown, Coconut Grove Waterfront, and Virginia Key.

#### Disability Access

Both Oleta River and Bill Baggs Cape Florida State Parks offer beach wheelchairs that can be reserved for use by persons with physical disabilities to obtain access to the bay. In addition, Oleta River State Park also has accessible fishing piers. Most county and municipal parks provide bay access, either visually or physically, to individuals with disabilities. Some bayfront parks offer sports programs for individuals of all ages.

Often, boats offer the best way to enjoy the bay, however, owning a boat in Miami-Dade is often difficult and expensive. For people with special needs, older residents, people with disabilities, and those with economic or language barriers, gaining access to the bay can be very difficult. Shake-a-Leg Miami is a sailing program which aims to provide a gateway to Biscayne Bay for children and adults with physical or developmental disabilities to sail and kayak, sometimes in modified vessels. Shake-a-Leg also provides kayak rentals, moonlight sails, and environmental education to the public at large. Nature Links/ Project Bridge is a collaborative project initiated by UM and Shake-a-Leg Miami. Nature Links’ goal is to build partnerships in the community to provide MDC Public School students ages 16-22 with developmental delays or disabilities greater educational, employment and volunteer opportunities that are environmentally oriented. BBAP works in cooperation with Nature Links to provide educational field day activities to students with developmental delays or disabilities.

#### Boating/Mooring

BBAP staff reviews and offers comments on several development initiatives for bay front land. The City of Miami is developing master plans for Virginia Key, Museum (formerly Bicentennial) Park, and Dinner Key in Coconut Grove. The high number of boaters presents a threat to the submerged resources of Biscayne Bay. Mooring fields help guard against that threat by giving boaters a safe place to anchor instead of inadvertently damaging coral reefs or seagrass beds with anchors. BBAP staff provide guidance for the development of additional mooring fields to accommodate the high number of boaters. In 2002, regulatory agencies and the City of Miami organized technical and field assessment teams and

produced a report to evaluate the feasibility of establishing a managed anchorage and mooring field in the Dinner Key area. The Dinner Key Master Plan incorporated a managed mooring field that was permitted through DEP's Southeast District's Environmental Resource Permitting program after incorporating comments from aquatic preserve staff. This is one of the only managed mooring fields serving the City of Miami residents and other visiting boaters and one of the largest in the Southeast US with 175 mooring buoys currently installed and up to 225 buoys to be added at a later date. In 2018, a managed mooring field adjacent to the north end of Dinner Key Marina within BBAP was established. The project consisted of installing 36 regulatory buoys, which include 11 mooring field buoys, 22 danger/shoal seagrass habitat limited entry zone buoys, and 3 channel marker buoys (DEP, 2018). Dinner Key marina also employs a pump out vessel to travel from boats in the mooring field. Both county and municipal-run marinas have become part of the DEP's Clean Marina program. Each marina follows best management practices, some mandatory and some optional, that help reduce pollution at the source. DEP also challenges the public to pledge to be Clean Boaters and use facilities where boat repairs are made to become Clean Boatyards.

The Florida Clean Marina Program is a voluntary designation program with a proactive approach to environmental stewardship, where participants receive assistance in implementing Best Management Practices through on-site and distance technical assistance, mentoring by other Clean Marinas and continuing education. The program encourages marinas, boatyards, and marine retailers to incorporate Best Management Practices (BMPs) that exceed regulatory requirements. To become designated as a Florida Clean Marina, facilities must meet regulatory requirements and implement BMPs designed to protect Florida's waterways and address critical environmental issues, such as sensitive habitats, waste management, stormwater control, spill prevention, and emergency preparedness. Facilities may also become designated as a Clean & Resilient Facility. BBAP supports the Clean Marina and Boating programs when possible.

Many powerboats, yacht, sailboat, jet ski, canoe, kayak rentals operate businesses throughout Biscayne Bay, some as concessionaires out of public parks. In addition to canoeing and kayaking, other lower impact water sports popular in Biscayne Bay include windsurfing and kitesurfing, rowing, dragon boat racing and outriggers. Rentals and schools that teach people these sports exist in Miami Beach, Coconut Grove, and Virginia Key. Biscayne Bay is an international destination for sailing Olympians to train. Dozens of regattas a year occur in Biscayne Bay both for youth and adults. BBAP staff work with the U.S. Coast Guard to review marine event permits for regattas and other water-based recreational activities on the bay. The Ronald W. Shane Watersports Center, part of Miami Beach Rowing Club, provides access to the bay for underprivileged youth.

### *Consumptive Use*

Predominant consumptive use within BBAP originates from recreational fishing, commercial fishing, lobstering, shrimping, and crabbing. BBAP staff attend monthly meetings of the Marine Advisory Support Team (MAST). MAST is a coalition of marine law enforcement officers within MDC including several municipal, county, state, and federal agencies that meet to organize major enforcement events, such as the Spiny Lobster Mini-Season, Columbus Day Regatta, and annual manatee protection operations. MAST's goal is to increase coordination of law enforcement agencies to provide maximum protection for human safety and environmental resources. BBAP personnel provide educational materials to marine officers for use when issuing boating violation citations or warnings. These materials serve to increase the public's awareness of local speed zones and natural resources, such as seagrass beds and manatees. The BBAP personnel's attendance at MAST meetings has facilitated increases in public education about Biscayne Bay's resources, repairs of downed or incorrect manatee signage, and greater knowledge of BBAP staff about marine laws and procedures. Participation has also facilitated a law enforcement response to illegal harvesting of sponges near Chapman Field.

The Local Government Comprehensive Development Master Plans *(*CDMP*)* for Dade and Monroe counties are required by the Local Government Comprehensive Planning and Land Development Regulation Act to include elements relating to different governmental functions (e.g., housing, physical

facilities, conservation, land use, coastal zone protection, etc.). Each plan, in effect, is intended to guide the future development of each respective county. Cities and counties are to adopt land development regulations and conform to the criteria, policies, and practices of their comprehensive plans, which must be updated periodically as required by recent statutory amendments. One goal in developing a management plan for BBAP is to guide county governments during their planning process, or as comprehensive plans are revised, toward creating local planning criteria and standards that will be consistent with the objectives of the program. MDC has completed and adopted a comprehensive plan; updates to the CDMP are performed every seven years. The CDMP also establishes an Urban Development Boundary. Development orders for urban development within the boundary were approved in 2020 (MDC, 2020).

***Non-Consumptive Use***

In 2007, the DEP Office of Greenways and Trails created water trails for non-motorized boats and helped develop the Biscayne Bay section of the Florida Circumnavigational Saltwater Paddling Trail. When the trail was being developed, BBAPs personnel provided access by vessel to the northern portion of the bay and introduced the Office of Greenways and Trails coordinator to local paddling experts with SFWMD, DERM, and TPL. The Biscayne Bay segment, 16 of 26 around the state, begins in the north at Oleta River State Park and ends at John Pennekamp Coral Reef State Park covering 68 miles (109.4 km). The circumnavigational trail is designed for multi-day, overnight trips. The City of Miami has created access points at Morningside and Margaret Pace Parks, both on the shoreline of the aquatic preserve. One of the goals of the Trust of Public Land Access Plan was to create water trails for non-motorized boats. Access points for canoes have been created at the Deering Estate and the mouth of C-100 Canal. BBAP partnered with Biscayne Bay Waterkeeper, Inc. through funding made available from National Geographic Education to develop a paddling access guide to Biscayne Bay, which will be updated in 2025.

***Interpretation***

SFWMD formerly contracted with FIND to permit, install, or replace signs within the water or at boat ramps. Recently, FWC became responsible for manatee speed zones and boating safety signs. Several of the signs within the BBAP must be adjusted in November and April at the beginning and end of manatee season. Following the Florida Legislature's passage of a seagrass protection bill in 2009 to protect seagrasses within aquatic preserves, DEP and FWC partnered to create signage explaining the new statute. BBAP staff have posted signs at local boat ramps and marinas to educate the public on seagrasses and seagrass coverage throughout the bay, as well as the boundaries of the preserve. Staff are also finding local partners to help provide signs offering information about cultural and natural resources in BBAP.

The Miami Circle, a historic Tequesta Indian structure approximately 2,000 years old, lies along the southern bank of the Miami River mouth. This site consists of a perfect circle of 24 holes cut into the limestone rock, surrounded by a large number of smaller holes. It is the only known evidence of a prehistoric permanent structure cut into the bedrock in the United States and predates other known permanent settlements on the east coast. Built by the Tequesta Indians and discovered by state archeologists in 1998, the site was listed on the National Register of Historic Places in 2002 and declared a National Historic Landmark in 2009. The function the circle served for the native Tequestas is unclear. It could have served as a celestial calendar or a chief's house or temple. Two delicately crafted stone axes were discovered along the eastern part of the circle. Both of these stone axes were made of basalt, an effusive rock not native to Florida. Animal offerings included a complete sea turtle carapace and the articulated remnant of a six-foot shark discovered from inside the circle. HistoryMiami (formerly known as the Historical Museum of Southern Florida) signed a 44-year lease of the site in March 2008 and Miami River advocates are working to install an educational program on the site. BBAP has been invited to provide information about the preserve for educational signage to commemorate the cultural and natural resource history of the site, as this site looks out on the waters of the BBAP.

Shake-a-Leg Miami has a series of colorful, child-friendly signs that illustrate habitat types and flora and fauna of Biscayne Bay. FIU's Biscayne Bay campus has partnered with BBAP to create signage that will

front the bay and provide information about cultural and natural resources along the BBAP.

#### *4.4.3 / Public Use Issue / Issue Five: Sustainable Public Use*

Biscayne Bay's significant ecological value is the reason it serves as an economic engine for Miami-Dade County. Turquoise waters rising up over seagrass and hard bottom communities— the natural systems helping to keep bay waters clear and healthy—is the first thing international visitors see when arriving in Miami. Boating, sailing, and recreational fishing excursions for tourists bring millions of dollars into local and regional economies every year. Commercial fishing landings data on the FWC website document the inflow of dollars to MDC from the harvest of some of the many species that spend parts of their life cycles in Biscayne Bay's seagrasses and/or mangroves. The bay's ecology, as it translates to economic viability, affects the citizens of Miami-Dade County not only in the way it supports the economy but also in how the bay serves as the people's source of social life. Local boating, sailing, paddling, and fishing enthusiasts need not travel far to enjoy the beauty and bounty of a subtropical ecosystem. The Biscayne Bay Economic Study (2023) concluded that the four most popular recreation activities for both visitors and residents as defined by the amount of "Person-Days" (one person participating in a recreational activity for all or part of a day) spent recreating were "Viewing the Bay from Shore, Picnicking on Biscayne Bay, Swimming from Shore and Fishing from Boat" (Hazen and Sawyer 2023)

Biscayne Bay is an international boating and sailing destination. Dozens of sailing regattas take place on the bay each year. An Olympic sailing team trains on Biscayne Bay's waters. The Miami International Boat Show contributes an estimated $1.34 billion (Miami-Dade County, 2024) to the local economy each year, not only in boat sales but also in dollars spent in local hotels, restaurants, and sightseeing—including fishing and boating tours of Biscayne Bay. Many tour guides make a living providing tours of Hollywood stars' homes, and one company in particular will take you through Miami's most popular sites on water and land without ever leaving your seat.

Miami-Dade County remains at the top of the list in terms of number of recreational vessels with 76,691 registered vessels in 2023 (FLHSMV, n.d.). Commercial fisheries operations provide economic input into the local and regional economy, although certain practices and deteriorating vessels pose great risk to the future health of Biscayne Bay. Commercial fishing in Biscayne Bay, while not as prolific as in the past, still provides livelihoods to hundreds of fishing operations and contributes to the county's economy. Protecting the species targeted by commercial fisheries and the habitats these species depend on helps to ensure both a productive ecosystem and economy for MDC. The area known as "Shrimper's Row" off Blackpoint Marina in the national park is now largely devoid of roller-frame net shrimp vessels (Ault et al., 1997), as their leases have been terminated from Dinner Key in Coconut Grove, one of their previously important docking sites (EDAW Inc., 2006). Approximately four or five stone crab boats still harvest in Biscayne Bay, and boats from the Keys come up to harvest stone crab in bay waters as well. About two boats still use the hook-and-line method to fish for mackerel in the bay. Mullet are no longer fished the way they once were because gill nets used to catch the fish were banned in the 1990s. Bait fish such as goggle eye and pilchards are caught using cast nets and sold as bait offshore, to fishers hoping to catch sailfish, and these numbers are not reported as landings (Dan Kipnis, personal communication). The Port of Miami is also a local economic engine for Miami-Dade County and is regarded as one of the county's leading sources of economic income and one of the largest Crew Ship ports in the world. With a shallow estuary supporting the operations of a port of call for cruise ships and cargo vessels alike, there are also environmental impacts endured due to long-term operations, expansions, and other activities. In defining what sustainability means, there is ample literature available to highlight various definitions of sustainability depending upon the context in which it is used. Goodland and Daly (1996) identify environmental sustainability, or overall preservation of the environment as a whole, as the goal with practices such as sustainable development or sustainable fisheries being an approach used as a means to reach that goal. For purposes of defining what sustainable economic use

might mean in the context of how this issue affects Biscayne Bay, the definition cited in Johnston, Everard, Santillo and Robert (2007) is more apt: "…of, relating to, or being a method of harvesting or using a resource so that the resource is not depleted or permanently damaged." It is clearly documented that Biscayne Bay is a resilient ecosystem that has rebounded from substantial pressures and degradation. The future of Biscayne Bay as an economic engine is directly linked to its ecological function, and finding a balance between the two continues to be a goal resource managers strive to achieve.

### *Issue Five: Sustainable Public Use*

**Goal 1:** Promote sustainable recreational opportunities, while increasing access to the bay.

**Objective 1:** Increase awareness and promote sustainable use of the bay's resources.

**Integrated Strategies:**

1. Promote awareness of proper boating practices to reduce propeller scarring in seagrasses and other benthic communities.
2. Provide formal and informal opportunities for various types of user groups (e.g. motorized vessels, SCUBA divers, kite surfers, birders) to learn about BBAP's natural resources in order to promote a sense of stewardship and conservation.
3. Increase the amount of accessible and marked freediving and SCUBA's diving locations in the bay.
4. Support local agencies (i.e., local rowing clubs) that promote sustainable low-impact recreational activities.
5. Determine what types of recreational tour operations are occurring in Biscayne Bay and its tributaries as well as the economic contribution and possible environmental impacts of these operations.

**Performance Measures:**

1. Host a meeting between the Biscayne Bay National Park, and other stakeholders to fund and implement an EcoMariner program specific to Biscayne Bay for residents and visitors to Miami-Dade County.
2. Partner with Sea Grant and other agencies and non-profits to offer various Florida Master Naturalist courses available to the public in Miami-Dade County. Track the number of programs and participants.
3. Obtain and keep current with Florida Marine Science Educator Association certifications to be compliant with the law in order to conduct seining and other collection activities.
4. Track meetings with agencies and stakeholders who previously sponsored the development and printing of the "Boating and Angling Guide to Biscayne Bay" in order to reproduce this extremely popular resource for user groups.
5. Mark existing artificial reefs and areas of interest with mooring buoys and place access points near the location, Track the number of buoys installed.
6. Meet with local, state and federal agencies to discuss a methodology by which potential impacts from tour operations and recreational fishing activities can be quantified. Meeting minutes, including participants' deliverables, will be disseminated.

**Objective 2:** Identify and support appropriate locations for paddling launch sites and desirable destinations to access via kayak, canoe, or paddleboard.

**Integrated Strategy:**

1. Develop “attractions” to paddle to near launch sites and on islands, including both natural areas and environmental exhibits.

**Performance Measures:**

1. Launch a campaign to promote paddling and other sustainable recreational activities. The campaign will include creating a guide that highlights launch locations, safety guidelines, and natural resource information. Distribute guides to social networks of paddlers, eco-tour concessionaires, and municipal or county run eco-tour concessionaires. Make it available on the BBAP website.
2. Host a meeting with non-profit organizations and other government agencies to promote themed-paddling tours of BBAP that provide all levels of paddlers with ecological interpretation of the bay’s natural resources.
3. Develop various trails and environmental exhibits on the islands to attract visitors.
4. Install metal fire rings and clear areas for tent camping and enjoyment of DEP islands. All camp groups would be required to follow Leave No Trace Principles and encouraged to do a marine debris cleanup while on the island.

**Objective 3:** Make the bay more accessible to underserved communities, while simultaneously promoting sustainable uses.

**Integrated Strategies:**

1. Increase access points, both physical and visual, to the bay and facilitate increased free public parking areas.
2. Increase education and access to audiovisual displays of healthy components of the bay, like the healthy seagrass beds located in Southern BBAP, to foster relationships to the bay and its resources.

**Performance Measure:**

1. Sponsor free parking days at paddle launches: if participants bring back a bag of debris, they get free parking.

*Photo 17 | Each year, BBAP hosts a site for the International Coastal Cleanup. More than 120 volunteers participate and nearly two tons of garbage are collected.*

# Chapter 5 / Administrative Plan

Successful implementation of the Biscayne Bay Aquatic Preserve (BBAP) programs and the goals outlined in this management plan are dependent upon adequate staffing, facilities, and funding. Citizen support and the cooperation of partnering agencies, non-governmental organizations, and other groups are also critical. Staff leverage state funds and advance BBAP's mission with support from local partners, namely Miami-Dade County; Florida Sea Grant; Florida International University's Biscayne Bay Campus; Miami Dade College's Center for Community Involvement Environmental Education Providers, Inc.; University of Miami's Rosenstiel School of Marine and Atmospheric Science; National Oceanic and Atmospheric Administration; Environmental Protection Agency; Friends of Biscayne Bay, Inc. (FOBB); marine law enforcement agencies; as well as the four state parks that border the BBAP.

### *Regional Office*

Each of the state's 43 aquatic preserves is supervised by one of the Office of Resilience and Coastal Protection's (ORCP) four regional headquarters that are separated geographically into Northwest, Northeast, Southwest, and Southeast. The Southeast Regional Program Administrator supervises three field offices (West Palm Beach, Miami, and Marathon) that house staff representing the Coral Reef Conservation Program (CRCP) which includes the Kristin Jacobs Coral Aquatic Preserve, Florida Keys National Marine Sanctuary (FKNMS) and Florida Keys Aquatic Preserves, in addition to BBAP.

### *Local Office and Staff*

The BBAP program is housed with the CRCP in the Biscayne Bay Environmental Center (BBEC) in Miami. BBAP staff is composed of an Aquatic Preserve Manager (officially titled Environmental Specialist III) and five Environmental Specialist II positions, whose working titles are as follows: Spatial Ecology Coordinator, Environmental Programs Coordinator, and Water Quality Specialist. An Operations

Manager (officially titled Operations and Management Consultant Manager), a Facilities Coordinator (officially titled Facilities Services Consultant), and an Administrative Assistant each divide their time between BBAP and other regional programs. This dedicated team manages 64,607 acres spreading across two counties.

The Aquatic Preserve Manager is a permanent, federally funded career service, full-time equivalent (FTE) position. The Spatial Ecology Coordinator is also an FTE. This coordinator's responsibilities include ArcGIS geodatabase management, map and spatial data output creation, field work assistance, providing technical assistance, leading monitoring projects, data handling and data analyses, and education and outreach engagement. The Marine Debris and Environmental Programs Coordinator is a full-time state-funded Other Personal Services (OPS) employee who oversees the Adopt-an-Island Program, the volunteer and internship program, law enforcement liaison, leading monitoring projects, data handling and data analyses, website and communications oversight, and education and outreach engagement. The Water Quality Specialist is a grant-funded OPS position that leads BBAP's participation in ORCPs statewide water quality monitoring initiative. This staff person leads water quality sampling projects and deploys data collection devices, such as datasondes that continuously monitor and analyze parameters, such as dissolved oxygen, salinity, temperature, turbidity, nutrients, pH, and chlorophyll. This staff person also works heavily in data handling and analyses, report writing, and education and outreach engagement. The FTE Operations Manager and the OPS Administrative Assistant share administrative duties for BBAP, including budgeting, purchasing, accounting, reporting, and serving as BBAP property custodian. The FTE Facilities Coordinator maintains the buildings and grounds, as well as the vessels and vehicles for the BBAP and the CRCP.

### *Internships and Volunteers*

Limited staff resources are supplemented by active intern and volunteer programs. Students from colleges, universities, local schools, community groups, non-profits, and businesses contribute to numerous volunteer projects and help staff accomplish BBAP's mission. Partnerships through Florida International University Biscayne Bay Campus, Miami Dade College Center for Community Involvement, and University of Miami's Rosenstiel School of Marine and Atmospheric Science allow BBAP to maintain a consistent internship program. As many as six interns per semester have worked several hours per week with BBAP staff on various projects that support students' career goals, as well as accomplish BBAP's mission. Past internship projects have included but are not limited to: a marina signage use study, an island recreational use study, an assessment of seagrass and mangrove spatial changes over time, educational trunk creation for local teacher curriculum assistance, water quality sampling assistance, data inputting and database creation, administrative inventorying, brochure and outreach material creation, and several ArcGIS spatial layer and map creation projects.

Staff recognizes the value of community stakeholder participation in protecting, promoting, and managing Biscayne Bay. FOBB, Inc. is BBAP's Citizen Support Organization and a federally recognized 501(c)3 that also provides support for staff and contractor activities and salaries, equipment purchasing needs, and funding for community outreach and education opportunities. The creation of the Adopt-an-Island Program in 2015 allowed for locally engaged citizens and citizen groups to adopt a spoil island and volunteer their time to remove marine debris from the island areas. In addition, individuals´ interests, assistance provided (educational docents, shoreline cleanup, outreach booths, etc.) and time dedicated to project-specific activities will be recorded and made accessible for future needs.

### *Staffing Needs*

Many of the strategies identified in this plan will be implemented using existing staff and funding. However, several objectives, and the strategies necessary to accomplish them, cannot be completed during the life of this plan without additional resources. The plan's recommended actions, time frames, and cost estimates will guide the DEP Office of Resilience and Coastal Protection's (ORCP) planning and budgeting activities over the period of this plan. These recommendations are based on the information that exist at the time the plan was prepared. A high degree of adaptability and flexibility must be built into this process to ensure that ORCP can adjust to changes in the availability of funds, unexpected events such as hurricanes, and changes in statewide issues, priorities and policies.

Statewide priorities for management and restoration of submerged and coastal resources are evaluated each year as part of the process for planning ORCP's annual budget. When preparing ORCP's budget, it considers the needs and priorities of the entire aquatic preserve program, other programs within ORCP, and the projected availability of funding from all sources during the upcoming fiscal year. ORCP pursues supplemental sources of funds and staff resources whenever possible, including grants, volunteers, and partnerships with other entities. ORCP's ability to accomplish the specific actions identified in the plan will be determined largely by the availability of resources, which may vary from year to year. Consequently, the target schedules and estimated costs identified in Appendix D may need to be adjusted during the ten-year management planning cycle.

*Photo 18 | The Biscayne Bay Environmental Center is the home of both the Biscayne Bay Aquatic Preserve and Coral Reef Conservation Program.*

# Chapter 6 / Facilities Plan

### *Buildings and Infrastructure*

The Biscayne Bay Aquatic Preserve (BBAP) office is housed in the City of Miami within the Biscayne Bay Environmental Center (BBEC) at Pelican Harbor, created from dredged material associated with Atlantic Intracoastal Waterway construction in 1928. Throughout the decades, dredged material was added on both the north and south side of the causeway creating Pelican Harbor, owned by Miami-Dade County (MDC), with boat slips to the north and boat ramps and a parking area to the south; riprap has been placed to allow for shoreline stabilization. The 0.73 acre of land on which the BBEC is located was submerged land that was deeded to MDC by the Board of Trustees of the Internal Improvement Fund of the State of Florida in 1934 (Appendix A). DEP occupies the land through a 99-year lease agreement with MDC signed in 1976 after which the state constructed the approximately 3,500 sq. foot BBEC office building BBAP moved into the building in 2001.

The state also owns a 700 square foot wood-framed storage garage. All maintenance tools and equipment, some field equipment, hurricane shutters for BBEC, and kayaks and a canoe are stored in this building. Also, the garage includes space for BBAP's outside laboratory area and ice and sample storage freezer. The 220 square foot dive shed is used for storing dive gear and some field equipment.

These outbuildings are enclosed within an eight-foot protective fence with three locked access gates. Within the fenced area is a cement projection yard with an asphalt lot where the vessels and trailers are

stored when not in use or secured at the dock. The dock is an L-shaped aluminum floating structure with a floating ramp connected to the land. A mangrove shoreline protects the eastern 200 feet of the property, of which 80 feet was restored with rip rap in 2015 to prevent further erosion. The parking lot was re-paved and striped in 2019, including ADA compliance improvements. Other infrastructure improvements completed in 2018 include additional and upgraded parking lot and entrance lighting that comply with MDC requirements for certification of the 40-year-old buildings.

The financial responsibility of operating BBEC, including the cost of a new roof in 2014, is shared between BBAP and CRCP program budgets. Over the years the BBEC has been subdivided into fifteen office spaces and storage closets, shared between BBAP and Coral Reef Conservation Program (CRCP) staff, the Clean Boating Program, and partner agencies. A lab, including a bench table, oven and refrigerator exclusively for BBAP use, has been carved out of some of the storage room space. The BBEC houses a small conference room, break room, several storage rooms, restrooms, and educational support closets.

The available BBEC building space has been maximized and no practical further expansion is possible in the existing building. Although Florida Marine Patrol (FMP) used an office trailer on the north side of leased property for overflow when they occupied the BBEC, Miami-Dade County has suggested that it would not be supportive of a replacement trailer as an expansion option at the present time.

Americans with Disabilities Act (ADA) upgrades in recent years include the renovation of one unisex restroom in 2017 and replacement of the front door and entrance ramp with an appropriate slope, landing platform, and handrails in 2020.

Following a theft on BBEC property in 2010, CRCP installed a security system and video recording devices. In case of an emergency, the buildings, vehicles, and vessels are secured according to the BBEC Emergency Action Plan that is updated annually by the Facilities Coordinator. The Emergency Action Plan includes the hurricane plan for the office and defines necessary preparations for other potential disasters. A copy of this plan is stored in the Facilities Coordinator's office and emailed to each staff member when updated. An annual safety review meeting is scheduled in advance of the hurricane season for all staff to attend.

***Vehicles and Vessels***

The vehicles and vessels identified in the strategic plan as necessary to accomplish program goals have been acquired. Both programs' vessels and vehicles are shared, depending on staff and project needs. As part of the programs' strategic planning cycle, all vehicles and vessels undergo a monthly inspection, cleaning, and maintenance by the Facilities Coordinator. Vehicles

- **2023 Ford Explorer:** Was purchased by BBAP in 2024. This vehicle undergoes routine preventative maintenance every 5 months, conducted by either the Facilities coordinator or a qualified service provider.

***Vessels***

**Biscayne Bay Aquatic Preserve**

- **1 Canoe with 2 Single Child-sized, 3 Single Adult-Sized, &** 3 **Double Person Ocean Kayaks:** Available for shallow water access and are racked in the outbuilding. These kayaks and on-water safety equipment are in good condition. A kayak trailer had been acquired through the division's ecotour funding in 2016, but was subsequently transferred in 2019 to the Northwest Aquatic Preserves in order to assist with their programmatic needs. 2 kayaks were also transferred to the Florida Keys Aquatic Preserves for shared use within the region.
- **20-foot 2005 Pathfinder vessel with a 2024 Yamaha 150 HP Four-stroke Outboard Engine and Trailer:** Upon transfer from the Florida Fish and Wildlife Conservation Commission, an appropriate ladder was added for in-water activities. A custom designed removable captain's seat was paid for by BBAP funds after the vessel transfer occurred. An aluminum t-top with black canvas cover and rod holder for a dive flag was also purchased for the vessel along with

installation of dive tank holders, a Power Pole, trolling motor and electrical wiring upgrades. A new VHF radio, Garmin chart plotter, anchor and chain line, and antenna have been replaced over the years and will continue to be replaced or repaired, as needed. The engine service is performed every 100 hours by a qualified Yamaha mechanic, as needed. This vessel is either docked on the property or trailered within the fenced-in area adjacent to the maintenance garage.

**Additional vehicles and vessels available for the use of BBAP as needed:** The following vehicles and vessels are maintained by CRCP.

**Vehicles**

- 2017 GMC Terrain Sport Utility Vehicle with Towing Package
- 2007 Dodge 3/4-ton 4WD Pick-up Truck with Towing Package

**Vessels**

- 26-foot 2007 Twin Vee Catamaran with one 2007 and one 2017 Yamaha 150 HP Four-stroke Outboard Engine and Trailer

**Future construction and maintenance needs include, but are not limited to:**

- Continue to qualify BBAP staff as DEP SCUBA Divers, First Aid and Emergency Oxygen certified, and acquire additional snorkel and SCUBA equipment, as needed.
- Replace field equipment and supplies as needed.
- Replace office furniture, flooring, and equipment as necessary.
- Continue management of exotic and/or invasive plant species and native plantings.
- Locate and acquire additional office and/ or lab space for staff and field activities.

# List of Appendices

# Appendix A / Legal Documents

## A.1 / Aquatic Preserve Resolution

WHEREAS, the State of Florida, by virtue of its sovereignty, is the owner of the beds of all navigable waters, salt and fresh, lying within its territory, with certain minor exceptions, and is also the owner of certain other lands derived from various sources; and

WHEREAS, title to these sovereignty and certain other lands has been vested by the Florida Legislature in the State of Florida Board of Trustees of the Internal Improvement Trust Fund, to be held, protected and managed for the long range benefit of the people of Florida; and

WHEREAS, the State of Florida Board of Trustees of the Internal Improvement Trust Fund, as a part of its overall management program for Florida's state-owned lands, does desire to insure the perpetual protection, preservation and public enjoyment of certain specific areas of exceptional quality and value by setting aside forever these certain areas as aquatic preserves or sanctuaries; and

WHEREAS, the ad hoc Florida Inter-Agency Advisory Committee on Submerged Land Management has selected through careful study and deliberation a number of specific areas of state—owned land having exceptional biological, aesthetic and scientific value, and has recommended to the State of Florida Board of Trustees of the Internal Improvement Trust Fund that these selected areas be officially recognized and established as the initial elements of a statewide system of aquatic preserves for Florida;

NOW, THEREFORE, BE IT RESOLVED by the State of Florida Board of Trustees of the Internal Improvement Trust Fund:

THAT it does hereby establish a statewide system of aquatic preserves as a means of protecting and preserving in perpetuity certain specially selected areas of state-owned land: and

THAT specifically described, individual areas of state-owned land may from time to time be established as aquatic preserves and included in the statewide system of aquatic preserves by separate resolution of the State of Florida Board of Trustees of the Internal Improvement Trust Fund; and

THAT the statewide system of aquatic preserves and all individual aquatic preserves established thereunder shall be administered and managed, either by the said State of Florida Board of Trustees of the Internal Improvement Trust Fund or its designee as may be specifically provided for in the establishing resolution for each individual aquatic preserve, in accordance with the following management policies and criteria:

(1) An aquatic preserve is intended to set aside an exceptional area of state-owned land and its associated waters for preservation essentially in their natural or existing condition by reasonable regulation of all human activity which might have an effect on the area.

(2) An aquatic preserve shall include only lands or water bottoms owned by the State of Florida, and such private lands or water bottoms as may be specifically authorized for inclusion by appropriate instrument from the owner. Any included lands or water bottoms to which a private ownership claim might subsequently be proved shall upon adjudication of private ownership be automatically excluded from the preserve, although such exclusion shall not preclude the State from attempting to negotiate an arrangement with the owner by which such lands or water bottoms might be again included within the preserve.

(3) No alteration of physical conditions within an aquatic preserve shall be permitted except: (a) minimum dredging and spoiling for authorized public navigation projects, or (b) other approved activity designed to enhance the quality or utility of the preserve itself. It is inherent in the concept of the aquatic preserve that, other than as contemplated above, there be: no dredging and filling to create land, no drilling of oil wells or excavation for shell or minerals, and no erection of structures on stilts or otherwise unless associated with authorized activity, within the confines of a preserve - to the extent these activities can be lawfully prevented.

(4) Specifically, there shall be no bulkhead lines set within an aquatic preserve. When the boundary of a

preserve is intended to be the line of mean high water along a particular shoreline, any bulkhead line subsequently set for that shoreline will also be at the line of mean high water.

(5) All human activity within an aquatic preserve shall be subject to reasonable rules and regulations promulgated and enforced by the State of Florida Board of Trustees of the Internal Improvement Trust Fund and/or any other specifically designated managing agency Such rules and regulations shall not interfere unduly with lawful and traditional public uses of the area, such as fishing (both sport and commercial), hunting, boating, swimming and the like.

(6) Neither the establishment nor the management of an aquatic preserve shall infringe upon the lawful and traditional riparian rights o private property owners adjacent to a preserve. In furtherance of these rights, reasonable improvement for ingress and egress, mosquito control, shore protection and similar purposes may be permitted by the State of Florida Board of Trustees of the Internal Improvement Trust Fund and other jurisdictional agencies, after review and formal concurrence by any specifically designated managing agency for the preserve in question.

(7) Other uses of an aquatic preserve, or human activity within a preserve, although not originally contemplated, may be permitted by the State of Florida Board of Trustees of the Internal improvement Trust Fund and other jurisdictional agencies, but only after a formal finding of compatibility made by the said Trustees on the advice of any specifically designated managing agency for the preserve in question.

IN TESTIMONY WHEREOF, the Trustees for and on behalf of the State of Florida Board of Trustees of the Internal Improvement Trust Fund have hereunto subscribed their names and have caused the official seal of said State of Florida Board of Trustees of the Internal Improvement Trust Fund to be hereunto affixed, in the City of Tallahassee, Florida, on this the 24th day of November A. D. 1969.

CLAUDE R. KIRK, JR, Governor TOM ADAMS, Secretary of State

EARL FAIRCLOTH, Attorney General FRED O. DICKINSON, JR., Comptroller

BROWARD WILLIAMS, Treasurer FLOYD T. CHRISTIAN, Commissioner of Education

DOYLE CONNER, Commissioner of Agriculture

As and Constituting the State of Florida Board of Trustees of the Internal Improvement Trust Fund

## A.2 / Florida Statutes

All the statutes can be found according to number at:

http://www.leg.state.fl.us/Statutes

- Florida Statutes, Chapter 253: State Lands
- Florida Statutes, Chapter 258: State Parks and Preserves
    3. Part II (Aquatic Preserves)
- Florida Statutes, Chapter 267: Historical Resources
- Florida Statutes, Chapter 370: Saltwater Fisheries
- Florida Statutes, Chapter 372: Wildlife
- Florida Statutes, Chapter 403: Environmental Control
    4. (Statute authorizing the Florida Department of Environmental Protection (DEP) to create Outstanding Florida Waters is at 403.061(27))
- Florida Statutes, Chapter 597: Aquaculture

## A.3 / Florida Administrative Code

All rules can be found according to number at: https://www.flrules.org/Default.asp

- Florida Administrative Code, Chapter 18-20: Florida Aquatic Preserves
  https://www.flrules.org/gateway/ChapterHome.asp?Chapter=18-20
- Florida Administrative Code, Chapter 18-21: Sovereignty Submerged Lands Management
  https://www.flrules.org/gateway/ChapterHome.asp?Chapter=18-21
- Florida Administrative Code, Chapter 62-302: Surface Water Quality Standards (Rule designating Outstanding Florida Waters is at 62-302.700)
  https://www.flrules.org/gateway/ChapterHome.asp?Chapter=62-302

# Appendix B / Resource Data

## B.1 / Glossary of Terms

References to these definitions can be found at the end of this list and in Appendix B.2 (References).

**aerial -** referring to the air (Collin, 2004).

**algae -** tiny single-celled or multicellular organisms living in water or in moist conditions, which contains chlorophyll but have no stems, roots or leaves (Collin, 2004).

**algal bloom -** a mass of algae which develops rapidly in a lake as a result of eutrophication (Collin, 2004).

**aggregate -** a mass of soil and rock particles stuck together (Collin, 2004).

**anaerobic** - growing or occurring in the absence of molecular oxygen (Lincoln et al., 2003).

**annual geometric mean** - criteria: a threshold which, when exceeded, indicates a degraded system. Criteria are intended to protect aquatic life and/or human health. Criteria are located in rules 62-302.500 and 62-302.503, F.A.C. (DEP, 2020).

**angiosperm -** a plant in which the sex organs are carried within flowers and seeds are enclosed in a fruit (Collin, 2004).

**anthropogenic -** caused by or resulting from human activities (Collin, 2004).

**aquaculture** - the cultivation of aquatic organisms (Lincoln et al., 2003).

**archipelago –** a group of islands (Collin, 2004).

**benthic -** on or living on the bottom of the sea or of a lake (Collin, 2004).

**channel –** a deep part of a harbor or sea passage where ships can pass or, a stretch of water between two seas (Collin, 2004).

**conservation -** the process of protecting something from undesirable change (Collin, 2004).

**coral -** a sedentary invertebrate animal that is composed of individual polyps, often colonial, that secretes a calcium carbonate skeleton that provides much of the structure in coral reefs (stony corals) or have a largely proteinaceous skeleton (soft corals) (Rupper, et al., 2004).

**crustacean -** an invertebrate animal with a chitinous and/or calcareous exoskeleton, several pairs of jointed legs, and stalked eyes (Collin, 2004).

**debris -** rubbish or waste matter (Collin, 2004).

**diversity** - a measure of the number of species and their relative abundance in a community (Lincoln et al., 2003).

**drainage basin (catchment)** - the area from which a surface watercourse or a groundwater system derives its water; watershed (Allaby, 2005).

**easement** - a right that one may have in another's land (Neufeldt & Sparks, 1990).

**ecosystem** - a community of organisms and their physical environment interacting as an ecological unit (Lincoln et al., 2003).

**emergent** - an aquatic plant having most of the vegetative parts above water (Lincoln et al., 2003).

**endangered species** - an animal or plant species in danger of extinction throughout all or a significant portion of its range (United States Fish and Wildlife Service, 2015).

**endemic** - native to, and restricted to, a particular geographical region (Lincoln et al., 2003).

**estuary** – the highly productive part of a river where it meets the sea and becomes brackish, often serving as nursery grounds and providing food, breeding grounds, and migration stopovers for many animals (National Oceanic and Atmospheric Administration, 2019)

**fauna** - the animal life of a given region, habitat or geological stratum (Lincoln et al., 2003).

**filter feeder -** an animal that lives in water and feeds on small particles that it filters out of the water it takes in, e.g. a clam, sponge, or baleen whale (Collin, 2004).

**flora** - the plant life of a given region, habitat or geological stratum. (Lincoln et al., 2003).

**geomorphology -** the study of landforms and relief features, including their origins and development (Merriam-Webster, 2020).

**geographic information system (GIS)** - computer system supporting the collection, storage, manipulation and query of spatially referred data, typically including an interface for displaying geographical maps (Lincoln et al., 2003).

**ground water -** water that stays in the top layers of soil or in porous rocks and can collect pollution (Collin, 2004).

**Gulf Stream -** a current of warm water in the Atlantic Ocean, which flows north along the east coast of the USA, then crosses the Atlantic to northern Europe, passing close to the west coast of Scotland and giving the British Isles and European coast a mild winter climate compared with countries at the same latitude such as eastern Canada (Collin, 2004).

**habitat** – the type of environment in which a specific organism lives (Collin, 2004).

**hurricane -** a tropical storm with winds in excess of 74 miles per hour (National Oceanic and Atmospheric Administration, 2018).

**infauna** - the animal life within a sediment (Lincoln et al., 2003).

**intertidal zone** - the shore zone between the highest and lowest tides; littoral (Lincoln et al., 2003).

**invertebrate -** an animal that has no backbone (Collin, 2004).

**limestone -** a common sedimentary rock, formed of calcium minerals and often containing fossilized shells of sea animals (Collin, 2004)

**listed species** - a species, subspecies, or distinct population segment that has been added to a federal or state list of endangered and threatened wildlife and plants (United States Fish and Wildlife Service, 2015).

**mandate** - an order or command; the will of constituents expressed to their representative, legislature, etc. (Neufeldt & Sparks, 1990).

**marsh -** an area of permanently wet land and the plants that grow on it; can be salt or fresh water (Collin, 2004).

**midden -** a refuse heap; used especially in archaeology (Lincoln et al., 2003).

**monitoring** – a process of regular checking on the progress of something (Collin, 2004).

**ocean acidification –** reduction in the pH of the ocean over an extended period, typically decades or longer, caused primarily by the uptake of CO2 from the atmosphere, but it can be caused by other chemical additions or subtractions from the ocean (Gattuso & Hansson, 2011).

**oolite –** a sedimentary rock consisting of cemented ooliths (Chiappone, 1996).

**oolith –** a spheoidal body, commonly 0.5-1mm across, consisting of concentric layers of aragonite formed in warm, shallow, turbulent seawater (Chiappone, 1996).

**patch reef –** a small, mound-like reef usually occurring in lagoons. In the Florida Keys, patch reefs are small, rounded clusters of coral heads and other reef biota generally occurring in Hawk Channel

(Chiappone,1996).

**pollution –** the presence of unusually high concentrations of harmful substances in the environment, as a result of human activity or a natural process (Collin, 2004).

**pollution, non-point source -** a source of pollution not associated with a specific discharge point (Collin, 2004).

**pollution, point source –** any single identifiable source of pollution from which pollutants are discharged, such as a pip, ditch, ship, or factory smokestack (United States Environmental Protection Agency, n.d.).

**population** - all individuals of one or more species within a prescribed area, or a group of organisms of one species, occupying a defined area and usually isolated to some degree from other similar groups (Lincoln et al., 2003).

**porous -** referring to rock which has many small pores in it and can absorb water (Collin, 2004).

**reef -** a submarine mound or ridge constructed of rock debris or formed by calcium carbonate-depositing marine organisms (Chiappone, 1996).

**resilience -** the ability of an organism to resist or recover from adverse conditions or, the ability of an ecosystem to return to its usual state after being disturbed (Collin, 2004).

**runoff** - part of precipitation that is not held in the soil but drains freely away (Lincoln et al., 2003).

**salinity -** a measure of the total concentration of dissolved salts in seawater (Lincoln et al., 2003).

**sampling -** to take a small quantity of something to test (Collin, 2004).

**sea level -** the average level of the surface of the sea (Collin, 2004).

**sessile** - non-motile; permanently attached at the base (Lincoln et al., 2003).

**species** - a group of organisms, minerals or other entities formally recognized as distinct from other groups; the basic unit of biological classification (Lincoln et al., 2003).

**stakeholder** - any person or organization who has an interest in the actions discussed or is affected by the resulting outcomes of a project or action (United States Fish and Wildlife Service, 2015).

**stewardship -** the protection of the environment for the future benefit of generations of human beings by developing appropriate institutions and strategies (Collin, 2004).

**storm surge -** a rise in sea level as a hurricane or other severe storm moves over water, causing flooding when the storm comes ashore storm swell storm swell (Collin, 2004).

**stratification -** the formation of several layers in substances such as sedimentary rocks, or water in a lake or air in the atmosphere (Collin, 2004).

**submarine -** situated or existing beneath the sea (Collin, 2004).

**substrate -** the matter or surface on which an organism lives (Collin, 2004).

**subtidal** - environment which lies below the mean low water level (Allaby, 2005).

**supratidal zone** - the zone on the shore above mean high tide level (Lincoln et al., 2003).

**threatened species** - an animal or plant species likely to become endangered within the foreseeable future throughout all or a significant portion of its range (United States Fish and Wildlife Service, 2015).

**turbid** - cloudy; opaque with suspended matter (Lincoln et al., 2003).

**upland** - land elevated above other land (Neufeldt & Sparks, 1990).

**vascular plant -** a plant that has specialized tubes within it for transporting sap (Collin, 2004).

**vegetation** - plant life or cover in an area; also used as a general term for plant life (Lincoln et al., 2003).

**water column** - the vertical column of water in a sea or lake extending from the surface to the bottom (Lincoln et al., 2003).

**watershed** - an elevated boundary area separating tributaries draining in to different river systems; drainage basin (Lincoln et al., 2003).

**wetland** - an area of low lying land, submerged or inundated periodically by fresh or saline water (Lincoln et al., 2003).

**wildlife** - any undomesticated organisms; wild animals (Allaby, 2005).

## B.2 / References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## B.3 / Species Lists

### *B.3.1 / Native Species*

**Legend:** FT = Federally- and State-Designated Threatened • FE = Federally-and State-Designated Endangered • ST = State-Designated Threatened • SE = State-Designated Endangered • BGEPA = Bald and Golden Eagle Protection Act

| Common Name | Scientific Name | Status |
|---|---|---|
| **PROTISTS - PROTISTA** | | |
| **Golden-brown Algae - Chrysophyta** | | |
| Bacillariophyta spp | *Diatom spp* | |
| | | |
| **Dinoflagellate Algae - Pyrrophyta** | | |
| Dinoflagellate sp. | *Prorocentrum micans* | |
| | | |
| **Green Algae - Chlorophyta** | | |
| Umbrella alga sp. | *Acetabularia sp.* | |
| Soft fan alga sp. | *Avrainvillea sp.* | |
| | *Caulerpa cupressoides* | |
| | *Caulerpa lanuginosa* | |
| | *Caulerpa mexicana* | |
| Common caulerpa | *Caulerpa prolifera* | |
| Feather alga | *Caulerpa sertularioides* | |
| | *Caulerpa verticillata* | |
| Cactus alga sp. | *Halimeda discoidea* | |
| Cactus alga sp. | *Halimeda goreauii* | |
| Disk alga | *Halimeda opuntia* | |
| Shaving brush sp. | *Penicillus capitatus* | |
| Shaving brush sp | *Penicillus dumetosus* | |
| Hard fan alga spp. | *Udotea spp.* | |
| Sea lettuce spp. | *Ulva spp.* | |
| Smooth bubble alga | *Valonia ventricosa* | |
| | | |
| **Brown Algae - Phaeophyta** | | |
| *Dictyota spp* | *Dictyota cervicornus* | |
| Petticoat alga spp. | *Padina spp.* | |
| Sargassum weed spp. | *Sargassum spp.* | |
| | | |
| **Red Algae - Rhodophyta** | | |
| Laurence's weed spp. | *Laurencia spp.* | |
| **Heterotrophs - Protozoa** | | |
| Foraminfera spp. | *Foraminfera spp.* | |

| Common Name | Scientific Name | Status |
|---|---|---|
| **PLANTS - PLANTAE** | | |
| **Vascular Plants - Tracheophyta** | | |
| **Pteridophytes – Pteridophyta** | | |
| Golden leather fern | *Acrostichum aureum* | ST |
| | | |
| **Flowering Plants – Anthophyta** | | |
| **Monocots - Monocotyledones** | | |
| Southern sandbur | *Cenchrus echinatus* | |
| Coastal sandbur | *Cenchrus incertus* | |
| Cowhorn orchid | *Cyrtopodium punctatum* | SE |
| Saltgrass | *Distichlis spicata* | |
| Dollar orchid | *Encyclia boothiana var. erythronioides* | SE |
| Butterfly orchid | *Encyclia tampensis* | |
| Finger grass | *Eustachys petraea* | |
| Hurricane grass | *Fimbristylis cymosa* | |
| Shoal weed | *Halodule wrightii* | |
| Caribbean seagrass | *Halophila decipiens* | |
| Engelmann's seagrass | *Halophila englemannii* | |
| Muhly grass | *Muhlenbergia capillaris* | |
| Seashore paspalum | *Paspalum vaginatum* | |
| Widgeon grass | *Ruppia maritima* | |
| Smooth cordgrass | *Spartina alterniflora* | |
| Saltmeadow cordgrass | *Spartina patens* | |
| Gulf cordgrass | *Spartina spartinae* | |
| Coral dropseed grass | *Sporobolus domingensis* | |
| Coastal dropseed | *Sporobolus virginicus* | |
| Manatee grass | *Syringodium filiforme* | |
| Turtle grass | *Thalassia testudinum* | |
| Banded Wild-pine | *Tillandsia flexuosa* | ST |
| Southern cattail | *Typha domingensis* | |
| | | |
| **Dicots- Eudicotyledones** | | |
| Black mangrove | *Avicennia germinans* | |
| False willow | *Baccharis angustifolia* | |
| Water hyssop | *Bacopa monnieri* | |
| Saltwort | *Batis maritima* | |
| Sea oxeye | *Borrichia frutescens* | |
| Buttonwood | *Conocarpus erectus* | |
| Coin vine | *Dalbergia ecastophyllum* | |

| Common Name | Scientific Name | Status |
|---|---|---|
| Seaside gentian | *Eustoma exaltatum* | |
| Scorpion tail | *Heliotropium angiospermun* | |
| Seaside heliotrope | *Heliotropium curassavicum* | |
| White mangrove | *Laguncularia racemosa* | |
| Christmasberry | *Lycium carolinianum* | |
| Mangrove mallow | *Pavonia paludicola* | SE |
| Mangrove rubber vine | *Rhabdadenia biflora* | |
| Red mangrove | *Rhizophora mangle* | |
| Annual glasswort | *Salicornia bigelovii* | |
| Perennial glasswort | *Salicornia perennis* | |
| Sea purslane | *Sesuvium portulacastrum* | |
| Seaside goldenrod | *Solidago sempervirens* | |
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| **ANIMALS - METAZOA** | | |
| **Sponges - Porifera** | | |
| Sponge sp. | *Aaptose aaptose* | |
| Branching sponge sp. | *Aplysina sp. (Verongia sp.)* | |
| Chicken liver sponge | *Chondrilla nucula* | |
| Sponge sp. | *Cinachyra cavernosa* | |
| Sponge sp. | *Cliona varians (Anthosigmella varians)* | |
| Lumpy overgrowing sponge | *Desmapsamma anchorata (Holopsamma helwigi)* | |
| Heavenly blue sponge | *Dysidea etherea* | |
| White sponge | *Geodia gibberosa* | |
| Purple sponge | *Haliclona molitba* | |
| Green sponge | *Haliclona viridis* | |
| Sheepswool sponge | *Hippospongia lachne* | |
| Vase sponge | *Ircinia campana* | |
| Black-ball sponge | *Ircinia strobilina* | |
| Sprawling sponge | *Neopetrosia longleyi* | |
| Pink vase sponge | *Niphates digitalis* | |
| Bleeding sponge | *Oligoceras hemorrhages* | |
| Sponge sp. | *Sarcotragus fasciculatus (Ircinia fasciculata)* | |
| Sponge sp. | *Scypha sp.* | |
| Loggerhead sponge | *Spheciospongia vesparium* | |
| Yellow sponge | *Spongia barbara* | |
| Glove sponge | *Spongia cheiris* | |
| Grass sponge | *Spongia graminea* | |
| Sponge sp. | *Spongia tubulifera* | |
| Fire sponge | *Tedania ignis* | |

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|---|---|---|
| **Cnidarians – Cnidaria** | | |
| **Hydrozoans - Hydrozoa** | | |
| Hydroid sp. | *Aglaophenia constricta* | |
| Hydroid sp. | *Aglaophenia dichotoma* | |
| Hydroid sp. | *Aglaophenia elongata* | |
| Hydroid sp. | *Aglaophenia pelagica* | |
| Hydroid sp. | *Aglaophenia tridentata* | |
| Hydroid sp. | *Campanularia sp.* | |
| Hydroid sp. | *Cladocarpus flexuosus* | |
| Hydroid sp. | *Clytia gracilis* | |
| Hydroid sp. | *Clytia hemisphaerica* | |
| Hydroid sp. | *Cnidoscyphus marginatus* | |
| Hydroid sp | *Dentitheca dendritica* | |
| Hydroid sp. | *Diphasia tropica* | |
| Hydroid sp. | *Dynamena quadridentata* | |
| Red stickhydroid | *Eudendrium carneum* | |
| Hydroid sp. | *Eudendrium eximium* | |
| Stickhydroid | *Eudendrium ramosum* | |
| Hydroid sp. | *Halecium tenellum* | |
| Christmas tree hydroid | *Halocordyle disticha* | |
| Hydroid sp. | *Hydractinea carnea* | |
| White stinger | *Macrorhynchia philippina* | |
| Sea thread hydroid | *Obelia dichotoma* | |
| Hydroid sp. | *Parawrightia robusta* | |
| Portuguese man-of-war | *Physalia physalis* | |
| Hydroid sp. | *Plumularia floridana* | |
| Hydroid sp. | *Plumularia strictocarpa* | |
| Hydroid sp. | *Rhizogeton sterreri* | |
| Hydroid sp. | *Tridentata distans* | |
| Hydroid sp. | *Tridentata marginata* | |
| Hydroid sp. | *Tubularia cristata* | |
| Hydroid sp. | *Turritopsis nutricula* | |
| Hydroid sp. | *Ventromma halecioides* | |
| Hydroid sp. | *Zyzzyzus warreni* | |
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| **Jellyfish - Scyphozoa** | | |
| Moon jelly | *Aurelia aurita* | |
| Upside-down jellyfish | *Cassiopea xamachana* | |
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|---|---|---|
| **Corals and Anemones - Anthozoa** | | |
| Giant Caribbean anemone | *Condylactis gigantea* | |
| Boulder brain coral | *Colpophylla natans* | |
| Encrusting gorgonian | *Erythropodium caribaeorum* | |
| Ten-ray star coral | *Madracis decactis* | |
| Rose coral | *Manicina areolata* | |
| Maze coral | *Meandrina meandrites* | |
| Fire coral | *Millepora alcicornis* | |
| Orange spiny sea rod | *Muricea elongata* | |
| Diffuse ivory bush coral | *Oculina diffusa* | |
| Giant slit-pore sea rod | *Plexaurella nutans* | |
| Finger coral sp. | *Porites furcata* | |
| Clubtip finger coral | *Porites porites* | |
| Purple sea plume | *Pseudopterogorgia acerosa* | |
| Angular sea ship | *Pterogorgia anceps* | |
| Massive starlet coral | *Siderastrea siderea* | |
| Lesser starlet coral | *Siderastrea radians* | |
| Smooth star coral | *Solenastrea bournoni* | |
| Knobby ctar coral | *Solenastrea hyades* | |
| Blushing star coral | *Stephanocoenia intersepta* | |
| | | |
| **Comb Jellies - Ctenophora** | | |
| Sea walnut | *Mnemiopsis mccradyi* | |
| | | |
| **Peanut Worms - Sipuncula** | | |
| Peanut worm sp. | | |
| | | |
| **Mollusks - Mollusca** | | |
| **Chitons - Polyplacophora** | | |
| West Indian fuzzy chiton | *Acanthopleura granulata* | |
| | | |
| **Gastropods - Gastropoda** | | |
| Limpet sp. | *Acmaea sp.* | |
| Striate barrel-bubble | *Acteocina bullata* | |
| Channeled barrel-bubble | *Acteocina canaliculata* | |
| Barrel-bubble sp. | *Acteocina candei* | |
| West Indian alvania | *Alvania auberiana* | |
| Greedy dovesnail | *Anachis avara* | |
| Fat dovesnail | *Anachis obesa* | |

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|---|---|---|
| Beautiful dovesnail | *Anachis pulchella* | |
| Well-ribbed dovesnail | *Anachis lafresnayi* | |
| Spotted seahare | *Aplysia dactylomela* | |
| Longspined starsnail | *Astralium phoebium* | |
| Caribbean glassy-bubble | *Atys caribaeus* | |
| Intricate phos | *Bailya intricata* | |
| Barleysnail sp. | *Barleeia sp.* | |
| West Indian false cerith | *Batillaria minima* | |
| Striate bubble | *Bulla striata* | |
| Ragged seahare | *Bursatella leachi pleii* | |
| Pearwhelk | *Busycotypus spiratus (Busycon spiratum)* | |
| Keys topsnail | *Calliostoma adelae* | |
| Mauve-mouth drill | *Calotrophon ostrearum* | |
| Ladder hornsmail | *Cerithidea scalariformis* | |
| Cerith sp. | *Cerithiopsis emersonii* | |
| Cerith sp. | *Cerithiopsis greenii* | |
| Cerith sp. / wide aclis | *Cerithiopsis lata or Aclis lata* | |
| Ivory cerith | *Cerithium eburneum* | |
| Stocky cerith | *Cerithium litteratum* | |
| Flyspeck cerith | *Cerithium muscarum* | |
| Variable cerith / cerith sp. | *Cerithium variabile or Cerithium lutosum* | |
| Tea drillia | *Cerodrillia thea* | |
| Lace murex | *Chicoreus dilectus (Murex florifer dilectus)* | |
| Crenulate horn | *Chondropoma dentatum* | |
| West Indian dovesnail | *Columbella mercatoria* | |
| Rusty dovesnail | *Columbella rusticoides* | |
| Jasper cone | *Conus jaspideus* | |
| Drill sp. | *Crassispira fuscescens* | |
| White-knob drill | *Crassispira leucocyma* | |
| Drill sp. | *Crassispira ostrearum* | |
| Common Atlantic slippersnail | *Crepidula fornicata* | |
| Convex slippersnail | *Crepidula convexa* | |
| Spotted slippersnail | *Crepidula maculosa* | |
| Eastern white slippersnail | *Crepidula plana* | |
| Snail sp. | *Cyclostremiscus beauii* | |
| Tuskshell sp. | *Dentalium antillarum* | |
| Texas tuskshell | *Dentalium texasianum* | |
| Cayenne keyhole limpet | *Diodora cayenensis* | |
| Lister's keyhole limpet | *Diodora listeri* | |
| False prickly winkle | *Echininus nodulosus* | |

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|---|---|---|
| Wide-coil wentletrap | *Epitonium echinaticosta* | |
| Wrinkle-rib wentletrap | *Epitonium foliaceicosta* | |
| Sharp-rib drill | *Eupleura sulcidentata* | |
| Banded tulip | *Fasciolaria lilium hunteria* | |
| True tulip | *Fasciolaria tulipa* | |
| Snail sp. | *Felimare bayeri* | |
| Snail sp. | *Finella dubia (Alabina cerithioides)* | |
| Snowflake marginella | *Gibberula lavalleeana (Marginella lavalleeana)* | |
| Teardrop marginella | *Granulina ovuliformis* | |
| Antilles glassy-bubble | *Haminoea antillarum* | |
| Elegant glassy-bubble | *Haminoea elegans* | |
| Amber glassy-bubble | *Haminoea succinea* | |
| Pallid marginella | *Hyalina pallida* | |
| American starsnail | *Lithopoma americanum* | |
| Carved starsnail | *Lithopoma caelatum* | |
| Sargassum snail | *Litiopa melanostoma* | |
| Mangrove periwinkle | *Littorina angulifera* | |
| Zebra periwinkle | *Littorina ziczac* | |
| Sea slug sp. | *Lobiger souverbii* | |
| Fleshy limpet sp. | *Lucapina sowerbii* | |
| Cancellate fleshy limpet | *Lucapina suffusa* | |
| Mangelia sp. | *Mangelia sp.* | |
| Dentate marginella | *Marginella denticulata* | |
| Marginella sp. | *Marginella sp.* | |
| Eulima sp. | *Melanella intermedia (Balcis intermedia)* | |
| Tinted cantharus | *Polia tincta (Pisania tincta)* | |
| Little oat marginella | *Prunum avenaceum (Hyalina avenacea)* | |
| Knave marginella | *Prunum torticulum (Hyalina torticula)* | |
| Snail sp. | *Mangelia trilineata* | |
| Coffee melampus | *Melampus coffeus* | |
| Snail sp. | *Microdochus sp. (M. floridana? Cingulus floridana?)* | |
| Florida miter | *Mitra florida* | |
| Miter sp. | *Mitra hanleyi* | |
| Lunar dovesnail | *Mitrella lunata* | |
| White-spot dovesnail | *Mitrella ocellata* | |
| Buttonsnail | *Modulus modulus* | |
| Pitted murex | *Murex cellulosa* | |
| White nassa | *Nassarius albus* | |
| Nassa sp. | *Nassarius sp.* | |

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|---|---|---|
| Bruised nassa | *Nassarius vibex* | |
| Moonsnail sp. | *Natica sp.* | |
| Bleeding-tooth nerite | *Nerita peloronta* | |
| Checkered nerite | *Nerita tessellata* | |
| Virgin nerite | *Neritina virginea* | |
| Dovesnail sp. | *Nitidella sp.* | |
| Odostome sp. | *Odostomia laevigata* | |
| Milky odostome | *Odostomia nivosa* | |
| Variable dwarf olive | *Olivella mutica* | |
| Antilles oxynoe | *Oxynoe antillarum* | |
| Princess marginella | *Persicula catenata* | |
| Common Atlantic marginella | *Prunum apicinum* | |
| Orange marginella | *Prunum carneum* | |
| Snail sp. | *Pyramidella candida* | |
| Snail sp. | *Pyrgocythara canoidissima* | |
| Pitted baby-bubble | *Rictaxis punctostriatus* | |
| Snail sp. | *Rissoina cancellata* | |
| Snail sp. | *Rissoina chesnelii / Schwartziella catesbyana* | |
| Snail sp. | *Rissoina multicostata* | |
| Snail sp. | *Seila adamsi* | |
| Snail sp. | *Stellatoma stellata* | |
| Grooved moonsnail | *Stigmaulax sulcatus* | |
| Rustic rocksnail | *Stramonita rustica (Thais rustica)* | |
| Milk conch | *Strombus costatus* | |
| Queen conch | *Strombus gigas* | |
| Hawkwing conch | *Strombus raninus* | |
| Beaded periwinkle | *Tectarius muricatus* | |
| Silky tegula | *Tegula fasciata* | |
| Snail sp. | *Teinostoma cryptospira* | |
| Snail sp. | *Teinostoma sp.* | |
| Checkered pheasant | *Tricolia affinis* | |
| Shouldered pheasant | *Tricolia bella* | |
| Pheasant snail sp. | *Tricolia tessellata* | |
| Black-line triphora | *Triphora nigrocincta* | |
| Four-spot trivia | *Trivia quadripunctata* | |
| Beautiful truncatella | *Truncatella pulchella* | |
| Chestnut turban | *Turbo castanea* | |
| Interrupted turbonilla | *Turbonilla interrupta* | |
| Turbonilla sp. | *Turbonilla sp.* | |
| Caribbean vase | *Vasum muricatum* | |

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|---|---|---|
| West Indian wormsnail | *Vermicularia spirata* | |
| Sulcate miter | *Vexillum albocinctum* | |
| Gem miter | *Vexillum gemmatum* | |
| Orange-band marginella | *Volvarina avena (Hyalina avena)* | |
| | | |
| **Bivalves - Bivalvia** | | |
| Rough scallop | *Lindapecten muscosus (Aequipecten muscosus)* | |
| Atlantic strawberry-cockle | *Americardia media* | |
| Eared ark | *Anadara notabilis* | |
| Transverse ark | *Anadara transversa* | |
| Buttercup lucine | *Anodontia alba* | |
| Pointed venus | *Anomalocardia auberiana* | |
| Common jingle | *Anomia simplex* | |
| Mossy ark | *Arca imbricata* | |
| Turkey wing | *Arca zebra* | |
| Adams ark | *Arcopsis adamsi* | |
| Nucleus or Atlantic calico scallop | *Argopecten gibbus or nucleus* | |
| Bay scallop | *Argopecten irradians* | |
| Red-brown ark | *Barbatia cancellaria* | |
| Scorched mussel | *Brachidontes exustus* | |
| Antillean scallop | *Bractechlamys antillarum* | |
| Broad-ribbed carditid | *Carditamera floridana* | |
| Leafy jewelbox | *Chama macerophylla* | |
| Cross-barred venus | *Chione cancellata* | |
| Venus sp. | *Chione sp.* | |
| Tiger lucine | *Codakia orbicularis* | |
| Lucine sp. | *Codakia sp.* | |
| Eastern oyster | *Crassostrea virginica* | |
| Spreading-sculpture crenella | *Crenella divaricata* | |
| Contracted semele | *Cumingia coarctata* | |
| Thin cyclinella | *Cyclinella tenuis* | |
| Elegant dosinia | *Dosinia elegans* | |
| Pearly entodesma | *Entodesma beana (Lyonsia beana)* | |
| Zigzag scallop | *Euvola ziczac (Pecten ziczac)* | |
| Southern pigtoe | *Fusconaia cerina* | |
| Waxy gouldclam | *Gouldia cerina* | |
| False beanclam | *Heterodonax bimaculatus* | |
| Flat tree-oyster | *Isognomon alatus* | |
| Purse-oyster sp. | *Isognomon sp.* | |

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|---|---|---|
| Eggcockle | *Laevicardium laevigatum* | |
| Morton eggcockle | *Laevicardium mortoni* | |
| Antillean fileclam | *Lima pellucida* | |
| Glassy lyonsia | *Lyonsia hyalina* | |
| Waxy macoma | *Macoma cerina* | |
| Macoma sp. | *Macoma sp.* | |
| Bivalve sp. | *Mactridae sp.* | |
| American horsemussel | *Modiolus americanus* | |
| Lateral mussel | *Musculus lateralis* | |
| Atlantic nutclam | *Nucula proxima* | |
| Atlantic pearl-oyster | *Pinctada imbricata* | |
| Amber penshell | *Pinna carnea* | |
| Threetooth carditid | *Pleuromeris tridentate* | |
| Atlantic wing-oyster | *Pteria colymbus* | |
| Atlantic semele | *Semele proficua* | |
| Benedict scallop | *Spathochlamys benedicti (Chlamys benedict)* | |
| Purplish tagelus | *Tagelus divisus* | |
| Stout tagelus | *Tagelus plebeius* | |
| Martinique tellin | *Tellina martinicensis* | |
| Pure tellin | *Tellina mera* | |
| Shiny dwarf-tellin | *Tellina nitens* | |
| Florida pricklycockle | *Trachycardium egmontianum* | |
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| **Cephalopods - Cephalopoda** | | |
| Atlantic brief squid | *Lolliguncula brevis* | |
| Atlantic pygmy octopus | *Octopus joubini* | |
| Common octopus | *Octopus vulgaris* | |
| | | |
| **Segmented Worms - Annelida** | | |
| Segmented worm sp. | *Eteone sp.* | |
| Segmented worm sp. | *Eusthenelais sp.* | |
| Segmented worm sp. | *Glycera sp.* | |
| Segmented worm sp. | *Lumbrineris impatiens* | |
| Segmented worm sp. | *Lumbrineris tenuis* | |
| Segmented worm sp. | *Myriochele sp.* | |
| Segmented worm sp. | *Nereis sp.* | |
| Segmented worm sp. | *Notomastus sp.* | |
| Segmented worm sp. | *Owenia fusiformis* | |
| Segmented worm sp. | *Pholoe sp.* | |

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|---|---|---|
| Segmented worm sp. | *Pista cristata* | |
| Segmented worm sp. | *Polydora sp.* | |
| Segmented worm sp. | *Polyphthalmus sp.* | |
| Segmented worm sp. | *Scoloplos sp.* | |
| Segmented worm sp. | *Sthenelais boa* | |
| Segmented worm sp. | *Syllis sp.* | |
| Segmented worm sp. | *Terebellides sp.* | |
| | | |
| **Arthropods - Arthropoda** | | |
| **Chelicerates - Chelicerata** | | |
| Spiders, Scorpions - Arachnida | | |
| Golden silk orbweaver | *Nephila clavipes* | |
| Horseshoe Crabs - Xiphosura | *Limulus polyphemus* | |
| | | |
| **Crustaceans - Crustacea** | | |
| Copepod sp. | *Acartia tonsa* | |
| Copepod spp. | *Oithona spp.* | |
| Copepod sp. | *Paracalanus parvus* | |
| Amphipod sp. | *Caprella sp.* | |
| Tanaidacean sp. | *Apseudes sp.* | |
| Mangrove boring isopod | *Sphaeroma terebrans* | |
| Bigclaw snapping shrimp | *Alpheus heterochaelis* | |
| Green snapping shrimp | *Alpheus normanni* | |
| Snapping shrimp sp. | *Automate evermanni* | |
| Pink-spotted shrimp | *Farfantepenaeus brasiliensis* | |
| Pink shrimp | *Farfantepenaeus duorarum* | |
| False zostera shrimp | *Hippolyte pleuracanthus* | |
| Slender sargassum shrimp | *Latreutes fucorum* | |
| Brown glass shrimp | *Leander tenuicornis* | |
| Peppermint shrimp | *Lysmata wurdemanni* | |
| Seawhip shrimp | *Neopontonides beaufortensis* | |
| Brackish grass shrimp | *Palaemonetes intermedius* | |
| Clear sponge shrimp | *Periclimenaeus wilsoni* | |
| American grass shrimp | *Periclimenes americanus* | |
| Iridescent shrimp | *Periclimenes iridescens* | |
| Longtail grass shrimp | *Periclimenes longicaudatus* | |
| Spotted cleaner shrimp | *Periclimenes yucatanicus* | |
| Night shrimp sp. | *Processa sp.* | |
| Banded coral shrimp | *Stenopus hispidus* | |

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|---|---|---|
| Speckled snapping shrimp | *Synalpheus fritzmuelleri* | |
| Snapping shrimp sp. | *Synalpheus longicarpus* | |
| Minor snapping shrimp | *Synalpheus minus* | |
| Townsend snapping shrimp | *Synalpheus townsendi* | |
| Bryozoan shrimp | *Thor floridanus* | |
| Arrow shrimp | *Tozeuma carolinense* | |
| Caribbean spiny lobster | *Panulirus argus* | |
| Mangrove tree crab | *Aratus pisonii* | |
| Box crab sp. | *Calappa sp.* | |
| Shelligs | *Callinectes ornatus* | |
| Blue crab | *Callinectes sapidus* | |
| Lesser blue crab | *Callinectes similis* | |
| Blue land crab | *Cardisoma guanhumi* | |
| Tricolor hermit crab | *Clibanarius tricolor* | |
| Thinstripe hermit crab | *Clibanarius vittatus* | |
| Land hermit crab | *Coenobita clypeatus* | |
| Sponge crab sp. | *Dromia sp.* | |
| Winged mime crab | *Epialtus dilatatus* | |
| Land crab sp. | *Gecarcinus sp.* | |
| Longnose spider crab | *Libinia dubia* | |
| Florida decorator crab | *Macrocoeloma camptocerum* | |
| Spongy decorator crab | *Macrocoeloma trispinosum* | |
| Florida stone crab | *Menippe mercenaria* | |
| Speck-claw decorator crab | *Microphrys bicornutus* | |
| Shaggy clinging crab | *Mithrax pleuracanthus* | |
| Green clinging crab | *Mithrax sculptus* | |
| Channel clinging crab | *Mithrax spinossisimus* | |
| Florida grassflat crab | *Neopanope packardii* | |
| Shorthorn spiny crab | *Nibilia antilocarpa* | |
| Atlantic ghost crab | *Ocypode quadrata* | |
| Bandeye hermit | *Paguristes tortugae* | |
| Hermit crab sp. | *Pagurus maclaughlinae* | |
| Atlantic mud crab | *Panopeus herbstii* | |
| Furrowed mud crab | *Panopeus occidentalis* | |
| Cryptic teardrop crab | *Pelia mutica* | |
| Shortspined hairy crab | *Pilumnus dasypodus* | |
| Roseate hairy crab | *Pilumnus holosericus* | |
| Quadrate hairy crab | *Pilumnus marshi* | |
| Beaded hairy crab | *Pilumnus pannosus* | |
| Longspined hairy crab | *Pilumnus spinosissimus* | |

| Common Name | Scientific Name | Status |
|---|---|---|
| Oval urn crab | *Pitho anisodon* | |
| Broadback urn crab | *Pitho lherminieri* | |
| Urn crab sp. | *Pitho mirabilis* | |
| Longfinger neck crab | *Podochela riisei* | |
| Flatface simming crab | *Portunus depressifrons* | |
| Iridescent swimming crab | *Portunus gibbesii* | |
| Redhair swimming crab | *Portunus ordwayi* | |
| Ocellate swimming crab | *Portunus sebae* | |
| Blotched swimming crab | *Portunus spinimanus* | |
| Marsh crab sp. | *Sesarma sp.* | |
| Yellowline arrow crab | *Stenorhynchus seticornis* | |
| Fourhorn crab | *Tyche emarginata* | |
| Burger's fiddler crab | *Uca burgersi* | |
| Dwarf fiddler crab | *Uca leptodactyla* | |
| Sand fiddler crab | *Uca pugilator* | |
| Caribbean fiddler crab | *Uca rapax* | |
| Ive's fiddler crab | *Uca speciosa* | |
| Ciliated false squilla | *Pseudosquilla ciliate* | |
| Acorn barnacle sp. | *Balanus improvisus* | |
| Light striped barnacle | *Balanus amphitrite* | |
| Ivory barnacle | *Balanus eburneus* | |
| Barnacle sp. | *Lepas sp.* | |
| | | |
| **Hexapods - Hexapoda** | | |
| **Insects - Insecta** | | |
| Robinson's anomala scarab beetle | *Anomala robinsoni* | |
| Ataenius beetle | *Ataenius brevicollis* | |
| Ataenius beetle | *Ataenius wenzelii* | |
| Bicolored burrowing scarab beetle | *Bolbocerosoma hamatum* | |
| Miami chafer beetle | *Cyclocephala miamiensis* | |
| Saltmarsh tiger beetle | *Cicindela marginata* | |
| Strohecker's ivory-spotted long-horned beetle | *Eburia stroheckeri* | |
| Mangrove long-horned beetle | *Heterachthes sablensis* | |
| Tropical white-spotted long-horned beetle | *Linsleyonides albomaculatus* | |
| Elongate june beetle | *Phyllophaga elongata* | |
| Round-necked romulus long-horned beetle | *Romulus globusus* | |
| Handsome flower scarab beetle | *Rutela formosa* | |
| Mangrove skipper | *Phocides pygmalion* | |

| Common Name | Scientific Name | Status |
|---|---|---|
| Mangrove buckeye | *Junonia evarete* | |
| **Echinoderms - Echinodermata** | | |
| **Starfishes - Asteroidea** | | |
| Spiny sea star | *Echinaster sentus* | |
| Cushion sea star | *Oreaster reticulatus* | |
| **Brittle Stars - Ophiuroidea** | | |
| Brittle star sp. | *Amphiodia pulchella* | |
| Brittle star sp. | *Amphioplus coniortodes* | |
| Brittle star sp. | *Amphioplus thrombodes* | |
| Brittle star sp. | *Amphipholis pachybactera* | |
| Brittle star sp. | *Amphipholis squamata* | |
| Brittle star sp. | *Amphiura stimpsoni* | |
| Brittle star sp. | *Micropholis gracillima* | |
| Oersted's brittle star | *Ophiothrix oerstedii* | |
| Savigny's brittle star | *Ophiactis savignyi* | |
| Coralline brittle star | *Ophiocomella ophiactoides* | |
| Short spine brittle star | *Ophioderma brevispinum* | |
| Brittle star sp. | *Ophionephthys limicola* | |
| Reticulated brittle star | *Ophionereis reticulata* | |
| Brittle star sp. | *Ophionereis squamulosa* | |
| Brittle star sp. | *Ophiophragmus pulcher* | |
| Brittle star sp. | *Ophiopsila riisei* | |
| Brittle star sp. | *Ophiostigma isacanthum* | |
| Brittle star sp. | *Ophiuroidea juvenile* | |
| | | |
| **Sea Urchins - Echinoidea** | | |
| Sea biscuit | *Clypeaster rosaceus* | |
| Long-spined sea urchin | *Diadema antillarum* | |
| Rock boring urchin | *Echinometra lucunter* | |
| Green sea urchin | *Lytechinus variegatus* | |
| Urchin sp. | *Moira atropos* | |
| | | |
| **Sea Cucumbers - Holothuroidea** | | |
| Worm cucumber | *Chiridota rotifera* | |
| Sticky sea cucumber | *Leptosynapta parvipatina* | |
| Florida sea cucumber | *Ludwigothuria floridana* | |
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| Common Name | Scientific Name | Status |
|---|---|---|
| **Chordates - Chordata** | | |
| **Sessile Tunicates - Ascidiacea** | | |
| Black tunicate | *Ascidia nigra* | |
| Sessile tunicate spp. | | |
| | | |
| **Cartilaginous Fishes - Chondrichthyes** | | |
| Spotted eagle ray | *Aetobatus narinari* | NT |
| Bull shark | *Carcharhinus leucas* | NT |
| Blacktip shark | *Carcharhinus limbatus* | NT |
| Southern stingray | *Dasyatis americana* | |
| Atlantic stingray | *Dasyatis sabina* | |
| Bluntnose stingray | *Dasyatis say* | |
| Nurse shark | *Ginglymostoma cirratum* | |
| Smooth butterfly ray | *Gymnura micrura* | |
| Giant manta ray | *Manta birostris* | FT |
| Lesser electric ray | *Narcine brasiliensis* | |
| Smalltooth sawfish | *Prictis pectinata* | FE |
| Hammerhead shark sp. | *Sphyrna sp.* | |
| Yellow stingray | *Urobatis jamaicensis* | |
| | | |
| **Bony Fishes - Osteichthyes** | | |
| Sergeant major | *Abudefduf saxatiallis* | |
| Scrawled cowfish | *Acanthostracion quadricornis* | |
| Clown goby | *Acanthurus bahianus* | |
| Doctorfish tang | *Acanthurus chirurgus* | |
| Blue tang | *Acanthurus coeruleus* | |
| Lined sole | *Achirus lineatus* | |
| Emerald clingfish | *Acyrtops beryllinus* | |
| Bonefish | *Albula vulpes* | NT |
| Silverside | *Allanetta harringtonensis* | |
| Orange filefish | *Alutera schoepfi* | |
| Bowfin | *Amia calva* | |
| Big-eye anchovy | *Anchoa lamprotaenia* | |
| Shortfinger anchovy | *Anchoa lyolepis* | |
| Bay anchovy | *Anchoa mitchelli* | |
| Flat anchovy | *Anchoviella perfasciata* | |
| American eel | *Anguila rostrata* | |
| Porkfish | *Anisotremus virginicus* | |
| Flame cardinal | *Apogon maculatus* | |

| Common Name | Scientific Name | Status |
|---|---|---|
| Sheepshead | *Archosargus probatocephalus* | |
| Sea bream | *Archosargus rhomboidalis* | |
| Bronze cardinalfish | *Astrapogon alutus* | |
| Conchfish | *Astrapogon stellatus* | |
| Southern stargazer | *Astroscopus y-graecum* | |
| Hardhead silverside | *Atherinomorus stipes* | |
| Silver perch | *Bairdiella chrysura* | |
| Grey triggerfish | *Balistes capriscus* | |
| Undescribed goby | *Bathygobius sp.* | |
| Spanish hogfish | *Bodianus rufus* | |
| Eyed flounder | *Bothus ocellatus* | |
| Flounder | *Bothus sp.* | |
| Yellowfin menhaden | *Brevoortia smithi* | |
| Atlantic menhaden | *Brevoortia tyrannus* | |
| Grass porgy | *Calamus acrtifrons* | |
| Spotted oceanic triggerfish | *Canthidermis maculatus* | |
| Checkered puffer | *Canthigaster rostrata* | |
| Yellow jack | *Caranx bartholomaei* | |
| Blue runner | *Caranx crysos* | |
| Crevalle jack | *Caranx hippos* | |
| Horse-eye jack | *Caranx latus* | |
| Bar jack | *Caranx ruber* | |
| Spotted whiff | *Catherichthys macrops* | |
| Common snook | *Centropomus undecimalis* | |
| Atlantic spadefish | *Chaetodipterus faber* | |
| Foureye butterflyfish | *Chaetodon capistratus* | |
| Reef butterflyfish | *Chaetodon sedentarius* | |
| Banded butterflyfish | *Chaetodon striatus* | |
| Bridled burrfish | *Chilomycterus antennatus* | |
| Striped burrfish | *Chilomycterus schoepfi* | |
| Atlantic bumper | *Chloroscombrus chrysurus* | |
| Hardhead halfbeak | *Chriodorus atherinoides* | |
| Blue reef damselfish | *Chromis cyaneus* | |
| Bay whiff | *Citharichthys spilopterus* | |
| Creole wrasse | *Clepticus parrai* | |
| Common dolphinfish | *Coryphaena hippurus* | |
| Bridled goby | *Coryphopterus glaucofraenum* | |
| Whitenose pipefish | *Corythoichthys albirostris* | |
| Crested pipefish | *Corythoichthys brachycephalus* | |
| Spottail goby | *Ctenogobius stigmaturus* | |

| Common Name | Scientific Name | Status |
|---|---|---|
| Spotted seatrout | *Cynoscion nebulosus* | |
| Sheepshead minnow | *Cyprinodon variegates* | |
| Clearwing flyingfish | *Cypselurus comatus* | |
| Sand stargazer | *Dactyloscopus tridigitatus* | |
| Striped mojarra | *Dasyatis americana* | |
| Round scad | *Decapterus punctatus* | |
| Balloon fish | *Diodon holacanthus* | |
| Porcupinefish | *Diodon hystrix* | |
| Dwarf sand perch | *Diplectrum bivittatum* | |
| Sand perch | *Diplectrum formosum* | |
| Spotted dragonet | *Diplogrammus pauciradiatus* | |
| Dwarf wrasse | *Doratonotus megalepis* | |
| Fat sleeper | *Dormitator maculates* | |
| Shad | *Dorosoma spp.* | |
| Rainbow runner | *Elagatis bipinnulata* | |
| Ladyfish | *Elops saurus* | |
| Sailfin blenny | *Emblemaria pandionis* | |
| Red grouper | *Epinephelus morio* | |
| High hat drum | *Equetus acuminatus* | |
| Striped drum | *Equetus pulcher* | |
| Spotted drum | *Equetus punctatus* | |
| Spotfin mojarra | *Eucinostomus argenteus* | |
| Jenny mojarra | *Eucinostomus gula* | |
| Bigeye mojarra | *Eucinostomus havana* | |
| Mojarra sp. | *Eucinostomus sp.* | |
| Goldspotted killifish | *Floridichthys carpio* | |
| Longnose killifish | *Fundulus similis* | |
| Sea catfish | *Galeichthys felis* | |
| Eastern mosquitofish | *Gambusia holbrooki* | |
| Yellowfin mojarra | *Gerres cinereus* | |
| Orangespotted goby | *Gobiosoma longum* | |
| Code goby | *Gobiosoma robustum* | |
| Green moray | *Gymnothorax funebris* | |
| Spotted moray | *Gymnothorax moringa* | |
| Tomtate | *Haemulon aurolineatum* | |
| Smallmouth grunt | *Haemulon chrysargyreum* | |
| French grunt | *Haemulon flavolineatum* | |
| Sailor's choice | *Haemulon parra* | |
| White grunt | *Haemulon plumieri* | |
| Bluestriped grunt | *Haemulon sciurus* | |

| Common Name | Scientific Name | Status |
|---|---|---|
| Slippery dick wrasse | *Halichoeres bivittatus* | |
| Clown wrasse | *Halichoeres maculipinna* | |
| Puddingwife wrasse | *Halichoeres radiatus* | |
| Redear herring | *Harengula humeralis* | |
| Scaled herring | *Harengula jaguana* | |
| Scaled sardine | *Harengula pensacolae* | |
| Pearly razorfish | *Hemipteronotus novacula* | |
| Green razorfish | *Hemipteronotus splendens* | |
| Lined seahorse | *Hippocampus erectus* | |
| Dwarf seahorse | *Hippocampus zosterae* | |
| Sargassumfish | *Histrio histrio* | |
| Blue angelfish | *Holacanthus bermudensis* | |
| Queen angelfish | *Holacanthus ciliaris* | |
| Rock beauty angelfish | *Holacanthus tricolor* | |
| Grouper sp. | *Hypoplectrus sp.* | |
| Round Herring sp. | *Jenkinsia sp.* | |
| Bermuda chub | *Kyphosus sectatrix* | |
| Hairy blenny | *Labrisomas nuchipinnis* | |
| Hogfish | *Lachnolaimus maximus* | |
| Scrawled cowfish | *Lactophrys quadricornis* | |
| Buffalo trunkfish | *Lactophrys trigonus* | |
| Smooth trunkfish | *Lactophrys triqueter* | |
| Pinfish | *Lagodon rhomboides* | |
| Atlantic tripletail | *Lobotes surinamensis* | |
| Crested goby | *Lophogobius cyprinoides* | |
| Bluefin killifish | *Lucania goodei* | |
| Rainwater killifish | *Lucania parva* | |
| Mutton snapper | *Lutjanus analis* | |
| Schoolmaster snapper | *Lutjanus apodus* | |
| Gray snapper | *Lutjanus griseus* | |
| Dog snapper | *Lutjanus jocu* | |
| Lane snapper | *Lutjanus synagris* | |
| Tarpon | *Megalops atlantica* | |
| Black durgon triggerfish | *Melichthys niger* | |
| Gulf kingfish | *Menticirrhus littoralis* | |
| Northern kingfish | *Menticirrhus saxatilis* | |
| Clown goby | *Microgobius gulosus* | |
| Banner goby | *Microgobius microlepis* | |
| Atlantic croaker | *Micropogonias undulatus* | |
| Fringed filefish | *Monacanthus ciliatus* | |

| Common Name | Scientific Name | Status |
|---|---|---|
| Planehead filefish | *Monacanthus hispidus* | |
| Striped mullet | *Mugil cephalus* | |
| White mullet | *Mugil curema* | |
| Gag grouper | *Mycteroperca microlepis* | |
| Emerald parrotfish | *Nicholsina usta* | |
| Yellowtail snapper | *Ocyurus chrysurus* | |
| Reef croaker | *Odontoscion dentex* | |
| Shortnose batfish | *Ogcocephalus nasutus* | |
| Leatherjacket | *Oligoplites saurus* | |
| Bank Cusk-eel | *Ophidion holbrooki* | |
| Redlip blenny | *Ophioblennius atlanticus* | |
| Thread herring | *Opisthonema oglinum* | |
| Gulf toadfish | *Opsanus beta* | |
| Pigfish | *Orthopristis chrysoptera* | |
| Marbled blenny | *Paraclinus marmoratus* | |
| Gulf flounder | *Paralichthys albigutta* | |
| Sailfin molly | *Poecilia latipinna* | |
| Black drum | *Pogonias cromis* | |
| Barbu | *Polydactylus virginicus* | |
| Gray angelfish | *Pomacanthus arcuatus* | |
| French angelfish | *Pomacanthus paru* | |
| Leopard searobin | *Prionotus scitulus* | |
| Freckled driftfish | *Psenes cyanophrys* | |
| Spotted goatfish | *Pseudupeneus maculates* | |
| Mangrove rivulus | *Rivulus marmoratus* | |
| Spanish sardine | *Sardinella anchovia* | |
| Blue parrotfish | *Scarus coeruleus* | |
| Rainbow parrotfish | *Scarus gaucamaia* | |
| Spanish mackerel | *Scomberomorous maculatus* | |
| Barbfish | *Scorpaena brasiliensis* | |
| Lookdown | *Selene vomer* | |
| Lesser amberjack | *Seriola fasciata* | |
| Almaco jack | *Seriola rivoliana* | |
| Redband parrotfish | *Sparisoma aurofrenatum* | |
| Redtail parrotfish | *Sparisoma chrysopterum* | |
| Bucktooth parrotfish | *Sparisoma radians* | |
| Redfin parrotfish | *Sparisoma rubripinne* | |
| Spotlight parrotfish | *Sparisoma viride* | |
| Bandtail puffer | *Sphoeroides spengleri* | |
| Sharpnose puffer | *Sphoeroides testudineus* | |

| Common Name | Scientific Name | Status |
|---|---|---|
| Checkered puffer | *Sphoeroides testudineus* | |
| Great barracuda | *Sphyraena barracuda* | |
| Southern sennet | *Sphyraena picudilla* | |
| Beaugregory | *Stegastes leucostictus* | |
| Bicolor damselfish | *Stegastes partitus* | |
| Cocoa damselfish | *Stegates variabilis* | |
| Planehead filefish | *Stephanolepis hispidus* | |
| Pygmy filefish | *Stephanolepis setifer* | |
| Atlantic needlefish | *Strongylura marina* | |
| Redfin needlefish | *Strongylura notata* | |
| Atlantic needlefish | *Strongylura timucu* | |
| Dusky flounder | *Syacium papillosum* | |
| Blackcheek tonguefish | *Symphurus palgiusa* | |
| Dusky pipefish | *Syngnathus floridae* | |
| Gulf pipefish | *Syngnathus scovelli* | |
| Inshore lizardfish | *Synodus foetens* | |
| Bluehead wrasse | *Thalassoma bifasciatum* | |
| Florida pompano | *Trachinotus carolinus* | |
| Permit | *Trachinotus falcatus* | |
| Palometa | *Trachinotus goodie* | |
| Rough scad | *Trachurus lathami* | |
| Hogchoker | *Trinectes maculates* | |
| Hound needlefish | *Tylosurus crocodilus* | |
| Mottled mojarra | *Ulaema lefroyi* | |
| Sand drum | *Umbrina coroides* | |
| | | |
| **Amphibians - Amphibia** | | |
| Squirrel treefrog | *Hyla squirella* | |
| | | |
| **Reptiles - Reptilia** | | |
| Green anole | *Anolis carolinensis* | |
| Florida Keys mole skink | *Eumeces egregious egregius* | ST |
| Florida cottonmouth | *Agkistrodon piscivorus* | |
| Racer | *Coluber constrictor* | |
| Eastern indigo snake | *Drymarchon couperi* | FT |
| Corn snake | *Elaphe guttata* | |
| Mangrove salt marsh snake | *Nerodia clarkia compressicauda* | |
| Florida water snake | *Nerodia fasciata pictiventris* | |
| American crocodile | *Crocodylus accutus* | FT |

| Common Name | Scientific Name | Status |
|---|---|---|
| Florida softshell | *Trionyx ferox* | |
| Florida cooter | *Pseudemys floridana* | |
| Diamondback terrapin | *Malaclemys terappin* | NT |
| Loggerhead sea turtle | *Caretta caretta* | FT |
| Green sea turtle | *Chelonia mydas* | FT |
| Leatherback sea turtle | *Dermochelys coriacea* | FE |
| Hawksbill sea turtle | *Eretmochelys imbricata* | FE |
| | | |
| **Birds - Aves** | | |
| Cooper's hawk | *Accipiter cooperii* | |
| Sharp-shinned hawk | *Accipiter striatus* | |
| Spotted sandpiper | *Actitus macularia* | |
| Red-winged blackbird | *Agelaius phoeniceus* | |
| Northern pintail | *Anas acuta* | |
| Northern shoveler | *Anas clypeata* | |
| Green-winged teal | *Anas crecca* | |
| Blue-winged teal | *Anas discors* | |
| Eurasian wigeon | *Anas penelope* | |
| Gadwall | *Anas strepera* | |
| Anhinga | *Anhinga anhinga* | |
| Brown noddy | *Anous stolidus* | |
| Great egret | *Ardea alba* | |
| Great blue heron | *Ardea herodias herodias* | |
| Great white heron | *Ardea herodias occidentalis* | |
| Ruddy turnstone | *Arenaria interpres* | |
| Lesser scaup | *Aythya affinis* | |
| Redhead | *Aythya americana* | |
| Ring-necked duck | *Aythya collaris* | |
| Canvasback | *Aythya valisineria* | |
| American bittern | *Botaurus lentiginosus* | |
| Cattle egret | *Bubulcus ibis* | |
| Bufflehead | *Bucephala albeola* | |
| Short-tailed hawk | *Buteo brachyurus* | |
| Red-tailed hawk | *Buteo jamaicensis* | |
| Red-shouldered hawk | *Buteo lineatus* | |
| Broad-winged hawk | *Buteo platypterus* | |
| Green-backed heron | *Butorides striatus* | |
| Green heron | *Butorides virescens* | |
| Sanderling | *Calidris alba* | |

| Common Name | Scientific Name | Status |
|---|---|---|
| Dunlin | *Calidris alpina* | |
| Red knot | *Calidris canutus* | |
| White-rumped sandpiper | *Calidris fuscicollis* | |
| Stilt sandpiper | *Calidris himantopus* | |
| Western sandpiper | *Calidris mauri* | |
| Pectoral sandpiper | *Calidris melanotos* | |
| Least sandpiper | *Calidris minutilla* | |
| Semipalmated sandpiper | *Calidris pusilla* | |
| Chuck-will's widow | *Caprimulgus carolinensis* | |
| Northern cardinal | *Cardinalis cardinalis* | |
| Turkey vulture | *Cathartes aura* | |
| Willet | *Catoptrophorus semipalmatus* | |
| Chimney swift | *Chaetura pelagica* | |
| Piping plover | *Charadrius melodus* | FT |
| Semipalmated plover | *Charadrius semipalmatus* | |
| Killdeer | *Charadrius vociferus* | |
| Wilson's plover | *Charadrius wilsonia* | |
| Black tern | *Chlidonias niger* | |
| Common nighthawk | *Chordeiles minor* | |
| Northern harrier | *Circus cyaneus* | |
| Yellow-billed cuckoo | *Coccyzus americanus* | |
| Mangrove cuckoo | *Coccyzus minor minardi* | |
| Eastern wood-pewee | *Contopus virens* | |
| Black vulture | *Coragyps atratus* | |
| Smooth-billed ani | *Crotophaga ani* | |
| Blue jay | *Cyanocitta cristata* | |
| Black-throated blue warbler | *Dendroica caerulescens* | |
| Yellow-rumped warbler | *Dendroica coronate* | |
| Prairie warbler | *Dendroica discolor* | |
| Yellow-throated warbler | *Dendroica dominica* | |
| Palm warbler | *Dendroica palmarum* | |
| Yellow warbler | *Dendroica petechia* | |
| Bobolink | *Dolichonyx oryzivorus* | |
| Gray catbird | *Dumetella carolinensis* | |
| Little blue heron | *Egretta caerulea* | ST |
| Reddish egret | *Egretta rufescens* | ST |
| Snowy egret | *Egretta thula* | FT |
| Tricolored heron | *Egretta tricolor* | FT |
| American swallow-tailed kite | *Elanoides forficatus* | |
| White ibis | *Eudocimus albus* | |

| Common Name | Scientific Name | Status |
|---|---|---|
| Merlin | *Falco columbarius* | |
| Peregrine falcon | *Falco peregrinus* | FT |
| Southeastern American kestrel | *Falco sparverius* | ST |
| Magnificent frigatebird | *Fregata magnificens* | |
| American coot | *Fulica americana* | |
| Wilson's snipe | *Gallinago gallinago* | |
| Common moorhen | *Gallinula chloropus* | |
| Common loon | *Gavia immer* | |
| Common yellowthroat | *Geothlypis trichas* | |
| American oystercatcher | *Haematopus palliatus* | ST |
| Bald eagle | *Haliaeetus leucocephalus* | BGEPA |
| Worm-eating warbler | *Helmitheros vermivorus* | |
| Black-necked stilt | *Himantopus mexicanus* | |
| Barn swallow | *Hirundo rustica* | |
| Mississippi kite | *Ictinia mississippiensis* | |
| Tree swallow | *Iridoprocne bicolor* | |
| Least bittern | *Ixobrychus exilis* | |
| Loggerhead shrike | *Lanius ludovicianus* | |
| Herring gull | *Larus argentatus* | |
| Laughing gull | *Larus atricilla* | |
| Ring-billed gull | *Larus delawarensis* | |
| Lesser black-backed gull | *Larus fuscus* | |
| Great black-backed gull | *Larus marinus* | |
| Bonaparte's gull | *Larus philadelphia* | |
| Short-billed dowitcher | *Limnodromus griseus* | |
| Long-billed dowitcher | *Limnodromus scolopaceus* | |
| Marbled godwit | *Limosa fedoa* | |
| Belted kingfisher | *Megaceryle alcyon* | |
| Red-bellied woodpecker | *Melanerpes carolinus* | |
| Black scoter | *Melanitta nigra* | NT |
| Red-breasted merganser | *Mergus serrator* | |
| Northern mockingbird | *Mimus polyglottos* | |
| Black-and-white warbler | *Mniotilta varia* | |
| Northern gannet | *Morus bassanus* | |
| Wood stork | *Mycteria americana* | FT |
| Great-crested flycatcher | *Myiarchus crinitus* | |
| Brown-crested flycatcher | *Myiarchus tyrannulus* | |
| Long-billed curlew | *Numenius americanus* | |
| Whimbrel | *Numenius phaeopus* | |
| Yellow-crowned night heron | *Nyctanassa violacea* | |

| Common Name | Scientific Name | Status |
|---|---|---|
| Black-crowned night heron | *Nycticorax nycticorax* | |
| Wilson's storm-petrel | *Oceanites oceanicus* | |
| Band-rumped storm-petrel | *Oceanodroma castro* | |
| Leach's storm-petrel | *Oceanodroma leucorhoa* | |
| Eastern screech owl | *Otus asio* | |
| Osprey | *Pandion haliaetus* | |
| Northern parula | *Parula americana* | |
| White-crowned pigeon | *Patagioenas leucocephala* | ST |
| American white pelican | *Pelecanus erythrorhynchos* | |
| Brown pelican | *Pelecanus occidentalis* | |
| Cave swallow | *Petrochelidon fulva* | |
| Cliff swallow | *Petrochelidon pyrrhonota* | |
| Double-crested cormorant | *Phalacrocorax auritus* | |
| Wilson's phalarope | *Phalaropus tricolor* | |
| Roseate spoonbill | *Platalea ajaja* | ST |
| American golden plover | *Pluvialis dominica* | |
| Black-bellied plover | *Pluvialis squatarola* | |
| Horned grebe | *Podiceps auritus* | |
| Pied-billed grebe | *Podilymbus podiceps* | |
| Blue-gray gnatcatcher | *Polioptila carulea* | |
| Purple gallinule | *Porphyrula martinica* | |
| Sora | *Porzana carolina* | |
| Purple martin | *Progne subis* | |
| Prothonotary warbler | *Protonotaria citrea* | |
| Greater shearwater | *Puffinus gravis* | |
| Sooty shearwater | *Puffinus griseus* | |
| Audubon's shearwater | *Puffinus Iherminieri* | |
| Common grackle | *Quiscalus quiscula* | |
| Virginia rail | *Rallus limicola* | |
| Clapper rail | *Rallus longirostris* | |
| American avocet | *Recurvirostra americana* | |
| Bank swallow | *Riparia riparia* | |
| Everglade snail kite | *Rostrhamus sociabilis plumbeus* | FE |
| Black skimmer | *Rynchops niger* | ST |
| Eastern phoebe | *Sayornis phoebe* | |
| Ovenbird | *Seiurus aurocapillus* | |
| Louisiana waterthrush | *Seiurus motacilla* | |
| Northern waterthrush | *Seiurus noveboracensis* | |
| American redstart | *Setophaga ruticilla* | |
| Yellow-bellied sapsucker | *Sphyrapicus varius* | |

| Common Name | Scientific Name | Status |
|---|---|---|
| Northern rough-winged swallow | *Stelgidopteryx serripennis* | |
| Least tern | *Sterna antillarum* | ST |
| Caspian tern | *Sterna caspia* | |
| Roseate tern | *Sterna dougalli* | FT |
| Forster's tern | *Sterna forsteri* | |
| Sooty tern | *Sterna fuscata* | |
| Common tern | *Sterna hirundo* | |
| Gull-billed tern | *Sterna nilotica* | |
| Sandwich tern | *Sterna sandvicensis* | |
| Royal tern | *Thalasseua maximus* | |
| Brown thrasher | *Toxostoma rufum* | |
| Lesser yellowlegs | *Tringa flavipes* | |
| Greater yellowlegs | *Tringa melanoleuca* | |
| Solitary sandpiper | *Tringa solitaria* | |
| Gray kingbird | *Tyrannus dominicensis* | |
| Black-whiskered vireo | *Vireo altiloquus* | |
| White-eyed vireo | *Vireo griseus* | |
| Red-eyed vireo | *Vireo olivaceous* | |
| Mourning dove | *Zenaida macroura* | |
| | | |
| **Mammals - Mammalia** | | |
| Opossum | *Didelphis marsupialis* | |
| Florida bonneted bat | *Eumops floridanus* | FE |
| Pigmy sperm whale | *Kogia breviceps* | |
| River otter | *Lutra canadensis* | |
| Key Largo cotton mouse | *Peromyscus gossypinus allapaticola* | FE |
| Raccoon | *Procyon lotor* | |
| Atlantic spotted dolphin | *Stenella frontalis* | |
| Marsh rabbit | *Sylvilagus palustris* | |
| Florida manatee | *Trichechus manatus latirostris* | FT |
| Bottlenose dolphin | *Tursiops truncatus* | |

### *B.3.2 / Listed Species*

**Legend:** FT = Federally- and State-Designated Threatened • FE = Federally-and State-Designated Endangered • ST = State-Designated Threatened • SE = State-Designated Endangered • BGEPA = Bald and Golden Eagle Protection Act

| **Common Name** | **Scientific Name** | **Status** |
|---|---|---|
| **PLANTS - PLANTAE** | | |
| **Vascular Plants - Tracheophyta** | | |
| **Pteridophytes – Pteridophyta** | | |
| Golden leather fern | *Acrostichum aureum* | ST |
| | | |
| **Flowering Plants – Anthophyta** | | |
| **Monocots - Monocotyledones** | | |
| Cowhorn orchid | *Cyrtopodium punctatum* | SE |
| Dollar orchid | *Encyclia boothiana var. erythronioides* | SE |
| Banded Wild-pine | *Tillandsia flexuosa* | ST |
| | | |
| **Dicots- Eudicotyledones** | | |
| Mangrove mallow | *Pavonia paludicola* | SE |
| | | |
| | | |
| **Cartilaginous Fishes - Chondrichthyes** | | |
| Spotted eagle ray | *Aetobatus narinari* | NT |
| Bull shark | *Carcharhinus leucas* | NT |
| Blacktip shark | *Carcharhinus limbatus* | NT |
| Giant manta ray | *Manta birostris* | FT |
| Smalltooth sawfish | *Prictis pectinata* | FE |
| | | |
| **Bony Fishes - Osteichthyes** | | |
| Bonefish | *Albula vulpes* | NT |
| | | |
| **Reptiles - Reptilia** | | |
| Florida Keys mole skink | *Eumeces egregious egregius* | ST |
| Eastern indigo snake | *Drymarchon couperi* | FT |
| American crocodile | *Crocodylus accutus* | FT |
| Diamondback terrapin | *Malaclemys terappin* | NT |
| Loggerhead sea turtle | *Caretta caretta* | FT |

| Common Name | Scientific Name | Status |
|---|---|---|
| Green sea turtle | *Chelonia mydas* | FT |
| Leatherback sea turtle | *Dermochelys coriacea* | FE |
| Hawksbill sea turtle | *Eretmochelys imbricata* | FE |
| | | |
| **Birds - Aves** | | |
| Piping plover | *Charadrius melodus* | FT |
| Little blue heron | *Egretta caerulea* | ST |
| Reddish egret | *Egretta rufescens* | ST |
| Snowy egret | *Egretta thula* | FT |
| Tricolored heron | *Egretta tricolor* | FT |
| Peregrine falcon | *Falco peregrinus* | FT |
| Southeastern American kestrel | *Falco sparverius* | ST |
| American oystercatcher | *Haematopus palliatus* | ST |
| Bald eagle | *Haliaeetus leucocephalus* | BGEPA |
| Black scoter | *Melanitta nigra* | NT |
| Wood stork | *Mycteria americana* | FT |
| White-crowned pigeon | *Patagioenas leucocephala* | ST |
| Roseate spoonbill | *Platalea ajaja* | ST |
| Everglade snail kite | *Rostrhamus sociabilis plumbeus* | FE |
| Black skimmer | *Rynchops niger* | ST |
| Least tern | *Sterna antillarum* | ST |
| Roseate tern | *Sterna dougalli* | FT |
| | | |
| **Mammals - Mammalia** | | |
| Florida bonneted bat | *Eumops floridanus* | FE |
| Key Largo cotton mouse | *Peromyscus gossypinus allapaticola* | FE |
| Florida manatee | *Trichechus manatus latirostris* | FT |

### *B.3.3 / Invasive Non-native and/or Problem Species*

Florida Exotic Pest Plant Council (FLEPPC) categorizes invasive exotic plants as Category I (plants that are altering native plant communities by displacing native species, changing community structures or ecological functions, or hybridizing with natives) or Category II (plants that have increased in abundance or frequency but have not yet altered Florida plant communities to the extent shown by Category I species).

| Scientific Name | Common Name | Classification |
|---|---|---|
| **PLANTS** | | |
| *Casuarina equisetifolia* | Australian pine | Category I |
| *Cynodon dactylon* | Bermuda grass | Potentially invasive |
| *Halophila stipulaceas* | Broadleaf seagrass | Potentially invasive |
| *Schinus terebenthifolius* | Brazilian pepper | Category I |
| *Washingtonia robusta* | Washington fan palm | Category II |
| | | |
| **ANIMALS** | | |
| **Mollusks** | | |
| *Melanoides tuberculatus* | Red-rim melania | Invasive |
| | | |
| **Crustaceans** | | |
| *Callinectes bocourti* | Bocourt swimming crab | Invasive |
| | | |
| **Fish** | | |
| *Cichla ocellaris* | Peacock bass | Invasive |
| *Cichlasoma bimaculatum* | Black acara | Invasive |
| *Cichlasoma urophthalmus* | Mayan cichlid | Invasive |
| *Pterois volitans* | Lionfish | Invasive |
| *Tilapia mariae* | Spotted tilapia | Invasive |
| | | |
| **Amphibians** | | |
| *Osteopilus septentrionalis* | Cuban tree frog | Invasive |
| | | |
| **Reptiles** | | |
| *Anolis sagrei* | Brown anole | Invasive |
| *Caiman crocodilus* | Spectacled caiman | Invasive |
| *Ctenosaura pectinata* | Mexican spinytail iguana | Invasive |
| *Iguana iguana* | Green iguana | Invasive |
| *Python molurus bivittatus* | Burmese python | Invasive |
| | | |
| **Birds** | | |
| *Cairina moschata* | Muscovy duck | Invasive |
| *Coragyps atratus* | Black vulture | Problem |
| | | |

| Scientific Name | Common Name | Classification |
|---|---|---|
| **Mammals** | | |
| *Felis catus* | Feral cat | Invasive |
| *Prycyon lotor* | Raccoon | Problem |
| *Rattus rattus* | Black rat | Invasive |

## B.4 /- Arthropod Control Plan

Spatial data (e.g. shapefiles) for the boundaries of the aquatic preserve have been made accessible to the appropriate mosquito control district. The aquatic preserve is deemed highly productive and environmentally sensitive. As per DEP policy since 1987, aerial adulticiding is not allowed, but larviciding and ground adulticiding (truck spraying in public use areas) is typically allowed. Mosquito control plans temporarily may be set aside under declared threats to public or animal health, or during a Governor's Emergency Proclamation. Mosquito control plans are typically proposed by local mosquito control agencies when they desire to treat on public lands.

## B.5 / Archaeological and Historical Sites Associated with Biscayne Bay Aquatic Preserve

The list below was derived from shapefiles obtained from the Florida Department of State, Division of Historical Resources on October 24, 2024, and includes sites within 0.25 miles of the Biscayne Bay aquatic preserves. The acreage of the sites within Biscayne Bay Aquatic Preserve totals 1,849 acres.

| Site ID | Site Name | Site Description | Location |
|---|---|---|---|
| DA00004 | BISCAYNE KEY MOUND | Land-terrestrial | Within 50 m (146 feet) of BBAP. |
| DA00007 | CUTLER KEY | Prehistoric burial(s) | Within 50 m (146 feet) of BBAP. |
| DA00010 | MUNROE | Building remains | Within BBAP. |
| DA00011 | GRANADA | Land-terrestrial | Within BBAP. |
| DA00012 | MIAMI CIRCLE AT BRICKELL POINT | Building remains | Within BBAP. |
| DA00013 | MIAMI SAND MOUND 4 | Prehistoric burial mound(s) | Within BBAP. |
| DA00015 | MIAMI SAND MOUND 2 | Prehistoric burial mound(s) | Within 50 m (146 feet) of BBAP. |
| DA00016 | MIAMI ROCK MOUND 1 | Prehistoric mound(s) | Within BBAP. |
| DA00017 | MIAMI ROCK MOUND 2 | Habitation (prehistoric) | Within 50 m (146 feet) of BBAP. |
| DA00021 | SURFSIDE MIDDEN | Prehistoric midden(s) | Within 50 m (146 feet) of BBAP. |
| DA00025 | OLETA RIVER 3 | Prehistoric midden(s) | Within BBAP. |
| DA00405 | OLD CUTLER ROAD HISTORIC HIGHWAY | Linear Resource | Within BBAP. |
| DA00412 | PIRATES PUNCHBOWL | Campsite (prehistoric) | Within BBAP. |
| DA01024 | OLETA RIVER 2 | Prehistoric midden(s) | Within BBAP. |
| DA01026 | BUTTONWOOD CAMP | Prehistoric midden(s) | Within BBAP. |
| DA01027 | SNAKE CREEK CROSSING | Historic burial(s) | Within 50 m (146 feet) of BBAP. |
| DA01028 | GREYNOLDS | Artifact scatter-low density (< 2 per sq meter) | Within BBAP. |
| DA01033 | BAY | Prehistoric midden(s) | Within BBAP. |
| DA01034 | SUTTON | Specialized site for procurement of raw materials | Within 50 m (146 feet) of BBAP. |
| DA01041 | OJUS | Prehistoric midden(s) | Within 50 m (146 feet) of BBAP. |

| Site ID | Site Name | Site Description | Location |
|---|---|---|---|
| DA01049 | FISH CAMP | Artifact scatter-low density (< 2 per sq meter) | Within 50 m (146 feet) of BBAP. |
| DA01063 | BLUFF CAMP 2 | Campsite (prehistoric) | Within 50 m (146 feet) of BBAP. |
| DA01082 | BRICKELL BLUFF | Prehistoric midden(s) | Within 50 m (146 feet) of BBAP. |
| DA01083 | BUTTON | Historic refuse / dump | Within 50 m (146 feet) of BBAP. |
| DA01087 | SOUTH MIAMI AVENUE BRIDGE | Bridge; Unspecified material; built 1917 | Within BBAP. |
| DA01655 | MIAMI RIVER RAPIDS | Campsite (prehistoric) | Within 50 m (146 feet) of BBAP. |
| DA01658 | WILLIAMS | Prehistoric midden(s) | Within 50 m (146 feet) of BBAP. |
| DA01675 | ALICE C WAINWRIGHT PARK | Mixed District | Within BBAP. |
| DA02099 | VILLA SERENA | Artifact scatter-low density (< 2 per sq meter) | Within 50 m (146 feet) of BBAP. |
| DA02119 | BALDWIN | Prehistoric midden(s) | Within 50 m (146 feet) of BBAP. |
| DA02132 | SANTA MARIA | Prehistoric midden(s) | Within 50 m (146 feet) of BBAP. |
| DA02577 | GERRY CURTIS PARK | Designed Historic Landscape | Within BBAP. |
| DA02815 | CHARLES DEERING ESTATE | Mixed District | Within BBAP. |
| DA03220 | JOSE MARTI | Prehistoric burial(s) | Within BBAP. |
| DA03296 | LIGHTHOUSE KEEPERS HOUSE AND FOUNDATIONS | Building remains | Within 50 m (146 feet) of BBAP. |
| DA04577 | SOUTH RIVER DRIVE HISTORIC DISTRICT | Historical District | Within BBAP. |
| DA04736 | VENETIAN CAUSEWAY | Designed Historic Landscape | Within BBAP. |
| DA05096 | LITTLE RIVER | Bridge; Steel; built 1928 | Within BBAP. |
| DA05098 | BRICKELL AVENUE BRIDGE | Bridge; Concrete-steel; built 1929 | Within BBAP. |
| DA05125 | LUMMUS PARK HISTORIC DISTRICT | Historical District | Within 50 m (146 feet) of BBAP. |
| DA05182 | SUNSET LAKE CANAL | Bridge; Steel; built 1936 | Within BBAP. |
| DA05201 | BAY SHORE HISTORIC DISTRICT | Historical District | Within BBAP. |
| DA05254 | KIRK MUNROE HOMESITE | Building remains | Within BBAP. |
| DA05360 | Brickell Resource Group | Archaeological District | Within BBAP. |
| DA05377 | Edgewater Historic District | Historical District | Within BBAP. |
| DA05766 | LA GORCE CANAL BRIDGE | Steel; built 1934 | Within BBAP. |
| DA05823 | BISCAYNE POINT BRIDGE | Bridge; Concrete; built 1950 | Within BBAP. |
| DA05828 | SUNSET ISLANDS BRIDGE NUMBER 2 | Bridge; Concrete; built c1929 | Within BBAP. |
| DA05829 | SUNSET ISLAND BRIDGE NUMBER 4 | Bridge; Concrete; built c1928 | Within BBAP. |
| DA05886 | NW 17TH AVENUE BRIDGE | Bridge; Concrete; built 1929 | Within BBAP. |

| Site ID | Site Name | Site Description | Location |
|---|---|---|---|
| DA06207 | GROVE PARK HISTORIC DISTRICT | Historical District | Within BBAP. |
| DA06208 | LITTLE SNAKE CREEK | Land-terrestrial | Within 50 m (146 feet) of BBAP. |
| DA06218 | NORTHWEST 5TH STREET BRIDGE | Bridge; Concrete; built 1929 | Within BBAP. |
| DA06222 | SOUTHWEST 1ST STREET BRIDGE | Bridge; Steel; built 1929 | Within BBAP. |
| DA06341 | NW 12TH AVENUE BRIDGE | Bridge; Concrete; built 1928 | Within BBAP. |
| DA06342 | MERRILL-STEVENS DRY DOCK COMPANY | FMSF Building Complex | Within BBAP. |
| DA06352 | LITTLE RIVER CANAL | Linear Resource | Within BBAP. |
| DA06419 | SPRING GARDEN HISTORIC DISTRICT | Historical District | Within BBAP. |
| DA06424 | OLETA RIVER | Bridge; Concrete; built 1925 | Within BBAP. |
| DA06425 | OLETA RIVER | Bridge; Concrete; built 1935 | Within BBAP. |
| DA06426 | N.W. 27TH AVENUE | Bridge; Concrete; built 1938 | Within BBAP. |
| DA06430 | OCEAN CANAL | Bridge; Concrete; built 1940 | Within BBAP. |
| DA06433 | OCEAN CANAL | Bridge; Concrete; built c1925 | Within BBAP. |
| DA06434 | S.W. 2ND AVENUE | Bridge; Concrete; built c1923 | Within BBAP. |
| DA06435 | OCEAN CANAL | Bridge; Concrete; built 1940 | Within BBAP. |
| DA06439 | INDIAN CREEK | Bridge; Concrete; built c1929 | Within BBAP. |
| DA06441 | SUNNY ISLES | Bridge; Concrete; built c1927 | Within BBAP. |
| DA06446 | NO NAME HARBOR I | Historic burial(s) | Within 50 m (146 feet) of BBAP. |
| DA06453 | TAMIAMI CANAL | Linear Resource | Within 50 m (146 feet) of BBAP. |
| DA06525 | MIAMI CANAL | Linear Resource | Within BBAP. |
| DA06537 | BISCAYNE CANAL | Linear Resource | Within BBAP. |
| DA06764 | 1855 US COAST SURVEY KEY BISCAYNE BASE | Land-terrestrial | Within 50 m (146 feet) of BBAP. |
| DA06880 | KEY BISCAYNE SHIPWRECK | Historic shipwreck | Within 50 m (146 feet) of BBAP. |
| DA06881 | PINE TREE DRIVE | Linear Resource | Within 50 m (146 feet) of BBAP. |
| DA06901 | BISCAYNE BLVD (ROADWAY) | Linear Resource | Within BBAP. |
| DA08048 | Lummus Park Resource Group | Designed Historic Landscape | Within 50 m (146 feet) of BBAP. |
| DA08129 | Normandy Isles Historic District | Historical District | Within BBAP. |
| DA09896 | West 63rd Street Flyover | Bridge; Concrete; built 1955 | Within 50 m (146 feet) of BBAP. |
| DA09897 | West 63rd Street Bridge | Bridge; Unspecified; built 1953 | Within BBAP. |
| DA10107 | F.E.C. Railway | Linear Resource | Within BBAP. |
| DA10123 | Broad Causeway | Bridge; Steel; built c1951 | Within BBAP. |
| DA10448 | Flagler Street | Linear Resource | Within BBAP. |
| DA10509 | SW 1st Street | Linear Resource | Within BBAP. |

| Site ID | Site Name | Site Description | Location |
|---|---|---|---|
| DA10515 | Bay Harbor Islands Historic District | Historical District | Within BBAP. |
| DA10529 | Normandy Shores Golf Course | Designed Historic Landscape | Within BBAP. |
| DA10754 | Snapper Creek Canal | Linear Resource | Within BBAP. |
| DA11346 | Lawrence Canal | Linear Resource | Within 50 m (146 feet) of BBAP. |
| DA11375 | Collins Canal | Linear Resource | Within BBAP. |
| DA11549 | Keystone Islands | Historical District | Within BBAP. |
| DA11609 | Surfside Residential District | Historical District | Within BBAP. |
| DA11611 | Western Key Biscayne Neighborhood | Historical District | Within 50 m (146 feet) of BBAP. |
| DA11654 | North Shore Historic District | Historical District | Within BBAP. |
| DA11716 | Rickenbacker West Fishing Pier | Bridge; Concrete; built 1944 | Within BBAP. |
| DA11736 | Cape Florida X-313 Survey Monument | Twentieth century structure | Within 50 m (146 feet) of BBAP. |
| DA11737 | Cape Florida DCBE-28 Survey Monument | Twentieth century structure | Within 50 m (146 feet) of BBAP. |
| DA11738 | Cape House | Building remains | Within 50 m (146 feet) of BBAP. |
| DA11743 | Shorecrest Midden | Campsite (prehistoric) | Within BBAP. |
| DA11745 | 24th Street Footbridge | Bridge; Unspecified; built 1937 | Within BBAP. |
| DA11746 | 41st Street Bridge | Bridge; Unspecified; built 1953 | Within BBAP. |
| DA11747 | 29th Street Footbridge | Bridge; Unspecified; built c1950 | Within BBAP. |
| DA11775 | Comfort Canal | Linear Resource | Within BBAP. |
| DA11789 | Seawall | Linear Resource | Within BBAP. |
| DA11796 | Bal Harbour  Res. Medians | Designed Historic Landscape | Within BBAP. |
| DA11799 | Bal Harbour Yacht Basin | Designed Historic Landscape | Within 50 m (146 feet) of BBAP. |
| DA11867 | Collins Waterfront Architectural Dist | Historical District | Within BBAP. |
| DA11919 | N River Drive/NW 17th Avenue | Bridge; Concrete; built 1969 | Within 50 m (146 feet) of BBAP. |
| DA12366 | Collins Canal Seawall | Linear Resource | Within BBAP. |
| DA12417 | The Barnacle Historic District | Historical District | Within BBAP. |
| DA12596 | FEC Bridge over Oleta River | Bridge; Steel; built 1963 | Within BBAP. |
| DA12610 | W. Flagler Street / Miami River Bridge | Bridge; Steel; built 1967 | Within BBAP. |
| DA12613 | NW 22nd Avenue / Miami River Bridge | Bridge; Steel; built 1964 | Within BBAP. |
| DA12620 | Port of Miami (Seaport) Bascule Bridge | Bridge; Steel; built 1964 | Within BBAP. |
| DA13352 | Flagler Street Midden | Campsite (prehistoric) | Within 50 m (146 feet) of BBAP. |
| DA13361 | Palm Grove Historic District | Historical District | Within BBAP. |
| DA13364 | FDOT Bridge No. 875102 | Bridge; Concrete; built c1958 | Within BBAP. |
| DA14019 | Matheson Hammock Park | Designed Historic Landscape | Within BBAP. |

| Site ID | Site Name | Site Description | Location |
|---|---|---|---|
| DA14373 | Venetian Causeway Bridge 1 | Bridge; Concrete; built c1926 | Within BBAP. |
| DA14374 | Venetian Causeway Bridge 2 | Bridge; Concrete; built c1926 | Within BBAP. |
| DA14375 | Venetian Causeway Bridge 3 | Bridge; Concrete; built c1926 | Within BBAP. |
| DA14376 | Venetian Causeway Bridge 4 | Bridge; Concrete; built c1926 | Within BBAP. |
| DA14377 | Venetian Causeway Bridge 5 | Bridge; Concrete; built c1926 | Within BBAP. |
| DA14378 | Venetian Causeway Bridge 6 | Bridge; Concrete; built c1926 | Within BBAP. |
| DA14379 | Venetian Causeway Bridge 7 | Bridge; Concrete; built c1926 | Within BBAP. |
| DA14380 | Venetian Causeway Bridge 8 | Bridge; Concrete; built c1926 | Within BBAP. |
| DA14381 | Venetian Causeway Bridge 9 | Bridge; Concrete; built c1926 | Within BBAP. |
| DA14382 | Venetian Causeway Bridge 10 | Bridge; Concrete; built c1926 | Within BBAP. |
| DA14383 | Venetian Causeway Bridge 11 | Bridge; Concrete; built c1926 | Within BBAP. |
| DA14384 | Venetian Causeway Bridge 12 | Bridge; Concrete; built c1926 | Within BBAP. |
| DA14398 | Sunset Lake Historic District | Historical District | Within BBAP. |
| DA14723 | Nautilus Historic District | Historical District | Within BBAP. |
| DA14816 | Robert King High Midden | Land-terrestrial | Within BBAP. |
| DA14823 | MacArthur Cswy East Bridge | Bridge; Steel; built c1957 | Within BBAP. |
| DA14824 | SR-907 Flyover | Bridge; Concrete; built c1958 | Within 50 m (146 feet) of BBAP. |
| DA15336 | SR A1A/Collins Ave | Linear Resource | Within BBAP. |
| DA15339 | Seybold Canal | Linear Resource | Within BBAP. |
| DA15697 | Coral Gables (C-3) Canal | Linear Resource | Within BBAP. |
| DA15722 | FDOT Bridge #870297 | Bridge; Other; built c1968 | Within BBAP. |
| DA15805 | Sandpiper Villa Co-op | FMSF Building Complex | Within BBAP. |
| DA15824 | Lake of the Isles | Designed Historic Landscape | Within BBAP. |
| DA15825 | Atlantic Isle Bridge and Lake | Designed Historic Landscape | Within BBAP. |
| DA16432 | FDOT #870626 | Bridge; Concrete; built c1947 | Within BBAP. |
| DA16467 | NE 78 Street Midden | Campsite (prehistoric) | Within 50 m (146 feet) of BBAP. |
| DA16540 | MacArthur Causeway | Linear Resource | Within BBAP. |
| DA16550 | Julia Tuttle Causeway | Linear Resource | Within BBAP. |
| DA16551 | FDOT Bridge No. 870314 | Bridge; Concrete; built c1961 | Within BBAP. |
| DA17109 | NE 79th Street Causeway | Linear Resource | Within BBAP. |
| DA17110 | FDOT Bridge No. 874541 | Bridge; Steel; built c1944 | Within BBAP. |
| DA17112 | Rickenbacker Causeway | Linear Resource | Within BBAP. |
| DA19223 | Haulover Park | Designed Historic Landscape | Within BBAP. |
| DA19227 | Broadway / SW 15th Road | Linear Resource | Within 50 m (146 feet) of BBAP. |
| DA19228 | FDOT Bridge 874275 | Bridge; Steel; built c1943 | Within 50 m (146 feet) of BBAP. |
| DA19230 | Cartagena Plaza | Designed Historic Landscape | Within BBAP. |
| DA19238 | 444 Brickell Avenue | Historic burial(s) | Within BBAP. |
| DA19241 | Atlantic Island Resource Group | Designed Historic Landscape | Within BBAP. |

| Site ID | Site Name | Site Description | Location |
|---|---|---|---|
| DA19548 | Treasure Island Historic District | Historical District | Within BBAP. |
| DA21594 | Broad Causeway Island | Designed Historic Landscape | Within BBAP. |
| DA21608 | Indian Creek Country Club Golf Course | Designed Historic Landscape | Within BBAP. |
| DA21621 | Town of Bay Harbor Islands Playground | Designed Historic Landscape | Within BBAP. |
| MO00208 | JOHN PENNEKAMP CORAL REEF STATE PK | Mixed District | Within BBAP. |
| MO01978 | PUMPKIN KEY | Prehistoric shell midden | Within BBAP. |
| MO02062 | OCEAN REEF | Prehistoric shell midden | Within BBAP. |
| MO02339 | Pennekamp Historic Building Remains | Building remains | Within BBAP. |

# Appendix C / Public Involvement

## C.1 / Advisory Committee

### *C.1.1 / List of invited members and their affiliations*

| Name | Organization |
|---|---|
| Rafael Almagro | FWC Regional |
| Michael Barrios | Miami Dade Marine Patrol |
| Tanya Bhatt | City of Miami Beach Elected Official |
| Jorge Brito | Florida DEP, Bill Baggs Cape Florida State Park |
| Jessica Cabral | Barnacle Historic State Park |
| Spencer Crowley | FIND, fishing community |
| Evan D'Alessandro | University of Miami |
| Dave Doebler | VolunteerCleanup.org |
| Laura Eldredge | MDC Regulation & Economic Resources Division |
| Chris Evans | CoM Parks Dept |
| Piero Gardinali | FIU Hydrology Dept. |
| Mike Gibaldi | Surfrider Miami |
| Adriana González Fernández | Miami Waterkeeper |
| Mark Hendrixson | Oleta State Park |
| Sarah Hopson | Biscayne National Park |
| Lauren Jonaitis | Tropical Audubon Society |
| Aliza Karim | Miami Waterkeeper |
| Maddie Kaufman | Debris Free Oceans |
| Carlos Martinez | SFWMD |
| Aabad Melwani | Rickenbacker Marina |
| Charles Munroe | FOBB |
| Jayantha T. Obeysekera | FIU Hydrology Dept. |
| Kevin O'Donnell | DEAR |
| Tom Reinert | FWC |
| Frank Reyes | Fishing Spot Conservation |
| Manoj Shivlani | University of Miami |
| Charles Smith | Oleta State Park |
| Rachel Streitfeld | North Bay Village Elected Official |
| David Suarez | City of Miami Beach Elected Official |
| Daniel Suman | University of Miami |
| Ed Swakon | Miami Marine Council Board Member |
| Pamela Sweeney | MDC Regulation & Economic Resources Division |
| John Tracey | Florida DEP |
| Oriel Tameron | CoM Marine Patrol |

| Name | Organization |
|---|---|
| Sam Van Leer | Urban Paradise Guild |
| Scott Wagner | SFWMD |
| Ana Zangroniz | Florida SeaGrant |
| Jared Zemantowski | Environmental Solutions |

### *C.1.2 / Florida Administrative Register Posting*

This information will be available in the final draft of the management plan.

### *C.1.3 / Meeting Summary*

This information will be available in the final draft of the management plan.

## C.2 / Formal Public Meeting

The following Appendices contain information about the Formal Public Meeting which was held in order to obtain input from the public about the Coupon Bight Aquatic Preserve Draft Management Plan.

### *C.2.1 / Florida Administrative Register Posting*

This information will be available in the final draft of the management plan.

### *C.2.2 / Advertisement Flyer*

This information will be available in the final draft of the management plan.

### *C.2.3 / Newspaper Advertisement*

This information will be available in the final draft of the management plan.

### *C.2.4 / Summary of the Formal Public Meeting*

This information will be available in the final draft of the management plan.

# Appendix D / Goals, Objectives, and Strategies

## D.1 / Current Goals, Objectives, and Strategies Budget Table

The following table provides a cost estimate for conducting the management activities identified in this plan. The data is organized by year and Management Program with subtotals for each program and year. The following represents the actual budgetary needs for managing the resources of the aquatic preserve. This budget was developed using data from the Office of Resilience and Coastal Protection (ORCP) and other cooperating entities, and is based on actual costs for management activities, equipment purchases and maintenance, and for development of fixed capital facilities. This budget assumes optimal staffing levels to accomplish these strategies, and includes the costs associated with staffing such as salary or benefits. Budget categories identified correlate with the ORCP Management Program Areas. The total for the plan as calculated is $654,840.

| Goals, Objectives & Integrated Strategies | Time frame | Estimated Average Yearly Cost | 25-26 | 26-27 | 27-28 | 28-29 | 29-30 | 31-32 | 32-33 | 33-34 | 34-35 | 10 year total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Issue 1: Water quality** | | | | | | | | | | | | |
| Goal 1: Maintain and improve water quality within and entering the preserve to meet natural resources needs. | | | | | | | | | | | | |
| Objective 1: Support local, state, and federal efforts to continue and expand monitoring and research programs, produce analyses of data, define gaps in watershed water quality restoration, identify management strategies, and enact policies to address those gaps in Biscayne Bay | | | | | | | | | | | | |
| Strategy 1: Support, engage, and incorporate the work of county, municipality, and state staff to compile, summarize, and analyze all local agency water quality data. | Ongoing | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $18,720 |
| Strategy 2: Identify sources of pollutants and turbidity impacting BBAP and its tributaries, with specific focus on the Miami River and Little River. | Ongoing | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $4,680 |
| Strategy 3: Promote the use of acceptable water quality monitoring standards that enable municipalities to accept data from more sources to increase data volume and reporting speed. | As needed | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 |
| Strategy 4: Facilitate discussions to develop Total Maximum Daily Load (TMDL) levels, Reasonable Assurance Plans (RAP), and/or Basin Management Action Plans (BMAP) to focus limited local and state resources directly on measures that will improve water quality for Biscayne Bay and its tributaries. | Ongoing | $800 | $800 | $800 | $800 | $800 | $800 | $800 | $800 | $800 | $800 | $7,200 |
| Strategy 5:Increase public and stakeholder access to historical and current data and resource information. | Ongoing | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $4,680 |

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| Strategy 6:Engage local entities in discussions on matters impacting water quality in the bay, such as wastewater overflows, water quality improvement efforts, septic-sewer conversion, seagrass restoration efforts, and nutrient reduction loads. | Ongoing | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 |
| Strategy 7: Enhance citizen science water quality monitoring networks by integrating volunteers into the data collection process to build appreciation for the benefits of restoration, enhancement, and management of natural resources. | Ongoing | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 |
| Strategy 8: Encourage municipal groups to record and maintain their water quality data in the Watershed Information Network | Ongoing | $800 | $800 | $800 | $800 | $800 | $800 | $800 | $800 | $800 | $800 | $7,200 |
| Objective 2: Reduce water quality impacts to surface water and groundwater caused by septic system sources within the watershed. | | | | | | | | | | | | |
| Strategy 1: Support the conversion of existing septic tanks to sewer systems at the municipal, county, and state levels, and facilitate dialogue to encourage implementation. | Ongoing | $800 | $800 | $800 | $800 | $800 | $800 | $800 | $800 | $800 | $800 | $7,200 |
| Strategy 2: Facilitate and engage in public awareness efforts to educate residents about septic systems and the impacts of faulty systems on Biscayne Bay's water quality. | Ongoing | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 |
| Objective 4: Work with city, county, and municipal agencies to preserve and restore natural shorelines and enhance armored shorelines adjacent to the aquatic preserve to maintain or restore water quality natural resources, and public access. | | | | | | | | | | | | |
| Strategy 1: Coordinate with government agencies and private landholders to identify and support the acquisition of lands (volunteer buyouts) that directly benefit the preserve's natural resources and enhance ecosystem services for the community. | Ongoing | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $1,080 |
| Strategy 2: Support the regulatory permitting process by informing regulatory staff about resources present in the aquatic preserve. | Ongoing | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 |
| Strategy 3: Engage the community in managing natural resources by involving them in existing projects (e.g., adopt-an-island program) and implementing new efforts that integrate marine debris removal, wildlife surveys, and habitat restoration projects (e.g., exotic plant removal). | Ongoing | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $9,360 |
| Strategy 4: Develop partnerships with governmental agencies and non-governmental organizations to secure funding for designing and conducting habitat restoration and enhancement projects within BBAP. | Ongoing | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 |
| Strategy 6: Promote the inclusion of public access and education in new and existing living shoreline projects. | Ongoing | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $1,080 |

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| Goal 2: Increase public and industry awareness about water quality issues in BBAP and what actions can be taken to improve water quality. | | | | | | | | | | | | | |
| Objective 1: Inform the public and partners about water quality conditions within BBAP. | | | | | | | | | | | | | |
| Strategy 1: Develop a BBAP annual report for Biscayne Bay with easy-to-understand and pertinent information about the health of Biscayne Bay, focusing on water quality, submerged aquatic vegetation, island management, and potentially other parameters such as species abundance and diversity if data is available. | Anualy | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $9,360 | |
| Strategy 2: Collaborate with local and state agencies to translate and distribute important water quality information to the public at outreach events, prioritizing underserved communities. | Ongoing | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $1,080 | |
| Strategy 3: Create outreach materials that explain how individual actions affect BBAP, both negatively and positively, and highlight ways people can help BBAP in their daily lives. | Ongoing | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $1,080 | |
| Strategy 4: Leverage new technology to design outreach materials that effectively describe the water quality challenges BBAP faces. | Ongoing | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $1,080 | |
| **Issue 2: Natural and Cultural Resource Protection** | | | | | | | | | | | | | |
| Goal 1: Document and preserve the natural resources within the preserve. | | | | | | | | | | | | | |
| Objective 1:Establish a baseline and/or add to the knowledge base of the current location, composition and abundance of the various habitat types and associated fauna, with specific focus on seagrass habitats. | | | | | | | | | | | | | |
| Strategy 1: Capture aerial photography/satellite imagery of BBAP for use in BBAP's website, creation of integrative maps, future restoration plans, survey efforts, and identification of critical habitat areas. | As needed | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $4,680 | |
| Strategy 2: Conduct wildlife and ground truthing surveys of seagrass areas, particularly those areas that have not been evaluated in over ten years. | As needed | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 | |
| Strategy 3:Support invasive exotic plant and animal eradication, such as lionfish and Brazilian pepper (Schinus terebenthifolius), by advertising exotic plant and animal removal volunteer activities. | Ongoing | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 | |
| Strategy 4:Facilitate awareness of the critical role natural resources play in the protection of Biscayne Bay and is surrounding communities. | Ongoing | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $9,360 | |

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| Strategy 5: Partner with FWC and other local, state, and federal agencies and organizations to conduct the Natural Resource Workshop wherein marine law enforcement learn about the importance of coastal wetlands and reefs and their ecological and economic value, marine mammal rescue basics, and their role in protecting these resources. | As needed | $160 | $160 | $160 | $160 | $160 | $160 | $160 | $160 | $160 | $160 | $1,440 |
| Strategy 6: Remove invasive species from BBAP and track numbers of species removed. | Ongoing | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $9,360 |
| Strategy 7: Participate in outreach activities targeting visitors to BBAP. | As needed | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $4,680 |
| Objective 2: Maintain a comprehensive monitoring program in Biscayne Bay, with particular focus on the northern bay, to include monitoring of existing sites and include additional sites as needed. | | | | | | | | | | | | |
| Strategy 1:Assess and maintain the number of epibenthic monitoring sites within the preserve boundaries. | Ongoing | $4,160 | $4,160 | $4,160 | $4,160 | $4,160 | $4,160 | $4,160 | $4,160 | $4,160 | $4,160 | $37,440 |
| Strategy 2: Develop partnerships with other governmental agencies and non-governmental organizations to design and conduct habitat restoration and enhancement projects within BBAP. | As needed | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 |
| Strategy 3: Maintain equipment and acquire new equipment to aid in the mapping and monitoring of benthic resources so that data can be incorporated into BBAP's learning pages, spatial data dashboards, and data repositories for access by BBAP staff and agency partners. | As needed | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $4,680 |
| Strategy 4: Track meetings with university faculty and staff as well as local, state, and federal partners to determine how to recreate key research projects undertaken in Biscayne Bay that provided critical information regarding abundance, diversity, and composition of species to compare and contrast with past and present conditions. | As needed | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $1,080 |
| Strategy 5: Acquire and maintained equipment to aid in mapping and monitoring efforts. | As needed | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $1,080 |
| Objective 3: Work with local governments and nonprofits to create a comprehensive marine debris prevention, reduction, and removal program within BBAP. | | | | | | | | | | | | |
| Strategy 1:  Develop collaborative campaigns with partner agencies to inform the public on ways to properly and improperly dispose of trash and the impacts of littering and marine debris to the health and management of Biscayne Bay. Incorporate "Leave No Trace" principles in campaign. | Ongoing | $8,320 | $8,320 | $8,320 | $8,320 | $8,320 | $8,320 | $8,320 | $8,320 | $8,320 | $8,320 | $74,880 |
| Strategy 2: Coordinate with partner agencies to conduct an analysis of marine debris in Biscayne Bay. | Ongoing | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $1,080 |
| Strategy 3: Assist partner agencies in evaluating existing stormwater outfall systems throughout the county to determine their effectiveness at preventing debris from entering Biscayne Bay. | Ongoing | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 |

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| Strategy 4: Create a program with municipalities to decrease the amount of trash pollution entering Biscayne Bay from land-based trash sources. | As needed | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $9,360 |
| Strategy 5:Develop a set of policies to reduce marine debris being created on the spoil islands in BBAP. | As needed | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $9,360 |
| Goal 2: Educate the public on the importance of BBAP's natural resources and history and cultural resources to the public. | | | | | | | | | | | | |
| Objective 1: Partner with other agencies and/or non-governmental organizations to promote greater understanding and interpretation of cultural and natural resources including threats to those resources that businesses, residents, and visitors can minimize. | | | | | | | | | | | | |
| Strategy 1: Provide environmental education events and materials related to the historical and cultural importance of outstanding cultural and natural resource sites. | Ongoing | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 |
| Strategy 2: Engage the community in the management of natural resources by expanding the adopt-an-island program and/or implementing an adopt-a-shoreline program that integrates marine debris removal, wildlife surveys, and habitat restoration/enhancement projects, including invasive plant removal. | Ongoing | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 |
| Strategy 3: Collaborate with law enforcement and government agencies' regulatory staff to reduce the incidence of non-compliant or illegitimate businesses operating in or on Biscayne Bay. | Ongoing | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 |
| Strategy 4: Facilitate greater presence at municipal and county waterfront-related committees that address alterations to Biscayne Bay shorelines. | Ongoing | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $1,080 |
| Strategy 5: Coordinate with DEP staff, law enforcement, and local and state staff to educate magistrates and judges to prevent the dismissal of environmental violations, such as manatee zone or fisheries infractions. | Ongoing | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $1,080 |
| Strategy 6:Continue dialogue with area colleges and universities to promote science and research addressing long-standing questions about the health of Biscayne Bay and its supported flora and fauna. | Ongoing | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $1,080 |
| Strategy 7: Participate in Marine Advisory Support Team meetings to coordinate with marine law enforcement and stakeholders on critical issues impacting natural resources and human health and safety in Biscayne Bay and its tributaries. | Ongoing | $320 | $320 | $320 | $320 | $320 | $320 | $320 | $320 | $320 | $320 | $2,880 |
| Strategy 8: Track coordination with agencies and non-governmental organizations managing natural areas along Biscayne Bay to encourage the integration of BBAP-related information into presentations, tours, and other outreach activities. | Ongoing | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $1,080 |
| Strategy 9: Collaborate with agencies and non-governmental organizations managing visitor centers to quantify the number of visitors exposed to educational messages about BBAP. | Ongoing | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $1,080 |

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| Strategy 10: Maintain or replace aquatic preserve signage at outstanding cultural sites such as the Miami Circle, Arch Creek, the Deering Estate, and the Miami Marine Stadium as needed. | As needed | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 | |
| Strategy 11: Maintain or replace aquatic preserve signage at outstanding natural resource sites, including FWC's Critical Wildlife Area, Chicken Key, Arch Creek, and Cutler Wetlands as needed. | As needed | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 | |
| Objective 2: Partner with state, county and municipal parks to incorporate information about BBAP history and resources into guided tours, signage, staff training, and promotional materials. | | | | | | | | | | | | | |
| Strategy 1: Create materials highlighting the natural and cultural resources of Biscayne Bay to share with ecotour guides. | Ongoing | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 | |
| Strategy 2: Encourage tour guides and county and municipal park staff to include information about the natural and cultural resources of Biscayne Bay in their tours of BBAP. | Ongoing | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $9,360 | |
| Strategy 3: Organize events in southern Biscayne Bay to allow visitors to experience healthy marine communities and educate them on the importance of proper ecological functioning. | Ongoing | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $9,360 | |
| Strategy 4: Participate in meetings hosted by the City of Miami, City of Miami Beach, Miami-Dade County, the Miami River Commission, and other agencies or organizations to discuss the natural and cultural resources of the bay. | Ongoing | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $9,360 | |
| Strategy 5: Engage senior county and city park staff managing natural areas along Biscayne Bay to encourage the integration of BBAP natural and cultural resource information into presentations, tours, and outreach activities. Collaborate with parks to track attendance and infer the number of visitors exposed to BBAP educational messages. | Ongoing | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 | |
| Strategy 6: Develop a presentation about the natural and cultural resources of Biscayne Bay to motivate ecotour guides to incorporate this information into their activities. | As needed | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 | |
| **Issue Three: Habitat Loss** | | | | | | | | | | | | | |
| Goal 1: Protect Biscayne Bay from impacts related to land use changes that disrupt the ecological functions of natural resources within ORCP's purview. | | | | | | | | | | | | | |
| Objective 1: Participate in the regulatory process with partner agencies to reduce the impacts of coastal construction on Biscayne Bay and its resources. | | | | | | | | | | | | | |
| Strategy 1: Analyze the direct impacts of coastal construction projects to develop effective avoidance and minimization criteria. | Ongoing | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 | |
| Strategy 2: Collaborate with local, state, and federal agencies to conduct marine habitat restoration projects and employ non-regulatory methodologies to reduce impacts on existing marine habitats. | As needed | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 | |

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| Strategy 3: Organize and conduct training sessions for on-site field surveys with DEP's Southeast District office staff and SFWMD, as appropriate. | As needed | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 |
| Strategy 4: Review Comprehensive Development Master Plans and management plans of adjacent managed areas to identify areas for alignment with BBAP goals. | As needed | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $1,080 |
| Strategy 5:Coordinate with local, state, and federal agencies on applications for proposed construction projects by providing biological survey information or supporting public interest projects. | As needed | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $4,680 |
| Strategy 6: Engage with Miami-Dade County staff and leadership to facilitate restoration-focused permits for filling seagrass scars and evaluate other habitat restoration opportunities in areas with minimal benthic resources. | As needed | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 |
| Strategy 7: Advise municipal, local, and state government agencies on the appropriate use of available fill material for restoration projects. | As needed | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 |
| Strategy 8: Communicate with environmental consultants, bayfront homeowners, environmental regulatory staff, and the USFWS to educate them about the effects of creating new shorelines on existing habitats. | Ongoing | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 |
| Objective 2: Describe and/or quantify function of ecological services provided by coastal habitats. | | | | | | | | | | | | | |
| Strategy 1: Quantify and enhance understanding of native biodiversity and ecosystem integrity within BBAP boundaries. | Ongoing | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $18,720 |
| Strategy 2: Investigate the form, function, and interactions between flora and fauna within BBAP boundaries, including the stresses experienced at the habitat or organism level. | Ongoing | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $9,360 |
| Strategy 3: Participate in discussions with resource agencies and non-governmental organizations at the Marine Health Summit to evaluate ongoing research on potential environmental stressors in the bay and their effects on human health. | Ongoing | $160 | $160 | $160 | $160 | $160 | $160 | $160 | $160 | $160 | $160 | $160 | $1,440 |
| Strategy 4: Share knowledge about ecosystem services provided by coastal habitats with the public and students, from grade school through university. | Ongoing | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $4,680 |
| Strategy 5: Promote awareness of the value of mangroves, seagrass, sediment, and benthic communities through a homeowner education campaign. | Ongoing | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $9,360 |
| Strategy 6: Educate visitors and residents of Miami-Dade County on the location and ecological services provided by lesser-known natural resources such as seagrasses, sediment, and benthic communities in the bay to address misconceptions about creating new habitats versus preserving existing ones. | Ongoing | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 |
| Objective 3: Protect the natural resources by reducing harmful and illegal activities. | | | | | | | | | | | | | |

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| Strategy 1: Coordinate with enforcement and permitting agencies through training opportunities, monthly meetings, and other venues to exchange natural resource information and address roadblocks to effective enforcement of environmental violations. | Ongoing | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $4,680 |
| Strategy 2: Collaborate with FWC, local governments, and law enforcement to review outcomes of pilot mooring projects and facilitate management of existing mooring areas to reduce impacts on the benthic community and water quality. | Ongoing | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 |
| Strategy 3: Work with law enforcement and partnering resource agencies to mitigate the number of derelict and "at-risk" vessels within BBAP boundaries. | Ongoing | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 |
| Strategy 4: Support resource agencies and law enforcement efforts to address derelict and/or illegal fisheries gear and harvesting activities through coordination and information sharing. | Ongoing | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $4,680 |
| Objective 4: Protect and restore seagrass areas. | | | | | | | | | | | | |
| Strategy 1: Work with law enforcement to encourage enforcement of the seagrass law, prohibiting destruction of seagrasses, in aquatic preserve. | Ongoing | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $4,680 |
| Strategy 2: Work with other agencies to respond to vessel groundings and quantify injuries through the use of surveys and GPS technology to map location, size, and volume of injury. | Ongoing | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 |
| Strategy 3: Work with law enforcement and governmental agencies to facilitate an agreement between tow boat operators and DEP and/or relevant agencies to report grounded vessels to BBAP staff. | Ongoing | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $120 | $1,080 |
| Strategy 4: Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP. | Ongoing | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 |
| Strategy 5: Partner with other resource agencies to confirm the success or failure of restoration techniques used in current and previously completed projects. | Ongoing | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 |
| Strategy 6: Facilitate emergency meetings in partnership with FWC, the county, universities and other agencies when support is needed to track algal blooms, groundings, injured wildlife, or other natural resource-related impacts. | Ongoing | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 |
| Objective 5: Mitigate the impacts of erosion. | | | | | | | | | | | | |
| Strategy 1: Identify sedimentation and eutrophication "hot spot" areas within the bay through ongoing water quality fieldwork in collaboration with partner organizations. | Ongoing | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 |
| Strategy 2: Raise public awareness about the effects of erosion by assisting partner organizations in outreach efforts. | Ongoing | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 |

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| Strategy 3: Promote resilient and/or living shorelines to protect upland communities from storm surges and mitigate coastal erosion. | Ongoing | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 | |
| Strategy 4: Engage environmental consultants, bayfront homeowners, environmental regulatory staff, and the United States Fish and Wildlife Service to advance the Living Shorelines program. | Ongoing | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 | |
| Objective 6: Help identify suitable locations for habitat migration of mangrove and seagrass species. | | | | | | | | | | | | | |
| Strategy 1: Promote research that will help identify the best areas for restoring mangrove shorelines and identify how that process will proceed. | Ongoing | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 | |
| Strategy 2: Raise awareness about the importance of living and sloped shorelines with a focus on the effects of sea level rise on seagrass communities. | Ongoing | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 | |
| Objective 7: Understand and ensure adaptability and responsiveness to changing precipitation patterns and upland freshwater delivery in delivery of freshwater to Biscayne Bay to maintain salinity levels. | | | | | | | | | | | | | |
| **Issue Four: Public Awareness, Access and Use** | | | | | | | | | | | | | |
| Goal 1: Maintain a safe environment for Biscayne Bay's wildlife, habitats and user groups. | | | | | | | | | | | | | |
| Objective 1: Identify human use conflicts with natural resources. | | | | | | | | | | | | | |
| Strategy 1: Collaborate with regulatory staff, law enforcement, legal staff, and resource management teams from other agencies to address non-water-dependent, potentially illegal, or resource-harming activities in BBAP. | Ongoing | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 | |
| Strategy 2: Provide Biscayne Bay-specific boater education and safety programs. | Ongoing | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 | |
| Strategy 3:Deliver formal and informal outreach activities in counties BBAP serves, with a focus on underserved communities, to promote awareness and stewardship of BBAP's natural resources. | Ongoing | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 | |
| Strategy 4: Support the distribution of BBAP materials at venues such as the Frost Science Museum, Bill Baggs State Park Visitor Center, and other locations to educate the visiting public about BBAP resources. | Ongoing | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 | |
| Strategy 5: Utilize innovative technologies to create video footage of healthy marine habitats in Biscayne Bay, providing interactive educational experiences for residents of MDC with limited bay access. | Ongoing | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 | |
| Objective 2: Reduce the amount of debris, contaminants, and resource injuries associated with user group activities. | | | | | | | | | | | | | |

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| Strategy 1: Determine effectiveness and management practices of mooring fields and potentially create new mooring fields to better protect resources from direct impacts (anchors) and indirect impacts (dumping of sewage). | As needed | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 |
| Strategy 2:Improve understanding and coordination with consumptive use impacts from fisheries such as shrimping, crabbing, and others that employ gear and methods regarding the potential impacts to Biscayne Bay resources. | Ongoing | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $4,680 |
| Strategy 3: Identify hotspots of vessel impacts in order to direct management measures more efficiently. | Ongoing | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $9,360 |
| Strategy 4: Identify methods to reduce and eliminate buildup of trash on spoil islands. | Ongoing | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $18,720 |
| Objective 3:Identify ways to increase and enhance effective on-water law enforcement patrols in BBAP. | | | | | | | | | | | | |
| Strategy 1: Coordinate with government agencies and private landholders to identify and support the acquisition of lands (volunteer buyouts) that directly benefit the preserve's natural resources and enhance ecosystem services for the community. | As needed | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 |
| Strategy 2: Promote awareness of proper boating practices to reduce propeller scarring in seagrass and other benthic communities. | Ongoing | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $9,360 |
| Strategy 3: Coordinate increasing or replacing regulatory signage and buoys, so they are correct, well-maintained, and enforceable. | As needed | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 |
| Strategy 4: Partner with other agencies and organizations to identify funding sources to conduct more targeted marine law enforcement. | Ongoing | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 |
| Strategy 5: Work with ORCP legal staff, law enforcement, and local and state legal staff to implement a class such as that is run by Biscayne National Park where on-water citations for violations related to speed zones and safety issues can result in reduced financial restitution if the offender participates in a class designed to educate him/ her and prevent future offenses. | As needed | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 |
| Objective 4: Inform the public and partners about water quality conditions within BBAP. | | | | | | | | | | | | |
| Strategy 1: Develop a BBAP annual report for Biscayne Bay with easy-to-understand and pertinent information about the health of Biscayne Bay, focusing on water quality, submerged aquatic vegetation, island management, and potentially other parameters such as species abundance and diversity if data is available. | Annually | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $9,360 |
| Strategy 2: Collaborate with local and state agencies to translate and distribute important water quality information to the public at outreach events, prioritizing underserved communities. | As needed | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 |
| Strategy 3: Create outreach materials that explain how individual actions affect BBAP, both negatively and positively, and highlight ways people can help BBAP in their daily lives. | Ongoing | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $9,360 |

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| Strategy 4: Leverage new technology to design outreach materials that effectively describe the water quality challenges BBAP faces. | Ongoing | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $18,720 |
| **Issue Five: Sustainable Public Use** | | | | | | | | | | | | | |
| Goal 1: Protect Biscayne Bay from impacts related to land use changes that disrupt the ecological functions of natural resources within ORCP's purview. | | | | | | | | | | | | | |
| Objective 1: Increase awareness and promote sustainable use of the bay's resources. | | | | | | | | | | | | | |
| Strategy 1: Promote awareness of proper boating practices to reduce propeller scarring in seagrasses and other benthic communities. | Ongoing | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $18,720 |
| Strategy 2: Provide formal and informal opportunities for various types of user groups (e.g. motorized vessels, SCUBA divers, kite surfers, birders) to learn about BBAP's natural resources in order to promote a sense of stewardship and conservation. | Ongoing | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $2,080 | $18,720 |
| Strategy 3: Increase the amount of accessible and marked freediving and SCUBA's diving locations in the bay. | Ongoing | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $9,360 |
| Strategy 4: Support local agencies (i.e., local rowing clubs) that promote sustainable low-impact recreational activities. | Ongoing | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $240 | $2,160 |
| Strategy 5: Determine what types of recreational tour operations are occurring in Biscayne Bay and its tributaries as well as the economic contribution and possible environmental impacts of these operations. | Ongoing | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $480 | $4,320 |
| Objective 2: Identify and support appropriate locations for paddling launch sites and desirable destinations to access via kayak, canoe, or paddleboard. | | | | | | | | | | | | | |
| Strategy 1: Develop "attractions" to paddle to near launch sites and on islands, including both natural areas and environmental exhibits. | Ongoing | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $9,360 |
| Objective 3: Make the bay more accessible to underserved communities, while simultaneously promoting sustainable uses. | | | | | | | | | | | | | |
| Strategy 1: Increase access points, both physical and visual, to the bay and facilitate increased free public parking areas. | Ongoing | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $1,040 | $9,360 |
| Strategy 2: Increase education and access to audiovisual displays of healthy components of the bay, like the healthy seagrass beds located in Southern BBAP, to foster relationships to the bay and its resources. | Ongoing | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $520 | $4,680 |

## D.2 / Budget Summary Table

| Fiscal Year | Annual Total |
|---|---|
| 2025-2026 | $72,760 |
| 2026-2027 | $72,760 |
| 2027-2028 | $72,760 |
| 2028-2029 | $72,760 |
| 2029-2030 | $72,760 |
| 2030-2031 | $72,760 |
| 2031-2032 | $72,760 |
| 2032-2033 | $72,760 |
| 2033-2034 | $72,760 |
| 2034-2035 | $72,760 |
| Ten Year Totals | $727,600 |

## D.3 / Major Accomplishments Since the Approval of the Previous Plan

Since 2012, the Biscayne Bay Aquatic Preserve (BBAP) has achieved numerous milestones to enhance the management and protection of Biscayne Bay. In 2018, BBAP secured a grant from the National Oceanic and Atmospheric Administration (NOAA) to address large-scale marine debris caused by Hurricane Irma. Concluding in 2022, the grant facilitated the removal of thousands of pounds of heavy debris from the spoil islands within the bay. This effort not only restored natural habitats and reduced pollution but also improved the aesthetic and ecological value of the bay.

In 2019, BBAP was awarded a grant from the Environmental Protection Agency (EPA) to develop a comprehensive water quality and seagrass monitoring program in response to the 2019 Julia Tuttle seagrass die-off. The funding supported the acquisition, installation, and operation of four datasondes strategically positioned to monitor outflows from the Miami and Little Rivers, providing critical data on their impacts to the bay. This grant also enabled the establishment of BBAP's current seagrass monitoring program, which tracks seagrass health in northern Biscayne Bay. Since 2019, the program has documented increases in seagrass cover. Upon the grant's conclusion in 2024, a comprehensive analysis and detailed report of the collected data were completed.

In 2021, BBAP obtained an additional EPA grant to pilot a sponge nursery in northern Biscayne Bay, south of the Julia Tuttle Causeway. This initiative also funded the creation of an eighth datasonde station in the bay, equipped with a buoy and telemetered capabilities to provide live data. The sponge nursery, the first

of its kind in Biscayne Bay, aims to cultivate sponges for transplantation to degraded areas throughout the bay, contingent upon the project's success.

In 2024, BBAP celebrated its 50th anniversary, marking five decades of steadfast dedication by the State of Florida to the preservation and enhancement of Biscayne Bay. This milestone underscores the significant progress made and sets the stage for continued protection and restoration efforts in the years ahead.

BBAP staff continue to provide vital technical support to land management and regulatory authorities. This includes assisting with fieldwork, offering informed recommendations and feedback, and notifying relevant agencies of natural resource violations and other environmental concerns.

# Appendix E / Other Requirements

## E.1 / Acquisition and Restoration Council Management Plan Compliance Checklist

**Land management Plan Compliance Checklist: Required for State-owned conservation lands over 160 acres**

***Section A: Acquisition Information Items***

| Item # | Requirement | Statute/Rule | Page Numbers and/or Appendix |
|---|---|---|---|
| 1 | The common name of the property. | 18-2.018 & 18-2.021 | |
| 2 | The land acquisition program, if any, under which the property was acquired. | 18-2.018 & 18-2.021 | p. 1 |
| 3 | Degree of title interest held by the Board, including reservations and encumbrances such as leases. | 18-2.021 | p.1, 7-10 |
| 4 | The legal description and acreage of the property. | 18-2.018 & 18-2.021 | |
| 5 | A map showing the approximate location and boundaries of the property, and the location of any structures or improvements to the property. | 18-2.018 & 18-2.021 | p. 19 |
| 6 | An **assessment** as to whether the property, or any portion, should be declared surplus. *Provide Information regarding **assessment and analysis** in the plan, and provide **corresponding map**.* | 18-2.021 | n/a |
| 7 | Identification of other parcels of land within or immediately adjacent to the property that should be purchased because they are essential to management of the property. *Please clearly indicate parcels on a map.* | 18-2.021 | n/a |
| 8 | Identification of adjacent land uses that conflict with the planned use of the property, if any. | 18-2.021 | |
| 9 | A statement of the purpose for which the lands were acquired, the projected use or uses as defined in 253.034 and the statutory authority for such use or uses. | 259.032(10) | |
| 10 | Proximity of property to other significant State, local or federal land or water resources. | 18-2.021 | |

***Section B: Use Items***

| Item # | Requirement | Statute/Rule | Page Numbers and/or Appendix |
|---|---|---|---|
| 11 | The designated single use or multiple use management for the property, including use by other managing entities. | 18-2.018 & 18-2.021 | |
| 12 | A description of past and existing uses, including any unauthorized uses of the property. | 18-2.018 & 18-2.021 | |
| 13 | A description of alternative or multiple uses of the property considered by the lessee and a statement detailing why such uses were not adopted. | 18-2.018 | n/a |
| 14 | A description of the management responsibilities of each entity involved in the property's management and how such responsibilities will be coordinated. | 18-2.018 | |

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| 15 | Include a provision that requires that the managing agency consult with the Division of Historical Resources, Department of State before taking actions that may adversely affect archeological or historical resources. | 18-2.021 | |
| 16 | Analysis/description of other managing agencies and private land managers, if any, which could facilitate the restoration or management of the land. | 18-2.021 | |
| 17 | A determination of the public uses and public access that would be consistent with the purposes for which the lands were acquired. | 259.032(10) | |
| 18 | A finding regarding whether each planned use complies with the 1981 State Lands Management Plan, particularly whether such uses represent "balanced public utilization," specific agency statutory authority and any other legislative or executive directives that constrain the use of such property. | 18-2.021 | |
| 19 | Letter of compliance from the local government stating that the LMP is in compliance with the Local Government Comprehensive Plan. | BOT requirement | App. E.3 |
| 20 | An assessment of the impact of planned uses on the renewable and non-renewable resources of the property, including soil and water resources, and a detailed description of the specific actions that will be taken to protect, enhance and conserve these resources and to compensate/mitigate damage caused by such uses, including a description of how the manager plans to control and prevent soil erosion and soil or water contamination. | 18-2.018 & 18-2.021 | |
| 21 | *For managed areas larger than 1,000 acres, an analysis of the multiple-use potential of the property which shall include the potential of the property to generate revenues to enhance the management of the property provided that no lease, easement, or license for such revenue-generating use shall be entered into if the granting of such lease, easement or license would adversely affect the tax exemption of the interest on any revenue bonds issued to fund the acquisition of the affected lands from gross income for federal income tax purposes, pursuant to Internal Revenue Service regulations. | 18-2.021 & 253.036 | n/a |
| 22 | If the lead managing agency determines that timber resource management is not in conflict with the primary management objectives of the managed area, a component or section, prepared by a qualified professional forester, that assesses the feasibility of managing timber resources pursuant to section 253.036, F.S. | 18-021 | n/a |
| 23 | A statement regarding incompatible use in reference to Ch. 253.034(10). | 253.034(10) | |

*The following taken from 253.034(10) is not a land management plan requirement; however, it should be considered when developing a land management plan: The following additional uses of conservation lands acquired pursuant to the Florida Forever program and other state-funded conservation land purchase programs shall be authorized, upon a finding by the Board of Trustees, if they meet the criteria specified in paragraphs (a)-(e): water resource development projects, water supply development projects, storm-water management projects, linear facilities and sustainable agriculture and forestry. Such additional uses are authorized where: (a) Not inconsistent with the management plan for such lands; (b) Compatible with the natural ecosystem and resource values of such lands; (c) The proposed use is appropriately located on such lands and where due consideration is given to the use of other available lands; (d) The using entity reasonably compensates the titleholder for such use based upon an appropriate measure of value; and (e) The use is consistent with the public interest.

### *Section C: Public Involvement Items*

| Item # | Requirement | Statute/Rule | Page Numbers and/or Appendix |
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| 24 | A statement concerning the extent of public involvement and local government participation in the development of the plan, if any. | 18-2.021 | App. C |
| 25 | The management prospectus required pursuant to paragraph (9)(d) shall be available to the public for a period of 30 days prior to the public hearing. | 259.032(10) | App. C.2 |
| 26 | LMPs and LMP updates for parcels over 160 acres shall be developed with input from an advisory group who must conduct at least one public hearing within the county in which the parcel or project is located. *Include the advisory group members and their affiliations, as well as the date and location of the advisory group meeting.* | 259.032(10) | App. C.1 |
| 27 | Summary of comments and concerns expressed by the advisory group for parcels over 160 acres | 18-2.021 | App. C.1.3 |
| 28 | During plan development, at least one public hearing shall be held in each affected county. Notice of such public hearing shall be posted on the parcel or project designated for management, advertised in a paper of general circulation, and announced at a scheduled meeting of the local governing body before the actual public hearing. *Include a copy of each County's advertisements and announcements (meeting minutes will suffice to indicate an announcement) in the management plan.* | 253.034(5) & 259.032(10) | App. C.2 |
| 29 | The manager shall consider the findings and recommendations of the land management review team in finalizing the required 10-year update of its management plan. *Include manager's replies to the team's findings and recommendations.* | 259.036 | n/a |
| 30 | Summary of comments and concerns expressed by the management review team, if required by Section 259.036, F.S. | 18-2.021 | n/a |
| 31 | If manager is not in agreement with the management review team's findings and recommendations in finalizing the required 10-year update of its management plan, the managing agency should explain why they disagree with the findings or recommendations. | 259.036 | n/a |

### *Section D: Natural Resources*

| Item # | Requirement | Statute/Rule | Page Numbers and/or Appendix |
|---|---|---|---|
| 32 | Location and description of known and reasonably identifiable renewable and non-renewable resources of the property regarding soil types. *Use brief descriptions and include USDA maps when available.* | 18-2.021 | |
| 33 | Insert FNAI based natural community maps when available. | ARC consensus | |
| 34 | Location and description of known and reasonably identifiable renewable and non-renewable resources of the property regarding outstanding native landscapes containing relatively unaltered flora, fauna and geological conditions. | 18-2.021 | n/a |
| 35 | Location and description of known and reasonably identifiable renewable and non-renewable resources of the property regarding unique natural features and/or resources including but not limited to virgin timber stands, scenic vistas, natural rivers and streams, coral reefs, natural springs, caverns and large sinkholes. | 18-2.018 & 18-2.021 | |

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| 36 | Location and description of known and reasonably identifiable renewable and non-renewable resources of the property regarding beaches and dunes. | 18-2.021 | |
| 37 | Location and description of known and reasonably identifiable renewable and non-renewable resources of the property regarding mineral resources, such as oil, gas and phosphate, etc. | 18-2.018 & 18-2.021 | |
| 38 | Location and description of known and reasonably identifiable renewable and non-renewable resources of the property regarding fish and wildlife, both game and non-game, and their habitat. | 18-2.018 & 18-2.021 | |
| 39 | Location and description of known and reasonably identifiable renewable and non-renewable resources of the property regarding State and Federally listed endangered or threatened species and their habitat. | 18-2.021 | |
| 40 | The identification or resources on the property that are listed in the Natural Areas Inventory. *Include letter from FNAI or consultant where appropriate.* | 18-2.021 | |
| 41 | Specific description of how the managing agency plans to identify, locate, protect and preserve or otherwise use fragile, nonrenewable natural and cultural resources. | 259.032(10) | |
| 42 | Habitat Restoration and Improvement | 259.032(10) & 253.034(5) | |
| 42-A. | Describe management needs, problems and a desired outcome and the key management activities necessary to achieve the enhancement, protection and preservation of restored habitats and enhance the natural, historical and archeological resources and their values for which the lands were acquired. | 259.032(10) & 253.034(5) | |
| 42-B. | Provide a detailed description of both short (2-year planning period) and long-term (10-year planning period) management goals, and a priority schedule based on the purposes for which the lands were acquired and include a timeline for completion. | 259.032(10) & 253.034(5) | App. D.1 |
| 42-C. | The associated measurable objectives to achieve the goals. | 259.032(10) & 253.034(5) | |
| 42-D. | The related activities that are to be performed to meet the land management objectives and their associated measures. *Include fire management plans - they can be in plan body or an appendix.* | 259.032(10) & 253.034(5) | |
| 42-E. | A detailed expense and manpower budget in order to provide a management tool that facilitates development of performance measures, including recommendations for cost-effective methods of accomplishing those activities. | 259.032(10) & 253.034(5) | App. D.1 |
| 43 | ***Quantitative data description of the land regarding an inventory of forest and other natural resources and associated acreage. *See footnote.* | 253.034(5) | n/a |
| 44 | Sustainable Forest Management, including implementation of prescribed fire management | 18-2.021, 253.034(5) & 259.032(10) | |
| 44-A. | Management needs, problems and a desired outcome (see requirement for # 42-A). | 18-2.021, 253.034(5) & 259.032(10) | n/a |
| 44-B. | Detailed description of both short and long-term management goals (see requirement for # 42-B). | 18-2.021, 253.034(5) & 259.032(10) | n/a |
| 44-C. | Measurable objectives (see requirement for #42-C). | 18-2.021, 253.034(5) & 259.032(10) | n/a |
| 44-D. | Related activities (see requirement for #42-D). | 18-2.021, 253.034(5) & 259.032(10) | n/a |
| 44-E. | Budgets (see requirement for #42-E). | 18-2.021, 253.034(5) & 259.032(10) | n/a |

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|---|---|---|---|
| 45 | Imperiled species, habitat maintenance, enhancement, restoration or population restoration | 259.032(10) & 253.034(5) | |
| 45-A. | Management needs, problems and a desired outcome (see requirement for # 42-A). | 259.032(10) & 253.034(5) | |
| 45-B. | Detailed description of both short and long-term management goals (see requirement for # 42-B). | 259.032(10) & 253.034(5) | |
| 45-C. | Measurable objectives (see requirement for #42-C). | 259.032(10) & 253.034(5) | |
| 45-D. | Related activities (see requirement for #42-D). | 259.032(10) & 253.034(5) | |
| 45-E. | Budgets (see requirement for #42-E). | 259.032(10) & 253.034(5) | App. D.1 |
| 46 | ***Quantitative data description of the land regarding an inventory of exotic and invasive plants and associated acreage. *See footnote.* | 253.034(5) | App. B.3.3 |
| 47 | Place the Arthropod Control Plan in an appendix. If one does not exist, provide a statement as to what arrangement exists between the local mosquito control district and the management unit. | BOT requirement via lease language | App. B.4 |
| 48 | Exotic and invasive species maintenance and control | 259.032(10) & 253.034(5) | |
| 48-A. | Management needs, problems and a desired outcome (see requirement for # 42-A). | 259.032(10) & 253.034(5) | |
| 48-B. | Detailed description of both short and long-term management goals (see requirement for # 42-B). | 259.032(10) & 253.034(5) | |
| 48-C. | Measurable objectives (see requirement for #42-C). | 259.032(10) & 253.034(5) | |
| 48-D. | Related activities (see requirement for #42-D). | 259.032(10) & 253.034(5) | |
| 48-E. | Budgets (see requirement for #42-E). | 259.032(10) & 253.034(5) | D.1 |

### *Section E: Water Resources*

| Item # | Requirement | Statute/Rule | Page Numbers and/or Appendix |
|---|---|---|---|
| 49 | A statement as to whether the property is within and/or adjacent to an aquatic preserve or a designated area of critical state concern or an area under study for such designation. *If yes, provide a list of the appropriate managing agencies that have been notified of the proposed plan.* | 18-2.018 & 18-2.021 | |
| 50 | Location and description of known and reasonably identifiable renewable and non-renewable resources of the property regarding water resources, including water classification for each water body and the identification of any such water body that is designated as an Outstanding Florida Water under Rule 62-302.700, F.A.C. | 18-2.021 | |
| 51 | Location and description of known and reasonably identifiable renewable and non-renewable resources of the property regarding swamps, marshes and other wetlands. | 18-2.021 | |
| 52 | ***Quantitative description of the land regarding an inventory of hydrological features and associated acreage. *See footnote.* | 253.034(5) | |
| 53 | Hydrological Preservation and Restoration | 259.032(10) & 253.034(5) | |
| 53-A. | Management needs, problems and a desired outcome (see requirement for # 42-A). | 259.032(10) & 253.034(5) | |

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|---|---|---|---|
| 53-B. | Detailed description of both short and long-term management goals (see requirement for # 42-B). | 259.032(10) & 253.034(5) | |
| 53-C. | Measurable objectives (see requirement for #42-C). | 259.032(10) & 253.034(5) | |
| 53-D. | Related activities (see requirement for #42-D). | 259.032(10) & 253.034(5) | |
| 53-E. | Budgets (see requirement for #42-E). | 259.032(10) & 253.034(5) | |

### *Section F: Historical Archaeological and Cultural Resources*

| Item # | Requirement | Statute/Rule | Page Numbers and/or Appendix |
|---|---|---|---|
| 54 | **Location and description of known and reasonably identifiable renewable and non-renewable resources of the property regarding archeological and historical resources. *Include maps of all cultural resources except Native American sites, unless such sites are major points of interest that are open to public visitation.* | 18-2.018, 18-2.021 & per DHR's request | |
| 55 | ***Quantitative data description of the land regarding an inventory of significant land, cultural or historical features and associated acreage. | 253.034(5) | |
| 56 | A description of actions the agency plans to take to locate and identify unknown resources such as surveys of unknown archeological and historical resources. | 18-2.021 | |
| 57 | Cultural and Historical Resources | 259.032(10) & 253.034(5) | |
| 57-A. | Management needs, problems and a desired outcome (see requirement for # 42-A). | 259.032(10) & 253.034(5) | |
| 57-B. | Detailed description of both short and long-term management goals (see requirement for # 42-B). | 259.032(10) & 253.034(5) | |
| 57-C. | Measurable objectives (see requirement for #42-C). | 259.032(10) & 253.034(5) | |
| 57-D. | Related activities (see requirement for #42-D). | 259.032(10) & 253.034(5) | |
| 57-E. | Budgets (see requirement for #42-E). | 259.032(10) & 253.034(5) | App. D.1 |

**While maps of Native American sites should not be included in the body of the management plan, the DSL urges each managing agency to provide such information to the Division of Historical Resources for inclusion in their proprietary database. This information should be available for access to new managers to assist them in developing, implementing and coordinating their management activities.

### *Section G: Facilities (Infrastructure, Access, Recreation)*

| Item # | Requirement | Statute/Rule | Page Numbers and/or Appendix |
|---|---|---|---|
| 58 | ***Quantitative data description of the land regarding an inventory of infrastructure and associated acreage. *See footnote.* | 253.034(5) | |
| 59 | Capital Facilities and Infrastructure | 259.032(10) & 253.034(5) | |
| 59-A. | Management needs, problems and a desired outcome (see requirement for # 42-A). | 259.032(10) & 253.034(5) | |
| 59-B. | Detailed description of both short and long-term management goals (see requirement for # 42-B). | 259.032(10) & 253.034(5) | |
| 59-C. | Measurable objectives (see requirement for #42-C). | 259.032(10) & 253.034(5) | |
| 59-D. | Related activities (see requirement for #42-D). | 259.032(10) & 253.034(5) | |
| 59-E. | Budgets (see requirement for #42-E). | 259.032(10) & 253.034(5) | App. D.1 |

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| 60 | *** Quantitative data description of the land regarding an inventory of recreational facilities and associated acreage. | 253.034(5) | |
| 61 | Public Access and Recreational Opportunities | 259.032(10) & 253.034(5) | |
| 61-A. | Management needs, problems and a desired outcome (see requirement for # 42-A). | 259.032(10) & 253.034(5) | 1 |
| 61-B. | Detailed description of both short and long-term management goals (see requirement for # 42-B). | 259.032(10) & 253.034(5) | |
| 61-C. | Measurable objectives (see requirement for #42-C). | 259.032(10) & 253.034(5) | |
| 61-D. | Related activities (see requirement for #42-D). | 259.032(10) & 253.034(5) | |
| 61-E. | Budgets (see requirement for #42-E). | 259.032(10) & 253.034(5) | App. D.1 |

***Section H: Other/ Managing Agency Tools***

| Item # | Requirement | Statute/Rule | Page Numbers and/or Appendix |
|---|---|---|---|
| 62 | Place this LMP Compliance Checklist at the front of the plan. | ARC and managing agency consensus | Front and App. E.1 |
| 63 | Place the Executive Summary at the front of the LMP. Include a physical description of the land. | ARC and 253.034(5) | Ex. Summ. |
| 64 | If this LMP is a 10-year update, note the accomplishments since the drafting of the last LMP set forth in an organized (categories or bullets) format. | ARC consensus | App. D.3 |
| 65 | Key management activities necessary to achieve the desired outcomes regarding other appropriate resource management. | 259.032(10) | |
| 66 | Summary budget for the scheduled land management activities of the LMP including any potential fees anticipated from public or private entities for projects to offset adverse impacts to imperiled species or such habitat, which fees shall be used to restore, manage, enhance, repopulate, or acquire imperiled species habitat for lands that have or are anticipated to have imperiled species or such habitat onsite. The summary budget shall be prepared in such a manner that it facilitates computing an aggregate of land management costs for all state-managed lands using the categories described in s. 259.037(3) which are resource management, administration, support, capital improvements, recreation visitor services, law enforcement activities. | 253.034(5) | App. D.1 |
| 67 | Cost estimate for conducting other management activities which would enhance the natural resource value or public recreation value for which the lands were acquired, include recommendations for cost-effective methods in accomplishing those activities. | 259.032(10) | App. D.1 |
| 68 | A statement of gross income generated, net income and expenses. | 18-2.018 | n/a |

*** = The referenced inventories shall be of such detail that objective measures and benchmarks can be established for each tract of land and monitored during the lifetime of the plan. All quantitative data collected shall be aggregated, standardized, collected, and presented in an electronic format to allow for uniform management reporting and analysis. The information collected by the DEP pursuant to s. 253.0325(2) shall be available to the land manager and his or her assignee.

## E.2 / Management Procedures for Archaeological and Historical Sites on State-Owned or Controlled Lands

**(revised June 2021)**
**These procedures apply to state agencies, local governments, and non-profits that manage state-owned properties.**

### A. Historic Property Definition

Historic properties include archaeological sites and historic structures as well as other types of resources. Chapter 267, Florida Statutes states: " '*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 Chapter 267, *F.S.* and state policy related to historic properties, state agencies of the executive branch must provide the Division of Historical Resources (Division) the opportunity to comment on any undertakings with the potential to affect historic properties that are listed, or eligible for listing, in the National Register of Historic Places, 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 undertaking. (267.061(2)(a))

State agencies must consult with the Division when, as a result of state action or assistance, a historic property will be demolished or substantially altered in a way that will adversely affect the property. State agencies must take timely steps to consider feasible and prudent alternatives to the adverse effect. If no feasible or prudent alternatives exist, the state agency must take timely steps to avoid or mitigate the adverse effect. (267.061(2)(b))

State agencies must consult with Division to establish a program to locate, inventory and evaluate all historic properties under ownership or controlled by the agency. (267.061(2)(c))

State agencies are responsible for preserving historic properties under their control. State agencies are directed to use historic properties available to the agency when that use is consistent with the historic property and the agency's mission. State agencies are also directed to pursue preservation of historic properties to support their continued use. (267.061(2)(d))

### C. Statutory Authority

The full text of Chapter 267, F.S. and additional information related to the treatment of historic properties is available at:

https://dos.myflorida.com/historical/preservation/compliance-and-review/regulations-guidelines/

### D. Management Implementation

Although the Division sits on the Acquisition and Restoration Council and approves land management plans, these plans are conceptual and do not include detailed project information. Specific information for individual projects must be submitted to the Division for review and comment.

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. The Division's recommendations may include, but are not limited to: approval of the project as submitted, recommendation for a cultural resource assessment survey by a qualified professional archaeologist, and modifications to the proposed project to avoid or mitigate potential adverse effects.

Projects such as additions or alterations to historic structures as well as new construction must also be submitted to the Division for review. Projects involving structures fifty years of age or older must be submitted to the Division for a significance determination**.** In rare cases, structures under fifty years of age may be deemed historically significant.

Adverse effects to historic properties must be avoided when possible, and if avoidance is not possible, additional consultation with the Division is necessary to develop a mitigation plan. Furthermore, managers of state property should make preparations for locating and evaluating historic properties, both archaeological sites and historic structures.

### E. Archaeological Resource Management (ARM) Training

The ARM Training Course introduces state land managers to the nature of archaeological resources, Florida archaeology, and the role of the Division in managing state-owned archaeological resources. Participants gain a better understanding of the requirements of state and federal laws with regard to protecting and managing archaeological sites on state managed lands. Participants also receive a certificate recognizing their ability to conduct limited monitoring activities in accordance with the Division's Review Procedure, thereby reducing the time and money spent to comply with state regulations. Additional information regarding the ARM Training Course is available at:

https://dos.myflorida.com/historical/archaeology/education/arm-training-courses/

### F. Matrix for Ground Disturbance on State Lands

The matrix is a tool designed to help streamline the Division's Review Procedure. The matrix allows state land managers to make decisions about balancing ground disturbance and stewardship of historic resources. The matrix establishes types of undertakings that are either minor or major disturbances and then guides the land manager to consult the Division, conduct ARM-trained project monitoring, or proceed with the project.

Additional information regarding the matrix is available at:
https://dos.myflorida.com/historical/archaeology/education/dhr-matrix-for-ground-disturbance-on-state-lands/

### G. Human Remains Treatment

Chapter 872, *Florida Statutes* makes it illegal to willfully and knowingly disturb human remains. In the event human remains are discovered, cease all activity in the area that may disturb the remains. Leave the bones and nearby items in place. Immediately notify law enforcement or the local district medical examiner of the discovery and follow the provisions of Chapter 872, FS. Additional information regarding the treatment of human remains and cemeteries is available at:

https://dos.myflorida.com/historical/archaeology/human-remains/
https://dos.myflorida.com/historical/archaeology/human-remains/abandoned-cemeteries/what-are-the-applicable-laws-and-regulations/

### H. Division of Historical Resources Review Procedure

Projects on state owned or controlled properties may submit projects to the Division for review using the streamlined State Lands Consultation Form. The form provides instructions to submit projects for review

and outlines the necessary information for the Division to complete the review process. The State Lands Consultation Form and additional information about the Division's review process is available at:

https://dos.myflorida.com/historical/preservation/compliance-and-review/state-lands-review/

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

Compliance and Review Section
Bureau of Historic Preservation Division of Historical Resources
R. A. Gray Building
500 South Bronough Street
Tallahassee, FL 32399-0250

**StateLandsCompliance@dos.myflorida.com**

Phone: (850) 245-6333
Toll Free: (800) 847-7278
Fax: (850) 245-6435

## E.3 / Letter of Compliance with County Comprehensive Plan

## E.4 / Division of State Lands Management Plan Approval Letter


Biscayne Bay Aquatic Preserve Management Plan
Florida Department of Environmental Protection
Office of Resilience and Coastal Protection
2600 Blair Stone Road, MS #235
Tallahassee, FL 32399
www.floridacoasts.org