Revised Draft

BROWARD COUNTY
INTERIM BOAT FACILITY SITING PLAN

Prepared for:
Broward County
Environmental Protection Department
Biological Resources Division

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List of Abbreviations

BCMAC	**Broward County Marine Advisory Committee**
BFSP	**Boat Facility Siting Plan**
Comp Plan	**Broward County Comprehensive Plan**
Corps	**U.S. Army Corps of Engineers**
DCA	**Florida Department of Community Affairs**
DEP	**Florida Department of Environmental Protection**
DRI	**Development of Regional Impact**
EMLEG	**Broward County Enhanced Marine Law Enforcement Grant**
EPD	**Broward County Environmental Protection Department**
ESL	**Environmentally Sensitive Lands**
ESA	**U.S. Endangered Species Act**
FAC	**Florida Administrative Code**
FDNR	**Florida Department of Natural Resources**
FIND	**Florida Inland Navigation District**
FMRP	**Florida Manatee Recovery Plan**
FMSA	**Florida Manatee Sanctuary Act**
FPL	**Florida Power and Light Company**
FWC	**Florida Fish and Wildlife Conservation Commission**
FWRI	**Florida Fish and Wildlife Research Institute**
GIS	**Geographic Information System**
ICW	**Intracoastal Waterway**
MMPA	**U.S. Marine Mammal Protection Act**
MPBS	**Manatee Protection and Boater Safety**
MPP	**Manatee Protection Plan**
MSA	**Metropolitan Statistical Area**
PJA	**Port Jurisdictional Area**
PWC	**Personal Watercraft**
SAV	**Submerged Aquatic Vegetation**
SFWMD	**South Florida Water Management District**
USFWS	**U.S. Fish and Wildlife Service**
USGS	**U.S. Geological Survey**

List of Definitions

1:100 - the number of powerboat slips at a boat facility must not be greater than single-family density, or one powerboat slip for every one hundred feet of shoreline owned or controlled by the applicant. Density limit does not apply to single-family residences. (Source: FWC)

Anchorage - in-water vessel storage either by anchor or fixed mooring device without an associated dock or boat slip. (Source: Sarasota MPP, Sept. 2003)

Boat - a vehicle designed for operation as a watercraft propelled by sails or one or more electric or internal combustion engine(s). A boat, or vessel, may refer to any size vessel including a personal watercraft to freighters or cruise ships. A boat shall not be considered a recreational vehicle even though it has facilities for temporary living quarters. For purposes of this plan, the word "boat" does not include canoes or kayaks. (Source: Sarasota MPP)

Boating or Marine Facility - a public or private structure or operation where boats are moored and/or launched, including commercial, recreational, private, governmental, residential marinas, and boat ramps. A dry storage facility is considered part of a boat facility if the dry storage facility has the capability of launching vessels into adjacent waters or water access is provided adjacent to the project. Facilities such as long-term boat storage lots, boat yards, or boat dealership lots that do not have adjacent water access will not be considered boat facilities. For the purposes of this plan, docks associated with single-family residences with less than five (5) wet slips are not considered boat facilities. Said single-family docks cannot be rented, leased or sold to a party unless said party rents, leases, or buys the associated single-family residence. (Source: FWC)

Boat Facility Siting - for the purposes of this plan - is the determination of a location for marinas, docking structures, and boat launching facilities. (Source: Broward County 1997 Comprehensive Plan, with deletions by FWC, per email 12-6-04)

Boat/Manatee Overlap - the use of a particular waterway by both manatees and boats. The amount of overlap refers to the probability or likelihood of adverse boat and manatee interactions (such as

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collisions, crushing, injury or harassment) in a waterway, as a result of boat and manatee use of the same waterways. (Source: FWC)

Boat Ramp - a structural, man-made or altered natural feature that facilitates the launching and landing of boats into a water body. (Source: FWC)

Boat Yard - a facility used solely for boat repair and/or boat building. (Source: FWC)

Class III Waters - those surface waters of the State of Florida that have been classified according to the following designated uses: recreation, propagation, and maintenance of a healthy well-balanced population of fish and wildlife. (Source: Broward County 1997 Comprehensive Plan and FWC)

Coastal Waters - for the purposes of this plan - are that portion of Broward County's tidally influenced waterways which have direct access to oceanic waters and which lie east of the Florida Turnpike. (Source: FWC)

Commercial Marina - a boat facility constructed and used for the purpose of sale, lease, or rent of boat dockage (dry storage or wet slips) for profit. This type of marina may be owned by private or governmental entities. (Source: Broward County 1997 Comprehensive Plan and FWC)

Critical Habitats - any federally designated areas which, pursuant to the Endangered Species Act of 1973, have been determined to include physical and/or biological features that are essential to the survival of an endangered species (such as the manatee) which may require special management considerations or protection. (Source: Broward County 1997 Comprehensive Plan and FWC)

Ditch - a man-made trench or canal that was not built for navigational purposes (see Federal Register 33 CFR 329.24 for definition of navigable waterways). (Source: FWC)

Dry Storage Facility - an upland structure, upland parking or space used for storing watercraft. A dry storage facility many be either a water-dependent use. A dry storage facility is considered part of a boat facility if the dry storage facility has the capability of launching vessels into water, even if that launching point is offsite. Facilities that do not represent daily in/out facilities, however, such as boat

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storage for boat dealerships or long-term, non-use storage (at least six months), are not considered to contribute significantly to boat traffic and therefore are not subject to the Boat Facility Siting Plan. (Source: Sarasota MPP and FWC)

Egress and Ingress - for the purposes of this plan- is the continuous pathway of deepest water that vessels would be most likely to travel to a facility and from a facility to a marked channel. (Source: FWC)

Essential Habitat - any land or water area constituting elements necessary to the survival and recovery of the manatee population from endangered status, which may require special management considerations and protective measures. The constituent elements include, but are not limited to: space for individual and population growth and for normal behavior; available food sources with adequate water depth and quality; warm and fresh water sources; sites for breeding and rearing of offspring; and habitats protected from disturbances that are representative of the geographical and seasonal distribution of the species. Essential Habitat is a criterion for determining areas where marine-related facilities should be limited. (Source: Broward County 1997 Comprehensive Plan and FWC)

Existing Boat/Marine Facility - a boat facility with more than 5 slips, that is permitted and/or authorized, constructed and in operation as of the effective date of this plan. Only property owned by the facility as of the effective date of this plan will be considered "existing" in the definition of an expanding marina. Permits and authorizations must be in place from federal, state and local permitting agencies. Facilities permitted but not yet constructed are also considered existing. This definition does not include unauthorized structures. (Source: FWC)

Idle Speed Zone - a speed regulated area in which vessels create no wake and are not permitted to proceed at a speed greater than that necessary to maintain steerageway of the vessel. [While operating in an idle speed zone, all vessel operators shall exercise a high degree of care for manatee presence.] (Source: Broward County 1997 Comprehensive Plan)

Lane - part of a boat ramp that allows for the launching and landing of one boat at a time. A boat ramp can have more than one lane. (Source: Sarasota MPP)

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Lift-On/Lift-Off (Lo/Lo) - containers and cargo lifted on and off transport ships by cranes. (Source: Broward County 1997 Comprehensive Plan)

Linear Shoreline - the mean high water line in tidally influenced areas and the ordinary high water line along waterways that are not tidally influenced. This definition shall not apply to shorelines artificially created through dredge and fill activities (such as boat basins or canals) after October 24, 1989. Such artificially created shorelines created before October 24, 1989 must have received the proper permitting authorization required at that time. Shoreline along man-made ditches (such as mosquito control, flood control ditches, etc.) shall not qualify as linear shoreline, regardless of their date of construction unless there is documentation of regular navigation use existing prior to July 1, 2004. Linear shoreline shall be calculated using survey quality aerial photographs or by accurate field survey. The calculation of linear shoreline is based upon shoreline that is owned or legally controlled by the applicant. (Source: FWC)

Mooring - a location where one vessel is typically stored or accommodated when not in use. Types of moorings include anchorages, beached or blocked, dry stack, hoist, ramp, seawall, trailer, floating platforms, davits, boat lifts, or wet slip. (Source: Sarasota MPP)

Multi-slip Docking Facility - any dock that includes five or more boat slips. (Source: FWC; note that the Broward County 1997 Comprehensive Plan defined a multi-slip dock as having "more than one boat slip") *Note: The University of Miami Multi-Slip Docking Facility Study includes facilities with 10 or more slips, based on the information available in the Broward County Property Appraiser's Database.*

Permanent Use - commercial, residential or private boat facilities that include wet or dry slips, moorings or spaces for the storage of vessels. (Source: FWC)

Port Uses - freight terminals or berthing for large vessels (>100'), including ancillary vessels required for Port operations. (Source: FWC)

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Powerboat - a vehicle designed for operation as a watercraft propelled primarily by motor, (one or more electric or internal combustion engine(s). Vessels that have two main propulsion systems (power and sail) shall be defined as powerboats. (Source: FWC)

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Refuge - a manatee protection areas in which the U.S. Fish and Wildlife Service has determined that certain waterborne activities would result in the taking of one or more manatees, or that certain waterborne activities must be restricted to prevent the taking of one or more manatees, including but not limited to taking by harassment. (Source: Broward County 1997 Comprehensive Plan and FWC)

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Residential Docking Facilities - docks and wet slips provided for the sole use of the residents of a residential land use/development adjacent to a coastal water body. These facilities may be for single family or multi-family use. (Source: Broward County 1997 Comprehensive Plan)

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Restricted – the number and type of slips allowed at an existing boat facility is unrestricted (unless required by existing zoning or environmental regulations), and the number and type of slips allowed at a new facility must not exceed 1:100. (Source: FWC)

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Deleted: Density limit does not apply to single-family residences

Roll-On/Roll-Off (Ro/Ro) containers and cargo rolled or driven on and off transport ships. (Source: Broward County 1997 Comprehensive Plan)

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Sanctuary - a manatee protection area in which the U.S. Fish and Wildlife Service has determined that any waterborne activity would result in the taking of one or more manatees, including but not limited to taking by harassment. Sanctuaries are areas reserved exclusively for manatees, where they may conduct activities such as breeding, nursing, and resting, free from any harassment by humans. (Source: Broward County 1997 Comprehensive Plan and FWC)

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Single Family Dock - a fixed or floating structure, including moorings, used for berthing buoyant vessels, accessory to a detached single-family residence. (Sarasota MPP)

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Single Family Residence - a building having a roof and outer walls entirely separated from any other structure by space, and occupied by members of a single family. (Source: Broward County 1997 Comprehensive Plan and FWC)

Slip - a space designed for the mooring or storage of a single watercraft, which includes wet or dry slips, anchorage, beached or blocked, hoist, seawall, floating platforms, davits, boat lifts, or the number of parking spaces for boat ramps. Piers authorized only for fishing or observation are not considered wet slips. (Source: FWC)

Slow Speed Zone - a speed regulated area in which vessels are completely off plane and proceeding with minimum wake. Slow speed also means no speed greater than that which is reasonable and prudent to avoid either intentionally or negligently annoying, molesting, harassing, disturbing, colliding with, injuring, or harming manatees. (Source: Broward County 199[illegible]omprehensive Plan)

Submerged Aquatic Vegetation (SAV) - fresh, saline (seagrass) or brackish submerged vegetation that may be used by manatees for food. (Source: FWC)

Transitory Uses - boat ramps or boat facilities with docking for transitory or temporary uses (generally less than one day), including water dependent public transportation, boat rental, restaurant and hotel docks, or docks [illegible]arious v[illegible]els. (Source[illegible]WC)

Travel Corridor - a waterway through which manatees travel, either daily or seasonally, in order to reach feeding areas, sources of fresh or warm water, or other Essential Habitat areas. (Source: Broward County 1997 Compr[illegible]nsive P[illegible]n and FWC)

Unrestricted - the number and type of slips allowed at any type of boat facility is unlimited, unless required by existing zoning or environmental regulations. (Source: FWC)

Warm Water Refuge - a natural or man-made warm water habitat, which maintains a temperature equal to or greater than the minimum for manatees' survival (approximately 20^{o} C or 68 ^{o} F). (Source: Broward County 1997 Comprehensive Plan)

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Water-dependent Uses - those uses whose primary function is derived by direct water access such as, but not limited to all boat facilities, boat ramps, charter fishing, touring and diving boat piers, temporary mooring for restaurants, hotels and boat ramps. (Source: FWC)

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Note: This draft document is a working document to be modified as appropriate by Broward County and Florida Fish and Wildlife Conservation Commission (FWC) in an effort to move toward a final county manatee protection plan. It is not a final version; it provides a starting point to be refined cooperatively between Broward County and FWC with input from the United States Fish and Wildlife Service.

I. INTRODUCTION

A. Boat Facility Siting Plan

A boat facility siting plan is a Commission-approved, county-wide plan for the development of boat facilities, including docks, piers, dry storage areas, marinas and boat ramps. The plan specifies preferred locations for boat facility development based on an evaluation of natural resources, manatee protection needs, and recreation and economic demands.

The boat facility siting plan is one component of the Manatee Protection Plan (MPP). It should include, but is not limited to, the following:

- An inventory of existing boat facilities and natural resources
- An evaluation of boat use and traffic patterns
- Criteria on which proposed sites will be screened
- A list and map of preferred locations, unacceptable locations, and locations which are acceptable with specific conditions
- Appropriate dock densities
- Boat facility siting policies including a policy for the expansion of existing boat facilities.

While the main goal of the resulting boat facility siting criteria is to minimize the amount of interaction between manatees and boats, there is a need to balance recreational and economic uses of waterways with manatee protection. Part of this goal is also to evaluate impacts of boat facility developments on manatee habitats (FWC, 2000).

Broward County is a difficult County for developing a BFSP because we have two power plants whose hot water effluents attract numerous manatees in the winter, narrow waterways and a large boat population. Unfortunately, even with many speed limited areas, we have slowly increasing manatee mortality. This plan has attempted to protect the endangered Florida manatee while recognizing the value of recreational boating and economic benefit of the marine industry in Broward County.

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Broward's BFSP recommendations will not be applied retroactively. In other words, if a boat facility with more than five slips has been permitted and/or authorized, constructed and in operation as of the effective date of this plan, it will be grandfathered in and not subject to the screening process. Further, only property owned by the facility as of the effective date of this plan will be considered "existing" in the definition of an expanding marina. Permits and authorizations must be in place from federal, state and local permitting agencies. Facilities permitted but not constructed are also considered existing for purposes of this plan.

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B. General Setting

Located in South Florida's Gold Coast region with the Atlantic Ocean to the east, Broward County (2000 population, 1.6 million) lies between Palm Beach County to the north and Miami-Dade County to the south. Hendry and Collier counties are to the west. Encompassing 1,197 square miles, Broward County contains 787 square miles (two-thirds of the entire area) in the western portion consisting of water conservation areas and parts of both the Miccosukee Indian Reservation (reaching into Miami-Dade) and the Big Cypress Seminole Indian Reservation (extending into Hendry County). The 410-square-mile developed area to the east includes the City of Fort Lauderdale, not only the county seat, but also the most populous of Broward's 30 municipalities (**Figure 1**), and a popular tourist destination. The ecological, aesthetic, and economic importance of Fort Lauderdale's New River System is evidenced by the city's distinction as both the "Venice of America" and the "Yachting Capital of the World."

It should be noted that Broward County does not have an abundance of undeveloped waterfront or shoreline property available for future development and is considered nearly built-out relative to boat facility siting. It is recognized that new facilities are likely to be conversions of some sort (i.e., existing

property to multifamily residential, dry stack conversion, or the redevelopment of commercial facilities to accommodate larger vessels, often by reducing the number of slips at a site). In addition to conversions of existing waterfront, other marine-related development may encompass shoreline properties that are not dependent upon water. In general, however, redevelopment will most likely be the predominant activity for marine development.

There is a conflict of use between growing human-related pressures and increasingly limited coastal resources. As population increases, there may also be an increase in boat traffic, although it is unclear at what point a saturation level will be reached. The adverse impact of watercraft on manatees is well documented. It has been demonstrated that the vast majority of adult manatees throughout Florida have scars that are representative of either single or repeated collisions with watercraft (Reynolds and Gluckman, 1988). In addition, a correlation between the number of registered vessels in Florida and the number of watercraft-related manatee mortalities has been shown to be statistically significant (Wright *et al.*, 1995).

This document presents the background information and an inventory of existing conditions needed for the preparation of a Boat Facility Siting Plan (BFSP), which is part of the Broward County Manatee Protection Plan (MPP). A Manatee Protection Plan is a federal- and state-approved summary of manatee data, strategies, and management actions aimed at protecting manatees in a specific area or county, including the 13 "key" counties described later in this document. Such a plan consists of three components: Boating Safety, Education and Awareness, and Boat Facility Siting. MPPs are important for the long-range planning needed to ensure the survival of the manatee in the rapidly growing State of Florida. The Boat Facility Siting Plan component provides countywide guidance for future construction, development, or expansion of boat facilities. Such a plan specifies the appropriateness of locations for boating-related facility development based upon an evaluation of potential natural resource impacts, manatee protection needs, zoning, and future land use compatibility.

C. Broward County Waterways

1. Introduction

To protect manatees and their habitats and to provide sufficient recreational opportunities for the county's population, a review of county waterways is essential. With more than 266 miles of fresh and estuarine waterways and thousands of lakes, Broward County has an abundance of surface waters used by residents and visitors and by the fish and wildlife that depend on these waters for survival. Although there are a few natural, freshwater ponds and remnant channelized rivers, such as the Middle and New Rivers, most of the waterways in Broward are man-made canals and storm water management lakes. The basic canal network throughout the county was constructed in the early 1900s for flood control and drainage to facilitate land development. Today, seven primary canals and numerous secondary and tertiary canals provide water-supply and flood protection. Coastal waterways, such as the Intracoastal Waterway (ICW) and other tidally influenced water bodies, are brackish (a mixture of salt and fresh water) (Broward County, 2004). A more detailed analysis of Broward County's waterways is presented below.

2. The System of Waterways

Based on the various data gathering methods used for manatee analysis, three waterways were identified as primary travel corridors for manatees in Broward County – the New River System, the Dania Cut-Off Canal, and the Intracoastal Waterway (ICW). These and other referenced Broward County waterways are shown in **Figure 2**. Access is gained through the Hillsboro and Port Everglades inlets along the Atlantic Ocean and from adjacent counties via the ICW. In 1993, state manatee protection speed zones were adopted county-wide. Year-round manatee protection speed zones were adopted for the New River System. Also included were speed restrictions for the Dania Cut-Off Canal and the ICW, as well as the Middle River, C-10 Canal, Cypress Creek Canal, the Stranahan River, and the Hillsboro Inlet (Comp Plan, Vol. 4 Support Documents, p. 13-92). Each of these waterways is described in detail below. Speed zone information can be found under III. Boating Activity in Broward County, D. Speed Zones.

The New River System is composed of the New River from the ICW, west to the fork in the river at Downtown Fort Lauderdale. The South Fork New River continues south and west to the saltwater barrier at US 441 (State Road 7). The North New River Canal runs from the South Fork New River west to salinity barrier, and the North Fork New River runs from confluence with the South Fork New River north and west to the salinity control structure west of NW 31st Avenue.

As a remnant of the Everglades, the New River provides an oasis of habitat in an otherwise urbanized environment. The New River, including its North and South Forks, is characterized by parks, condominiums and other residences, boating-related facilities, and a riverwalk that includes Las Olas Riverfront, an area with upscale shops, movie theatres, and the Broward Center for the Performing Arts with nearby Museum of Discovery and Science. The natural ecosystem includes cypress and mangrove wetlands, including such natural areas as Pond Apple Slough and the Secret Woods Nature Center along the South Fork.

The **North Fork** is a shallow tributary of the New River that meanders through the northwest section of the City of Fort Lauderdale and unincorporated Broward County. For purposes of this study, the boundary of the North Fork New River is the salinity control structure located at Sunrise Boulevard just west of NW 31st Avenue. Land use is mixed with single- and multi-family residential, commercial, industrial, and parks. The **South Fork** consists of the North New River Canal and the C-11 Canal, two freshwater drainage tributaries that join and converge with the North Fork. East of the S-13 structure, tidewaters split into the South Fork and the **Dania Cut-Off Canal**. The Dania Cut-Off flows west from the ICW just south of Port Everglades. The **C-10 Canal** connects to the Dania Cut-Off Canal and flows south through Hollywood.

The **Stranahan River** is approximately a mile long stretch of ICW that connects to the New River from the west. The waterway includes the canal system of Rio Vista Development east of Cordova Road and the canal and associated boat basin south of Southeast 15th Street (Broward County Speed Zones).

The Las Olas canal system is composed of manmade islands along Las Olas Boulevard in east-central Fort Lauderdale that provides a transition area between the New River and the Middle River on the Intracoastal Waterway.

The **ICW** receives the flow from all tributaries and basins described above. The outflow is combined with tidal waters and then discharged through Port Everglades Inlet to the Atlantic Ocean. The Middle River, Cypress Creek Canal, and other drainage canals also flow into the ICW. In Broward, as in the upper reaches of Miami-Dade County, the ICW is a narrow, dredged channel approximately 80 percent of which is enclosed by bulkheads or seawalls (Carson & Ackerman 2004, p. 3). The waterway,

averaging 90 meters wide and 3.3 meters deep, is characterized by shoreline areas used for commercial, single- and multi-family residential housing, and marina, park, and conservation uses. Remaining undeveloped areas are rare, and those that exist are predominately designated conservation or recreation land use.

Deleted: Boating safety slow and idle speed restrictions exist throughout the ICW within the City of Fort Lauderdale and at 11 bridge crossings in several jurisdictions.

Port Everglades Inlet on the southeast coast of Florida serves as a primary access to the sea with Bakers Haulover about 15 miles to the south and Hillsboro Inlet about 10 miles to the north. Originally known as Lake Mabel, the port was formally dedicated in 1928 with the opening of an inlet to the sea (Broward County, 2000).

Hillsboro Inlet in the northern reaches of Broward County links to Lake Santa Barbara (formerly Lettuce Lake), which lies east of Federal Highway and south of Atlantic Boulevard in southeast Pompano Beach. The Pompano and Cypress Creek canals drain into Lake Santa Barbara, then to the ICW. Hillsboro Inlet can be treacherous depending on weather conditions; local knowledge is advised.

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II. MANATEES IN BROWARD COUNTY

A. Introduction and Background

The Florida manatee (*Trichechus manatus latirostris*) is a distinct subspecies of the West Indian manatee (*Trichechus manatus*) and is listed as endangered throughout its range. Manatees (Order Sirenia) evolved from land mammals more than 60 million years ago, and a fossil record extends back approximately 45-million-years. While information on manatees prior to the first half of the 20th Century is limited, it is known that these marine mammals were hunted in Florida as early as the Paleo-Indian period (8500-6000 B.C). This time period coincides with the earliest known occupation of Florida by aboriginal Indians (Reynolds and Odell, 1991). Historic records suggest the routine hunting of manatees in Florida by both Indians and settlers in the 1800's.

Florida represents the northern limit of their typical geographic range, though some individuals have been known to occasionally travel farther north along the eastern seaboard and west along the Gulf of Mexico states (USFWS, 2001). They can be found in riverine (fresh), estuarine (brackish), and coastal

(marine) environments in the southeastern United States. These areas include many habitat types, including vegetated freshwater bottoms, coastal marshes, seagrass meadows, tidal creeks, and man-made canals. In addition, manatees also utilize natural springs and artificial warm-water sites, such as power plants, for warmth; quiet, secluded tributaries and creeks for resting, calving, and nurturing their young; and open waterways and deep channels, including man-made dredged canals, as travel corridors (USFWS, 2001). **Figure 3** shows essential manatee habitats. In summary, while manatees tend to have preferred areas and aggregation sites, they can be found in a wide variety of coastal habitats.

Protection of manatees in Florida began in the late 1800's, and the State of Florida passed legislation prohibiting the hunting and killing of manatees in 1893. Florida remains one of the fastest growing states in the nation. The human population has grown from 6.8 million to 15.7 million residents since 1970, and is expected to exceed 18 million by 2010 and 20 million by 2015 (U.S. Census Bureau). This has resulted in a conflict of use between growing human-related pressures and increasingly limited coastal resources. Along with population increases, there will be an increase in boat traffic as coastal areas become increasingly crowded, although data in Broward County comparing growth of boating with population increases shows minimal boater growth (6%) in spite of large population increases (20%) from 1995 to 2000. The cumulative effects from both natural and human-related mortalities, combined with habitat loss and low reproductive rate, continue to jeopardize the long-term existence of the Florida manatee population along with other natural resources.

Because of increased incidental take by a continually increasing human population, Florida manatees are now protected by several forms of legislation, including the Marine Mammal Protection Act of 1972 (amended in 1996), the Endangered Species Act of 1973, and the Florida Manatee Sanctuary Act of 1978. As a result of concerns over the long term sustainability of the species, the U.S. Fish and Wildlife Service also developed a Manatee Recovery Plan in 1989. The objective of the Manatee Recovery Plan is the downlisting and ultimate delisting of the Florida manatee from its endangered status. This plan was revised in 1996 and again in 2001 (USFWS, 1996 and 2001). In conjunction with the Manatee Recovery Plan, the State of Florida identified thirteen "key counties" with significant manatee populations (Broward, Brevard, Citrus, Collier, Miami-Dade, Duval, Indian River, Lee, Martin, Palm Beach, Sarasota, St. Lucie, and Volusia). The Florida Governor and Cabinet directed these counties to

develop a comprehensive Manatee Protection Plan (MPP) in order to minimize human-related threats to the species.

B. Population Status

Long-term studies suggest four relatively distinct regional subpopulations of the Florida manatee: Northwest, Southwest, Atlantic (including the St. Johns River north of Palatka), and St. Johns River (south of Palatka). These divisions are based primarily on documented manatee use of wintering sites and from radio-tracking studies of individuals' movements. Although some movement occurs among subpopulations, researchers found that analysis of manatee status on a regional level provided insights into important factors related to manatee recovery. The following is from the Population Status Working Group Statement in 2001 (Florida Manatee Recovery Plan, Appendix D) regarding the Atlantic coast subpopulation:

> "Scientists are concerned that the adult survival rate (the percentage of adults that survives from one year to the next) is lower than what is needed for sustained population growth. The population on this coast appears to have been growing slowly in the 1980s but now may have leveled off, or could even be declining. In other words, its too close to call. This finding is consistent with the high level of human-related and, in some years, cold-related mortality in the region…..In order to assure high adult survival the group emphasizes the urgent need to make significant headway in reducing the number of human-related manatee deaths."

A Biological Status Review of the Florida manatee was finalized in December 2002 by FWC's Florida Marine Research Institute. This review states that, statewide, the rate of increase in watercraft-related manatee deaths over the past decade (expressed as annual percentage increase) exceeds estimates of population growth rate. In addition, it also states that it is likely that there will be a 50% decline in the Florida manatee population within the next 45 years (Biological Status Review, 2002).

C. Review of Available Scientific Data from Broward County

Scientific data on manatees in Broward County are available from a variety of sources. Information on the distribution of manatees throughout the County is available from a series of aerial survey projects which were conducted by Broward County in 1991-92 and by the Florida Department of Natural

Resources (FDNR) in 1988-90 (the Florida Department of Natural Resources was renamed the Florida Fish and Wildlife Conservation Commission in 1999). Additional aerial survey information on winter season distribution is also available from a series of statewide manatee synoptic surveys that are managed by the State of Florida and from aerial surveys funded by Florida Power and Light Company (FPL). Synoptic survey data from Broward County extends back to 1991, while FPL surveys in proximity to Broward County power plants have also been conducted annually since 1977 (Reynolds, 2004). These studies provide a long term database of information on manatee abundance and trends in the Broward County area. Radio and satellite telemetry data from tagged manatees utilizing Broward County waters are also available from the U.S. Geological Survey Sirenia Project (Deutsch, 2001). Finally, a database of information on manatee mortality extends back to 1974. These data sets are reviewed and discussed separately below.

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D. Aerial Surveys

1. Aerial Surveys – Distributional Surveys

Low-level aerial surveys are generally accepted as the most effective method for collecting information on manatee distribution, and are typically used to determine minimum estimates of the manatee population size (Ackerman, 1995). Survey techniques typically follow methods described by Irvine *et al*., (1982) and Packard *et al*., (1989), and involve the flying of a standard flight path, with repeated circles over areas where manatees are sighted. Surveys typically utilize a fixed wing aircraft at a speed of approximately 90 knots and at an altitude of 500 feet (152m) or a helicopter at a similar altitude. Survey frequency is usually a function of the level of funding support, however monthly or twice-monthly surveys are most common.

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Two aerial survey datasets from Broward County are available for review. The first series of surveys was conducted by the FDNR between 1988 and 1990 (a total of 48 flights). A second series of surveys was conducted by Broward County staff between 1991 and 1992 (a total of 12 flights). The 1991-92 surveys included the major tributaries, including the New River, while the 1988-90 surveys were limited to the ICW. FDNR surveys were routinely conducted twice-monthly. Broward County surveys essentially focused on winter months. However, limited surveys were also conducted between April and October to identify an "off season" manatee population to validate the need for year-round speed zones

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for manatee protection in waterways west of the ICW. The majority of areas surveyed have boating safety speed zones but not for manatee protection (Don Stone, Broward County, personal communication). The flight path for FDNR aerial flights is shown in **Figure 4**.

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A composite of aerial survey data from FDNR flights conducted between 1988 and 1990 is provided in **Figure 5**. These surveys documented the presence of manatees along the entire length of the ICW in Broward County, with higher concentrations in proximity to both tidal inlets, and near the FPL Port Everglades Power Plant. Similar results are shown in **Figure 6** for Broward County flights conducted between 1991 and 1992. Because 1991-92 Broward County surveys extended farther west along the New River System, additional sighting data is also available for both the New River and the FPL Lauderdale Power Plant, indicating that these are high-use areas for manatees as well.

Aerial survey data also suggests a strong seasonal component to habitat use by manatees in Broward County. A summary of monthly aerial survey data for 1988-90 FDNR survey flights is shown in **Figure 7.** While manatees occur in Broward County year-round, significantly greater numbers of animals occupy County waters during the winter months, with an average of more than 100 animals observed per survey flight during the months of December, January, and February. Broward County had fewer than 20 manatees per month as observed from April to November during the aerial surveys of 1988-90. Seasonal differences in manatee counts were also determined to be statistically significant (Carson and Ackerman, 2004).

Aerial survey results from Broward County should be approached with some caution. While data collected to date provides documentation of manatee use along the ICW, tidal inlets, and warm water refugia, it does not provide enough adequate information to assess manatee use in numerous other areas. The distribution of manatees as determined by aerial surveys is largely a function of survey effort. Many significant waterways in Broward County, including Cypress Creek and Canal, Pompano Canal, Middle River, and the upper portions of the New River and Dania Cut-off Canal, were either not surveyed or the survey effort was limited. As a result, the use (or lack of use) of some of these waterways by manatees cannot be determined based solely upon available aerial survey data. While aerial surveys have been used extensively to count and map manatee distribution, they are somewhat limited by the fact that manatees are difficult to detect and count accurately and are assumed to be an

underestimate of the actual population size (Lefebvre *et al*., 1995). In Broward County, this is complicated by the fact that the only available comprehensive aerial survey data are more than ten years old. However, ongoing synoptic and power plant surveys (discussed below) indicate that these older datasets, at least in areas where flight paths overlap, seem reasonably accurate. To restate this point, there have been aerial synoptic surveys done from flying craft but not with regularity or comprehensively. The flyover surveys were done with regularity for more than a year, and other surveys were done at irregular intervals from the air. New surveys currently underway by the Broward County Environmental Protection Department (EPD) will provide additional information which will better characterize the use of Broward County waterways by manatees. Preliminary observations show similar seasonal trends, characterized by low manatee use during non-winter season.

Because the waterways in Broward County are relatively narrow and restrictive, there are a limited number of possible travel corridors from which animals can migrate to or from their preferred sites. Aerial survey data (including synoptic survey data) suggest that the New River and the ICW serve as important migratory corridors for mana tees. Manatees also appear to utilize the Atlantic Ocean; however, siting frequency is much lower than in the ICW.

2. Aerial Surveys - Synoptic Surveys

Statewide aerial synoptic manatee surveys are flown following significant cold fronts, when manatees aggregate near established warm-water refuge sites. Surveys are conducted by an interagency team coordinated by the Florida Wildlife Conservation (FWC) and are useful in determining minimum population estimates (Ackerman, 1991). Synoptic surveys have been flown since 1991 with the exception of 1993 and 1994. The frequency of surveys varies from year to year depending upon the number of cold fronts in a given year.

Synoptic survey data from Broward County consistently show large aggregations of manatees at both the FPL Lauderdale Power Plant and the Port Everglades Power Plant. Surveys also show frequent manatee use of the ICW and lower portion of the New River. Because synoptic surveys are flown under varying weather and sighting conditions, results typically vary from year to year. Synoptic surveys flown following severe cold fronts show high concentrations of manatees that are essentially limited to the thermally enhanced areas near the power plants. When synoptic surveys are flown during more mild

cold fronts, manatee distribution tends to be more widespread, and more sightings occur along the ICW and in proximity to tidal inlets. A summary of synoptic survey data is provided in **Figure 8**.

In general, manatee data from synoptic surveys are consistent with aerial distributional survey data, and indicate that the areas of significant recurrent use in Broward County tend to be in proximity to warm water refugia and along the entire ICW corridor during the months of December, January, and February. As is the case with aerial distribution surveys however, the spatial distribution of manatees is largely a function of the survey flight path, resulting in numerous areas in Broward County for which there is no available survey data.

3. Aerial Surveys – FPL Power Plant Surveys

Manatees are unable to tolerate water temperatures below approximately 68°F (20°C) for extended periods of time. During winter months, they seek out both natural and man-made warm water refugia in places such as natural warm water springs and discharge canals near power generating plants. Among the most important artificial warm water sites in Florida are Florida Power & Light Company's (FPL) Cape Canaveral, Fort Lauderdale, Port Everglades, Riviera, and Fort Myers power plants, and the Tampa Electric Company's Apollo Beach power plant (Reynolds and Odell, 1991). Many manatees return to the same refuges each year, though some use different refuges in different years.

Aerial surveys of manatees at FPL power plants, including Broward County's Fort Lauderdale and Port Everglades Power Plants, have been conducted annually since 1977 (Reynolds, 2004). A summary of survey data from both Broward County power plants is provided in **Figure 9**. Survey results indicate that overall use of these power plants by manatees has increased, although there is a high level of variability in use from year to year. This variability may be due to a combination of factors. Since the aggregation of manatees at warm water sites is a response to cold weather, the number of manatees at power plants will vary depending upon the severity of the cold weather, which differs from year to year. In 2002-03, for example, high counts of manatees at both Broward County plants (265 animals observed at the Port Everglades Power Plant and 173 animals observed at the Lauderdale Power Plant) corresponded to an exceptionally cold winter. The following year (2003-04), survey counts were relatively low (155 animals observed at the Port Everglades Power Plant and 64 animals at the Lauderdale Power Plant) during a somewhat mild winter (Reynolds, 2004). The highest one-day census

of the two Broward power plants counted 346 manatees in 2001-02. For the most recent series of FPL surveys (Reynolds, 2004), calves comprised 6.7% of all animals sighted at all FPL power plants, with higher percentages found at both the Port Everglades Power Plant (9.0%) and the Fort Lauderdale Power Plant (8.2%).

Additional variation in counts from year to year can also be attributed to variations in the level of operation of individual plants. Since manatees are known to routinely travel between power plants (Deutsch, 2000), their preference for a specific power plant discharge may change from year to year. In some cases, a power plant may temporarily go offline with little or no warm water output, resulting in a "shift" in winter distribution through time. Such a shift occurred in 2003 when the FPL Riviera Beach Power Plant temporarily went offline, resulting in an increased number of manatees observed at the FPL Fort Lauderdale and Port Everglades Power Plants. Variations in abundance of manatees among different Florida east coast power plants is shown in **Figure 10**. Over the past ten years, manatee sightings at Broward County power plants have comprised 30% of all east coast FPL survey sightings. Differences in survey counts may also be attributed to other factors. The effectiveness of aerial surveys is highly dependent upon survey conditions, including weather conditions, water surface conditions, and water clarity. Additional variability has also been introduced due to recently-added security measures, which, at times, have limited the ability to effectively conduct surveys in proximity to power plants.

While survey counts demonstrate a high level of variability from year to year, both FPL power plants in Broward County show an apparent trend toward increasing numbers of manatees through time. This may be indicative of an overall trend along the Florida east coast (Reynolds, 2004). Analysis of east coast power plants suggests that the east coast manatee population increased during the 1980's, then stabilized or slightly decreased in the early 1990's. Aerial survey data analyzed through 1997-98 suggests that the east coast manatee population remains relatively stable, with perhaps a slight increase or decrease since the mid 1990's (Craig and Reynolds, 2000). In summary, FPL aerial survey data indicates that power plants in Broward County provide refuge for a significant proportion of the east coast manatee population, and the level of use at these power plants, though highly variable, appears to have increased over the past two decades.

4. Broward County Aerial Surveys - 2004

Because there has been little manatee aerial survey data collected in more than a decade, the non-winter distribution of manatees in Broward County remains unclear. Recently, the Broward County EPD began conducting aerial distributional surveys to determine the current seasonal distribution and relative abundance of manatees. Flights are scheduled twice monthly along a desired flight path as permitted due to clearance at Fort Lauderdale-Hollywood International Airport. Unlike previous aerial surveys conducted in Broward County, the flight path includes areas not previously surveyed extensively. These areas include both the north and south forks of the New River, the Dania Cut-off Canal, Hillsboro Canal, and Middle River. Actual flight paths are recorded along with notes describing each survey conducted. These new aerial surveys will provide additional insight on both spatial distributions of manatees in the county, along with temporal (seasonal) variations in animal abundance. This information may serve to enhance boat facility siting, along with providing useful information relevant to speed zones and protection areas. Data collection is currently underway, and final results are not yet available. However, information to date confirms that manatee use of Broward County waters is limited during the non-winter season.

E. Telemetry Studies

While aerial surveys are the most common method of characterizing manatee population abundance and distribution, they are somewhat limited by the fact that they only provide the location (or "snapshot") of individuals at a particular moment in time. Little can be interpreted from aerial surveys regarding site fidelity, movement patterns, travel corridors, habitat use, migratory ranges, or other behavioral information. For this reason, other techniques such as tagging and tracking/monitoring (telemetry) studies are employed. In Broward County in particular, telemetry data provides important supplemental information on manatee distribution because previous aerial surveys were not inclusive of many major waterways.

Between 1986 and 1998, a comprehensive research project examining manatee migratory patterns and site fidelity along the Florida east coast was coordinated by The U.S. Geological Survey Sirenia Project (Deutsch *et al*., 2003). During this study, 78 manatees were radio-tagged and monitored. Most of the 78 study animals were tracked remotely with the Argos satellite system and all were regularly tracked in the field using conventional radio telemetry methods. The combined effort yielded more than 93,000 locations ("hits") over 32,000 tag-days. The median duration of tracking was 8.3 months per individual;

however, some individuals were tracked for several years. Surveys included 46 adult females, 21 adult males, 5 sub-adult females, and 6 sub-adult males; 4 of the sub-adults were tagged as large dependent calves, and then tracked after weaning. Sixty-five of these were tagged in the wild and 13 individuals (11 adults and 1 mother-calf pair) had been rescued and rehabilitated in oceanaria for short periods and then radio-tagged at release. Sixty-three manatees were tracked with satellite-monitored platform transmitter terminal (PTT) tags and 15 others carried only field-monitored VHF tags. Manatees carrying VHF tags were located an average of 3 days per week, and those with PTT tags were located in the field once per week, on average. More than 1,000 sightings of tagged manatees by the public were confirmed according to individual animals. This information was used to supplement field observations (Deutsch *et al*., 2003).

A composite map of all radio-tagged manatees within Broward County is provided in **Figure 11**. Most frequent locations of tagged animals were in proximity to both Broward County power plants. A large number of sightings (represented by a single animal over multiple years) were also observed along the north fork of the New River. Telemetry data suggests that manatee use is county-wide, with documented sightings along most major waterways (the ICW, New River, Dania Cutoff Canal, Stranahan River, and C-10 Canal. Only a limited number of sightings were documented in the Middle River, Cypress Creek, and Pompano Canal. The ICW along the entire east coast was determined to be a migratory corridor for manatees (Deutsch, 2003). This finding is reinforced by numerous sightings of animals in the ICW during aerial and synoptic surveys.

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For tagged manatee TBCO9 ("C-Cow"), its migratory range essentially includes the entire Florida east coast, though it has repeatedly returned to Broward County in the winter over at least an eight-year period (**Figures 12 and Figure 12A**). In addition, offspring of this animal also exhibited the same migratory patterns, indicating natal philopatry. Sightings of tagged manatee TPEO1 ("Spot") also indicate seasonal (winter) use at the Port Everglades Power Plant and C-10 Canal, and documented movement along the ICW (**Figure 13**). This animal used the Port Everglades Power Plant effluent over six consecutive winters (Deutsch *et al*., 2003). TBCO3 ("Moon") showed strong fidelity to the Port Everglades Power Plant effluent canal, visiting the site over eight consecutive years (**Figure 14**). Similar results were found for other tagged manatees and demonstrate recurrent use in Broward County over multiple years, along with winter site fidelity at one or both Broward County power plants.

Telemetry data also emphasizes the importance of travel corridors in Broward County. While sightings within the ICW are less frequent, this is likely due to the fact that manatees use the waterway to travel to and from their preferred destinations while not remaining in the waterway for a significant period of time. This is also supported by other datasets, particularly aerial and synoptic survey data which documented numerous sightings of animals within the ICW.

In summary, telemetry data has been useful for characterizing manatee movements in Broward County in a number of ways. First, these data support and confirm other datasets by further documenting seasonal use by manatees at both the Fort Lauderdale and Port Everglades Power Plants. Secondly, the data serves to document manatee use in areas not previously surveyed. Finally, telemetry studies provide evidence of site fidelity with a number of animals returning to the same sites each year.

F. Manatee Habitat

1. Power Plants and Warm Water Refugia

Two significant primary warm water refuges for manatees (The FPL Lauderdale and FPL Port Everglades Power Plants) are located in Broward County. While these are artificial warm water sources, manatees are both habituated and dependent upon their existence, and they have been determined to be among the most important manatee aggregation sites not only in Broward County, but also in Florida (Reynolds, 2004).

The Lauderdale Power Plant was the first FPL plant in Florida, and began operating in 1926. The plant was repowered in 1993, changing its primary fuel source from oil to natural gas. Repowering is expected to extend the life span of the plant to approximately thirty years. Currently, there are two power generating units with a generating capacity of 930 megawatts. The once-through cooling process utilizes a maximum water flow of approximately 345 million gallons of water per day. Intake water is drawn from the nearby Dania Cutoff Canal and Biscayne Aquifer. The discharge canal includes approximately 200 acres of cooling lakes (Mezich, 2001).

The Port Everglades Power Plant also has two units capable of a power generating capacity of 1200 megawatts. The once-through cooling process uses a maximum water flow of approximately 670 million gallons per day. Intake water is drawn directly from within the boat basin at Port Everglades (Slip #3). Heated water is discharged along a one mile long canal that terminates at the Intracoastal Waterway (Mezich, 2001).

The importance of these facilities as warm water refuges to manatees has been well documented (Deutsch, 2000; Mezich, 2001; and Reynolds, 2004.). Highest single day manatee counts at the Lauderdale Power Plant were 173 individuals in 2002-03. Highest single day manatee counts at the Port Everglades Power Plant were 290 individuals in 2000-01. These figures corresponded to exceptionally cold winters.

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In addition to primary warm water refugia, manatees also utilize secondary warm water sites in Miami-Dade County, including Coral Gables Waterway and Palmer Lake (Mezich, 2001). These secondary sites provide short-term relief to manatees during milder winter weather, and also enable manatees to utilize the more abundant foraging resources in Miami-Dade County, particularly in Biscayne Bay.

2. Seagrasses and Submerged Aquatic Vegetation

Manatees are herbivores that feed opportunistically on a wide variety of submerged, floating, and emergent vegetation. Because of their broad distribution and migratory patterns, Florida manatees utilize a wider diversity of food items and are possibly less specialized in their feeding strategies than manatees in tropical regions (Lefebvre *et al.*, 2000). While food preferences and feeding rates depend upon the availability of aquatic vegetation, manatees most often consume seagrasses (Etheridge *et al.*, 1985).

Among known manatee use sites in Florida, habitat, water quality, and vegetation have been found to be limiting factors. The situation is somewhat different in Broward due to the nature of the county's waterways, which are, in general, deep and channelized with hardened shoreline. Averaging approximately 3.3 meters deep and 90 meters wide, the ICW is typically an inhospitable environment for seagrasses and other submerged aquatic vegetation, though some seagrasses occur near both Hillsboro and Port Everglades Inlets in Broward County and the Boca Raton Inlet in Palm Beach County

(Carson & Ackerman, 2004). As well, recent Broward County surveys have discovered additional availability of seagrass and aquatic vegetation in a number of areas, such as the Dania Cut-off Canal, a corridor in the ICW, and points in the North Fork of the New River. Broward County also expects water quality improvements that will allow better light penetration and more widespread occurrence of seagrass. In recent history though, the majority of seagrass availability was limited within 25 km to the south and 75 km to the north of the Port Everglades Power Plant, which, as noted, was the principal winter destination for many tagged manatees in southeast Florida and one of the most heavily used manatee aggregation sites along the Atlantic coast (Reynolds and Wilcox, 1994).

While sources of food for manatees are somewhat limited in Broward County, adequate resources do exist in adjacent areas, particularly in Miami-Dade County (Mezich, 2001). Within Biscayne Bay, extensive seagrass beds comprised of turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), and shoal grass (*Halodule wrightii*) are readily available and considered to be within a relatively short distance from animals which are seeking warm water refuge in Broward County. Other freshwater foraging sites in Miami-Dade County that are considered to be utilized by manatees from Broward County include the Snapper Creek Canal, Blue Lagoon, Glide Angle Lake, Andover Lakes, and Sky Lake (Mezich, 2001). Submerged vegetation in these areas is limited to exotic freshwater vegetation, primarily *Hydrilla verticilata.* Because manatees must leave warm water sites in order to utilize these resources, it emphasizes the importance of the ICW as a travel corridor between warm water refugia in Broward County and food resources in Miami-Dade County.

3. Water Quality and Fresh Water Sources

Manatees' reliance on coastal habitats and their attraction to industrial and municipal outfalls has the potential to expose them to relatively high levels of contaminants. Water contaminants, including pesticides, herbicides, fertilizers, industrial byproducts and human sewage, may cause sub-lethal effects on manatees (Packard, 1983). All of the canals and waterways in Broward County have been designated as Class III waters by the State of Florida for recreational use and propagation of fish and wildlife. Water quality in Broward County waterways continues to improve, largely due to programs designed to alleviate urban and rural run-off, identify direct or indirect industrial discharge, and minimize the effects of contaminated seepage into groundwater.

Broward County EPD is the local environmental regulatory agency with the responsibility for protecting the quality of the county's surface water, groundwater and wetland resources. Since Broward County water resources are substantially interconnected, EPD's pollution control programs serve to protect the water quality in those sections of the county utilized by the Florida manatee.

To help focus attention and restoration efforts after water quality problems were discovered in the New River in the early 1990s, Broward County began describing the system according to four geographical sub-basins (as also used in this report) – the North Fork, the South Fork, Las Olas Isles, and the ICW [see the New River Report, Broward County Department of Natural Resources Protection (hereinafter EPD – DNRP was renamed the Department of Planning and Environmental Protection (DPEP) in 1999 and renamed Environmental Protection Department in 2004), 1993]. (DPEP, 2001, pp. 1-4.)

Upstream in the North Fork of the New River, the S-33 salinity control structure is opened only during major storms, thereby restricting natural freshwater inflow from the western C-12 drainage basin. Limited tidal flow north of Broward Boulevard is the result of debris and sediment accumulation. Continuous groundwater inflow and both point and non-point sources of storm water runoff constitute sources of water for the North Fork. Because of the high particulate load from storm water, light penetration is hindered resulting in reduced aquatic productivity and virtually destroying the ability of submerged aquatic vegetation (SAV) to survive. However, there have been anecdotal reports of SAV in the North Fork, and a dredging project to improve water quality flows in the North Fork was completed in September 2003 (Stout, personal communication).

The drainage basin of the South Fork is characterized as partially residential with a large number of commercial marine industry-related facilities, a number of which have been in business since the 1930s. Groundwater inflow and surface runoff contribute to this system with the S-13 salinity control structure regulating water levels at the east end of the C-11 Canal through the control of discharges to tide. Cooling waters discharged from the FPL Lauderdale power plant contribute additional flow to the South Fork. Seepage and releases from Water Conservation Areas 2 and 3, along with groundwater inflow from secondary canals, maintain the flows into the North New River Canal and discharge into the South Fork of the New River.

Las Olas Isles, with its large number of inhabited and semi-permanently moored vessels, has been subject to unacceptable levels of water-borne bacteria. In 1997 the City of Fort Lauderdale passed an ordinance requiring owners of habitable boats to have marine sanitation pump-out facilities installed. Compliance with the ordinance has since resulted in the decline of fecal coliform concentrations in Las Olas Isles.

All the basins and tributaries described in this report flow into the ICW and the waters are then mixed with tidal waters. Chemical contaminants from these waterways, including the Cypress Creek Canal, the Middle River, and other drainage canals, in addition to stormwater runoff, litter, and debris, constitute the primary water-quality concern.

G. Manatee Mortality Data

1. Introduction

Manatee carcasses have been routinely recovered and examined by state and federal agencies since 1974, and a Manatee Carcass Salvage Program was initiated by the State of Florida (FWC) in July 1986. In 1992, a dedicated laboratory and necropsy facility was constructed to perform post-mortem examinations. Currently staff from four field stations collect carcasses from the southeastern United States and transport them to the Marine Mammal Pathobiology Laboratory (MMPL) in St. Petersburg, Florida. The purpose of the manatee carcass retrieval program has been to determine the cause of death in order to develop possible corrective actions and to obtain information on manatee morphology and physiology to better understand the biological limitations of the species. The MMPL produces monthly and annual report summaries by county as well as overall mortality figures for the State of Florida.

2. Broward County

A total of 144 manatee deaths have been reported in Broward County between 1974 and 2003. Of these, 66 deaths were attributed to human-related causes (54 watercraft-related deaths, 6 flood gate/lock deaths, and 6 deaths from other human-related causes). While the absolute number of human-related manatee deaths in Broward County is relatively low (ranked 8th among the 13 key Florida counties; **Figure 15**), the relative proportion of deaths from human causes (47%) is relatively high (ranked 3rd

among the 13 key counties). By comparison, human-related deaths account for 35% of all manatee deaths among the 13 key Florida counties and 30% among all Florida counties combined. The counties with the highest proportion of human-related deaths are all located in southeast Florida (Miami-Dade, Martin, Broward, and Palm Beach counties). This is an indication that areas of conflict between manatees and human-related activity are particularly common in some of the most highly developed areas of the state. Statewide and countywide watercraft attributed deaths represent 2-5% of manatee in population survey counts.

A summary of manatee mortality data through time is shown in **Figures 16** and **17**. Both total mortality and watercraft-related mortality, though highly variable from year to year, show an increasing trend through time. A total of 19 watercraft-related deaths occurred in Broward County over the past 5 years (1999-2003). This exceeds the number of watercraft deaths which occurred during the previous 10 years. Similar trends are observed for other death categories as well, however, and may indicate an increase in the overall manatee population in this area, or an increase in the level of use of Broward County waters by manatees over the past decade.

Mortality data may also be used as a tool for better understanding spatial and temporal distribution of manatees. The locations of recovered carcasses in Broward County (all death categories) are shown in **Figure 18**. The distribution of recovered carcasses in Broward County is similar to the observed distribution of live animals, which confirms many of the preferred areas suggested in the aerial survey datasets. The high number of carcasses recovered in proximity to both FPL power plants again suggests that these are preferred areas for manatees. While boat survey data for Broward County is not yet available, mortality data also indicates the waterway in proximity to both Port Everglades and Hillsboro Inlets are areas of conflict between manatees and human activity due to a significant number of watercraft mortalities in these areas (**Figure 19 and Figure 20**).

Manatee calf (perinatal) mortality differed spatially. Calf mortality is less common along the presumed high boat traffic areas such as the Intracoastal Waterway and in the vicinity of tidal inlets, and is more common along the intermediate and upper portions of major tributaries and canals such as the New River and Dania Cutoff Canal (**Figure 21**). This does not necessarily suggest an area of conflict with human use; instead it suggests that the distribution of female manatees with dependent calves (cow-calf

pairs) may differ from the distribution of other manatees in Broward County, and that cows with calves are more likely to seek quiet, less disturbed areas for calving and/or nursing of young.

While more than 60 percent of all carcasses were recovered during the period between November through March, the remaining 40 percent of carcasses were recovered outside of the typical winter period when manatees frequent the warmer waters around the power plants. These data serve as an additional indication that while winter use in Broward County is well established, many animals utilize county waters year-round.

Mortality data may be used to supplement other forms of population data and assist in the determination of spatial trends. While the spatial accuracy of recovered carcasses provides limited information on the precise area where death occurred, it does provide useful information on overall use of an area by manatees. In Broward County, the location of recovered carcasses is consistent with datasets from both aerial and telemetry surveys. To date, highest numbers of carcasses have been found in proximity to warm water refugia, tidal inlets, and along the ICW.

Typically, maps displaying the spatial distribution of recovered carcasses should be approached with caution because plotted points only represent points of recovery, not necessarily points where animals expire. In Broward County, however, areas of recovery may be more spatially accurate for two reasons. First, because Broward County is highly developed, carcasses are likely to be reported relatively quickly upon initial discovery, thus reducing the recovery/response time. Second, the relatively narrow inshore waterway in Broward County probably limits the ability of a carcass to drift a significant distance in a short amount of time. This situation is in contrast to counties such as Lee County or Collier County, where carcasses in less populated areas may not be reported for several days and may drift over large expanses of coastal waterway prior to initial report and subsequent recovery.

With regard to watercraft collision, it is generally accepted that an animal may be seriously injured and succumb later to secondary complications, perhaps far removed from the initial collision site. Post-mortem examination of carcasses recovered in proximity to the tidal inlets in Broward County indicates that, in many instances, traumatic injury was so severe that the animal likely succumbed quickly (FWC manatee salvage data base; 1974-2003). This would suggest that the point of collision and the point of

recovery may be in relatively close proximity. In addition, while the spatial distribution of carcasses in other portions of the county are represented by a variety of different death categories (perinatal, cold stress, other natural, watercraft-related, undetermined), a much higher proportion of watercraft-related deaths were documented near both inlets. As a result, it may be more likely that these animals were struck in proximity to these inlets and suggests an ongoing resource conflict between human activity (boating) and manatee use in these areas. Deaths attributable to Port activities should be separated out from other boating-related deaths.

3. Summary Analysis

A review of available scientific data indicates that Broward County is utilized by a significant proportion of the Florida east coast sub-population of manatees. While evidence suggests that some manatees are found in Broward County year-round, the population is essentially seasonally migratory, with large aggregations of animals occupying two artificial warm water refugia (the FPL Lauderdale and Port Everglades Power Plants) during the coldest months of the year. This has been documented with aerial survey data (including synoptic survey data) and with telemetry data. Along with warm water sites, the migratory paths leading to and from these sites should also be considered as critical manatee habitat. Because the waterways throughout Broward County are relatively narrow and restrictive, there are a limited number of options for manatees that travel through these areas. As a result, waterways such as the New River and the ICW should also be considered as essential habitat due to the fact that they are the primary pathways to and from preferred areas in the county.

Aerial survey results (both distributional surveys and synoptic surveys) are largely a function of survey effort, and several areas in Broward County have inadequate survey data. Information on manatee use is lacking in areas such as the Middle River, Cypress Creek, and Pompano Canal. An assessment of the relative importance to manatees in these areas cannot be determined without additional information. Recreational boat traffic data is also lacking, though areas of conflict with human use have been identified based upon watercraft-related manatee mortality data. The most critical areas appear to be Hillsboro Inlet, Port Everglades Inlet, and the waterways adjacent to the FPL Port Everglades Power Plant.

There is limited available submerged vegetation in Broward County on which to feed, though the tidal inlets (Hillsboro and Port Everglades) and the upper reaches of some tributaries may provide some sources of food. More typically, manatees probably travel south to Miami-Dade County where there are significantly more resources on which to feed. Telemetry data also indicates that Broward County is an area of recurrent use, with many manatees traveling north along the Florida east coast during the warmer months of the year and returning to Broward County in subsequent winters.

Aerial synoptic survey data, along with data from FPL power plant surveys, indicate that manatee use of Broward County appears to be increasing, but that may change if port-related deaths are removed. Manatee mortality, including human-related mortality, is also increasing. Whether these trends are an indication of an increasing Florida east coast manatee population, an increasing proportion of manatees utilizing Broward County waters, increasing levels of recreational use of Broward County waters, or a combination of factors are unclear. The collection of new aerial survey data in Broward County, along with newly implemented studies of recreational boat traffic, will provide additional information on current manatee abundance and distribution, and a better understanding of the interrelationship between manatees and human activities in Broward County.

III. BOATING ACTIVITY IN BROWARD COUNTY

A. Introduction and Background

Boating is a very popular recreational activity in Broward County and more than 46,000 vessels were registered in 2003. Boats navigating Broward County waterways include local boaters, as well as boaters from international and other U.S. locations. To accommodate these boaters, a major marine industry exists in the county, representing an $8.8 billion economic impact. Boating industries provide 109,000 jobs, leading the state with a 13.5 percent growth rate. Broward County is the number one contributor of marine sales in Florida with 28 percent of all marine-related sales for an estimated 1,000 marine businesses.

B. Marine Facilities and Boat Ramps

Marine sales in Broward County in 1991 were $494,390,692. In 1996, Broward accounted for 28 percent of Florida's marine sales, Miami-Dade accounted for 10 percent and Palm Beach accounted for 6 percent. Together they accounted for 44 percent of total marine sales in Florida. The industry contributes jobs in manufacturing, wholesale trade, retail trade, dockage, and marine services (Marine Industries Association of South Florida). Marine industry trends are shown in **Table 1**.

The annual Fort Lauderdale International Boat Show has a $600 million impact and attracts 130,000 visitors, of which 11 percent are international and one-third from out-of-state. Moreover, megayachts, luxury boats measuring 80 feet or longer, have a large economic impact in the region. With 1,400 megayachts visiting South Florida annually, 1,300 rely on area boatyards for service, refit, and repair (Florida Atlantic University, 2004). In 2002, $576.3 million were spent overall on megayachts in South Florida (*Sun-Sentinel*, April 26, 2004).

Figure 22 shows marine facilities in Broward County and **Table 2 and Table 3** provide the updated listing of marine facilities and boat ramps in Broward County, together with the results of the 2003 Dry Stack Survey conducted by the Marine Industries Association of South Florida (MIASF, 2000-2004). There are a total of 96 marinas and 23 boat ramps, with concentrations of marinas at State Road 84/Marina Mile area, the Downtown New River, the ICW north of Port Everglades, and at the Dania Cut-off Canal/C-10 Canal.

1. University of Miami – Residential Multi-slip Report

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An analysis of multi-slip docking facilities was conducted to assess the status of multiple docks adjacent to water bodies located in the eastern portion of Broward County. The areas examined consist of the ICW, Dania Cut-off Canal, C-10 Canal, Middle River, North and South Forks of the New River, and the Hillsboro Canal. Multi-slip docking facilities were determined to be present on parcels of land designated as multi-family homes (both fewer than 10 units and more than 10 units), condominiums, restaurants, hotels, and motels as referenced in the Broward County Property Appraiser's database.

The initial datasets for this project were gathered using a variety of sources including the Broward County Property Appraiser's website, Florida Marine Research Institute website, the phone book, general internet searches, and the evaluation of aerial photography. The addresses of these localities

were referenced on the Mapquest internet site (http://www.mapquest.com) and road maps. Potential facilities were identified and phone inquires confirmed whether these facilities were adjacent to waterways. Further inquiry regarding the address, site description, facility use and other information were collected. Unfortunately, the majority of respondents were not willing to offer additional information about their facility. For this reason, site visits were scheduled along the ICW, Hillsboro Canal, the North and South Forks of the New River, and the Middle River. The localities identified during these trips were restaurants, hotels, condominiums, boat rentals (charters), one casino boat, and marinas in addition to those in the Property Appraiser's database.

Various types of information were recorded at each of the facilities. The location, the maximum boat size, the number of docks, the number of wet slips, the number of boats present at the time, the boat type (power or sail) in the facility, and the site description. This information was compounded and put into a Geographic Information System and a map of the facilities was created and provided for interpretation of the multi-slip facilities in Broward.

The majority of multi-slip docks were found in Hallandale and in Hollywood. Most of these consisted of multi-family residential docks with a few restaurants and marinas. The total number of facilities and boats in this region was minimal compared to other parts of Broward County. The majority of marine facilities were found in Fort Lauderdale, having more variability in use than in Hollywood and Hallandale. Restaurants, hotels, marinas, and condominiums were found in downtown Fort Lauderdale. The total number of boats present in this location was much greater than in Hollywood or Hallandale. Continuing north, the number of facilities and boats dropped considerably. In Pompano Beach and Hillsboro Beach, there were fewer marine facilities, and the majority were multi-family residential docks, along with a few restaurants and charters with boat access. Moreover, the majority of marine facilities were located near exits to the ocean at either Hillsboro Inlet or Port Everglades Inlet. In Hillsboro Beach and Pompano Beach, most of the multi-slip facilities were less than five miles from Hillsboro Inlet and in Fort Lauderdale; many facilities were located within a few miles of Port Everglades Inlet.

Deleted: 2. University of Miami – Residential Multi-slip Report

This study is underway by University of Miami.

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2. Single-family Docks

Single-family docks are permitted throughout Broward County for residential single-family houses, mirroring the County's residential canal network.

C. Boating Use

Broward County experienced a six percent increase in vessel registrations from 1995/96 to 2002/03, while the county's population jumped 29 percent from 1990 to 2000. Throughout the State of Florida, there was a 20 percent increase in vessel registrations from 1995/96 to 2002/03. These data are shown in **Figure 23**.

Of the 46,347 registered boats in Broward County (2002/03, Florida Department of Highway Safety and Motor Vehicles), 70 percent are less than 26 feet in length (*i.e.*, "trailerable"), 21 percent are shorter than 12 feet long, and 9 percent are longer than 26 feet.

Three previous surveys of boaters using Broward County waterways have been conducted by various organizations. These are summarized in the section below.

1. FIND Study

The Florida Inland Navigation District (FIND) commissioned a study of boating activity along the ICW in 1998. Conducted concurrently from August 8 through August 16 of that year, the surveys aimed at gauging both boat traffic and recreational water use. Researchers noted that the survey was undertaken in good weather and was considered representative of peak non-holiday (off-season) summer activity. (November through April is considered the peak boating season because of the influx of winter residents and may be as much as three times more active than the summer season.) The boat traffic study consisted of an observational component with data (estimating boat size, type, speed, use, and wake size) collected 24 hours per day on the weekend and 18 hours per day (5:00 a.m. to 11:00 p.m.) on weekdays. Direction of travel was also recorded. Survey sites for this study included the Hillsboro Inlet, the ICW across from the Middle River, the ICW across from Lake Santa Barbara, and the ICW slightly south of Hallandale Beach Boulevard (at the Hemispheres Condominiums and Marina). Boating

activity at Port Everglades was not surveyed.

Results included detailed characteristics for 21,656 boats that passed the four observation points in Broward County during the study period. (The report cautions that, for a variety of reasons, all data elements were not recorded for all boats. p. 10.) Hillsboro Inlet was the most active site evaluated and, based on the directional survey, it was used primarily by Broward County boaters for recreational purposes (77.3 percent). The Lake Santa Barbara site was also frequently used, followed by the Middle River and Hallandale sites. Interestingly, sightseeing and water bus (water taxi) trips comprised 12.8 percent of traffic on the Middle River. The study found that 97 percent of the weekday traffic and 97.7 percent of the weekend traffic produced wakes within the desired legal parameters.

The Recreational Water Use Survey of 327 boaters (interviewed at various launch sites) had two purposes: (1) to gather information on the economic impact of the ICW in Broward County and (2) to collect data on boating characteristics to supplement those obtained by observation only. Results indicated that 95.6 percent of respondents resided in Broward County; 4.4 percent were from neighboring Miami-Dade and Palm Beach counties. Most (63.2 percent) owned outboard boats, 15.6 percent had inboard/outboard boats, and 13.1 percent owned personal watercraft. Only 6.9 percent had inboard boats; this result was not unexpected because most interviews were conducted at sites unsuitable for launching larger vessels.

Those surveyed said they launched in Broward County 82 percent of the time and did 83 percent of their boating in Broward. General respondent comments concerned boating conditions on the ICW, including crowding on the waterways, problems with personal watercraft, and a desire for fewer speed/no wake zones, additional ramps, and more parking.

2. University of Miami Study

Recreational Boaters in Broward County

This study was conducted by the Boating Research Center of the Rosenstiel School of Marine and Atmospheric Science at the University of Miami for the Marine Industries Association of South Florida. The two-part project included a survey of recreational boaters in Broward County and a survey of 25

leading marine re lated businesses in the county. The boater survey included questions regarding boat use patterns, boater expenditures, and water use preferences. It was mailed to 1,200 randomly selected boat owners in Broward, with a 16 percent rate of return. In addition to the mailed survey, ramp intercept surveys were conducted at various public and private ramps in Broward County, on weekends between February 15 and March 22, 1992, from 12 p.m. to 5 p.m. A total of 173 responses were obtained from the ramp surveys and 365 from the mailed surveys.

Results included the following:

- 50 percent of the boaters who responded have boats between 16 and 25 feet in length.
- More than 50 percent of the boaters surveyed said they leave for their destination between 8 a.m. and 12 p.m., returning between 2 and 6 p.m.
- Boat trips are most frequent on summer and winter weekends.
- Fishing was the most popular activity, with more than 60 percent of owners of boats less than 25 feet in length using their boats for fishing at least half the time.
- 50 percent of owners of boats more than 25 feet in length spent at least half their time cruising.
- Offshore locations were the most popular destinations for boaters with boats less than 41 feet.
- 20 percent of all boaters frequent the ICW, while 25 percent of boaters with boats less than 16 feet frequent canals and rivers. Boats larger than 40 feet usually frequent the Bahamas or Bimini Islands.

3. Broward County Parks and Recreation Study

The Broward County Parks and Recreation Division, in conjunction with the county's Marine Advisory Committee, conducted a point-intercept and mail-out survey from December, 2003, through February, 2004, in an effort to quantify the needs of marine facilities. Six thousand mail-out surveys were distributed to a random selection of county boat registrants, based proportionately on the number of registered vessels in each size class. Roughly 10 percent (N=557) were returned, with an additional 340 point-intercept surveys completed at boat ramps (Appendix H) during the two days of the Holiday Boat Parade (December 13-14, 2003).

Preliminary overall results indicated that 80 percent of respondents owned vessels that were less than 26 feet in length (in other words, "trailerable"), which is equivalent to the county's total registrations (2003) in this size class of 70 percent. Included among the challenges of owning watercraft in Broward County, many boat owners reported that they were unable to keep their boat at their residence due to city codes. Forty-eight percent said that dockage was either unavailable or too expensive, and others remarked on the problems of using trailers in general. Approximately two-thirds or those surveyed said they use their boat for recreational purposes, mainly to go fishing. More than 50 percent go boating on either a daily or weekly basis, and one-third take the boat out monthly. Suggestions for improvement of conditions for Broward's boaters included a desire to have more of the following: ramps and parking, waterfront destinations, marina slips, mooring spaces, dry stacks, short-term storage places, and dinghy dockage.

4. Mote Marine Laboratory Boating Traffic and Use Study

This study is now in progress with preliminary results expected in summer 2005.

D. Speed Zones

The FWC's Imperiled Species Management Section is charged with adopting rules that regulate the operation and speed of motorboat traffic for manatee protection purposes. Under Florida Statutes, Ch. 370.12(2)(f), (n), and (o) Broward County speed zone parameters are defined in Section 68C-22.010 of the Florida Administrative Code (FAC) and are presented in **Figures 24 through 28**. It was noted that year-round speed restrictions were instituted throughout the New River system in 1993. Most of the required signage was installed by 1994. In addition, Broward's ICW Channel of 25.4 miles, in contrast to all but one of the Florida East Coast ICW counties, is totally speed regulated with 17 miles of boating safety zones and 8.4 miles of manatee zones (total of 25.4 miles) (Source: FIND). The different classes of speed zones are described below.

"**Idle speed zone**" means an area where vessels many not be operated at greater than Idle Speed (the minimum speed that will maintain the steerageway of a motorboat—no wake). 68C-22.002(3) (FAC).

"**Slow speed zone**" means an area where vessels may not be operated at greater than Slow Speed (the speed at which a vessel proceeds when it is fully off plane and completely settled into the water—minimum wake.) 68C-22.002(8) FAC.

"**Caution zone**" means an area where manatees frequently inhabit on a somewhat regular basis and motorboat operators are advised to use caution so as not to strike a manatee. 68C-22.002(9) FAC.

"**Motorboats prohibited zone**" means an area where the entry of vessels being propelled or powered by machinery is prohibited. 68C-22.002(6) FAC.

"**No entry zone**" means a limited areas of critical importance as a safe haven for manatees to rest, feed, reproduce, give birth, nurse, or otherwise habituate undisturbed by human activity. No vessel of any kind, whether power-driven or non-motorized … including every description of watercraft, barge, and airboat, shall be permitted within the designated area. No other vessel or flotation device, including but not limited to a seaplane, sailboard, surfboard, raft, or any water toy or other like object intended for or capable of use as a means of transportation on the water, shall be permitted within the designated area, nor shall other human activities including but not limited to diving, snorkeling, swimming, fishing…, and the introduction by persons of food or other objects, that involves disturbance of these waters or the manatees so inhabiting them, be permitted within such a designated area…68C-22.002(17) FAC.

"**Maximum 25 MPH Speed Zone**" means a controlled area within which as vessel's speed made good over the bottom, measured in statue miles, shall not exceed 25 miles per hour. Although it is the intention of the Commission to allow those vessels capable of attaining a planning configuration at 25 MPH to do so, this speed limit shall not be construed as permitting the reckless or careless operation of a vessel, in violation of Section 327.33, F.S., or authorizing any vessel to travel at an unsafe speed, in violation of 33 U.S.C. s. 2006, as adopted pursuant to Section 327.33, F.S., by reason of

(a) Having an elevated bow which restricts visibility, or
(b) Producing an excessive wake which endangers other vessels or natural resources of the state. 68C-22.002(11) F.A.C.

"**Maximum 30 MPH Speed Zone**" 68C-22.003(12) FAC. Similar text, restrictions and guidelines as the Maximum 25 MPH Speed Zone, except the speed is 30 MPH.

"**Maximum 35 MPH Speed Zone**" 68C-22.003(13) FAC. Similar text, restrictions and guidelines as the Maximum 25 MPH Speed Zone, except the speed is 35 MPH.

It should also be noted that Broward County has adopted by ordinance a different set of speed zones than those described above. Certain areas on Broward waterways have a designation based on season of the year. Speed zones for other areas differ, depending on whether the boating activity occurs during the weekday or on the weekend. Countywide, there are more than 50 zones as depicted in the *Broward Safe Boating Guide*. (MIASF produces and distributes more than 25,000 of these boating guides annually.)

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IV. PORT EVERGLADES

A. Port Everglades Power Plant

Situated on Florida's east coast, 23 miles north of Miami and 312 miles south of Jacksonville, Port Everglades is Florida's deepest port and has the shortest, straightest entrance channels on the East Coast. Port Everglades in-water facilities include 48 berths (39 berths within Port Everglades proper), eight Roll on/Roll off (Ro/Ro) Ramps, three slips, three finger piers, and 7,272 linear feet of bulkhead. The Port Jurisdictional Area (PJA) totals approximately 2,380 acres, and portions lie within the cities of Hollywood, Fort Lauderdale, Dania Beach, and the Unincorporated Area of Broward County. Port Everglades Department, under the authority of the Broward County Board of County Commissioners, is operated by numerous divisions, each with responsibility for specific functions. Shoreline uses include transportation uses (48 berths), institutional uses (the U.S. Naval Surface Weapons Center, the U.S. Coast Guard facility, and the Nova Southeastern University Oceanographic Center), recreational uses (John U. Lloyd State Recreation Area) and commercial uses (Dry Marine, Inc.; lease has been extended). Another significant use within Port Everglades is Florida Power & Light's Lauderdale Power Plant, located on 86 acres. The power plant's discharge canal is a state designated manatee sanctuary and a site where manatees congregate during cooler weather.

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The importance of this power plant and its warm water discharges has been documented throughout this report. This section provides additional information about the port as its operations relate to manatees.

Historically, Port Everglades was a place for public viewing of manatees, but this is no longer possible for security reasons. However, manatees can still be found in the port area for up to four months a year. To protect these mammals, various programs have been instituted to address manatee awareness and protection, as highlighted below. Because a portion of manatee mortalities each year are due to human causes statewide, emphasis has been placed on educating the public about manatees and their endangered status. Many federal, state, and local government efforts are in place to improve the availability and distribution of educational information and materials. In fact, anyone born after September 30, 1980, and wishing to operate a motorboat in Florida must successfully complete a

National Association of State Boating Law Administrators approved boating safety course. These classes are usually offered at no charge and are administered by a number of different agencies.

1. Manatee Awareness Programs

Manatee Signage - Port officials coordinated with state and federal agencies to improve warning signs within protection areas advising boaters of speed zones.

Manatee Studies - The port has funded studies that provided information regarding manatee migrations and feeding habitats within Sanctuary Areas. This information was used to develop the port expansion plan and for manatee protection, as well as for future enhancement and creation of manatee habitats.

2. Manatee Protection Program

Manatee Nursery Area - The port designated the former "E.P.A. Slip" in the FPL discharge canal as a Manatee Nursery Area to restrict the area's use by boaters and people. The area has been found to be used by calving mothers.

Manatee Protection Plan for Dredging - This plan provides that, if feasible, dredging activities are scheduled outside of the designated winter manatee season. If not possible, the protection program puts a system in place where trained staff maintain an intensive manatee watch for the duration of the project. As a result, no injuries or deaths of manatees have ever been observed. This program is now incorporated into all federal and state dredging permits.

Manatee Protection Plan for Blasting - As part of the expansion program to the south, a blasting project was necessary for widening and deepening of the AIW. By employing a Manatee Protection Plan similar to that used for dredging, no manatees were either injured or killed during the operation. The Manatee Protection Plan will be enacted for any future blasting projects.

Manatee Lagoon Improvement - A shallow lagoon exists in the northern portion of the port's mangrove forest that provides a habitat for the manatees' winter stay at Port Everglades. It was observed that manatees only used this area during the higher portions of the tidal cycle so the port proposed deepening the lagoon to provide manatees with a more permanent tidal habitat. After approval was obtained from

the state, this area was dredged to -5.0 feet, providing the depth necessary for manatees to use this area throughout the complete range of the tidal cycle. Both entrances to the lagoon are restricted from boating traffic and the area is used by manatees as a safe haven.

Lagoon Protection at John U. Lloyd State Recreation Area - As part of the port's mitigation program associated with construction of a turning notch, a lagoon conducive to use by manatees was barricaded to boating traffic at John U. Lloyd State Recreation Area. In addition, an educational facility was constructed for use by park personnel to provide information to the public. An observation boardwalk allows visitors to observe the surrounding wetlands.

B. FPL Lauderdale Power Pl

The FPL Lauderdale Power Plant, located east of US 441 (State Road 7) near the juncture of the South Fork New River and the Dania Cut-off Canal, was re-powered in the mid-1990s. The flow from the re-powered plant is 167.04 MGD for two units. As mitigation for the re-powering project, FPL constructed experimental "resting shelves" along the shorelines of the cooling lake closest to the power plant. Additionally, FPL treats the 200-acre canal/lake system as a year-round No Entry zone for the protection of the manatees. This designation prohibits boating, fishing, and swimming in the cooling lake system.

C. Manat Protection Strategies in the Comprehensive Plan

As described above, mechanisms are already in place to avoid or reduce threats to the manatee within the Port Everglades Jurisdictional Area. Through the comprehensive planning process, the county recognizes that existing and successful operational strategies should continue to be implemented. In particular, the county has recommended that the following practices should continue:

- The utilization of appropriate "boom" techniques, spill notification protocols, and spill response procedures to avoid or mitigate hazardous and/or pollutant situations, which may be associated with the transfer of petroleum products.

- The location and use of appropriately sized fenders to prevent manatees from being crushed against bulkheads. New fenders are being installed and all fender upgrades are consistent with manatee protection measures. The Southport has old fenders; the Port is in the process of replacing these with larger fenders. Fender dimensions are as follows: For Midport, the fender

panel is 89"H x 79"W with the distance between the front of the fender panel and the face of the seawall at 41"; for Southport, the fender panel is 89"H x 98"W with the distance between the front of the fender panel and the face of seawall at 47" (Allan Sosnow, Port Everglades Authority, communication).

- The implementation of maintenance dredging and construction dredging programs (planned through 2008) to prevent manatee entrapments between vessel bottoms and the sea bed. Dredging for 2005 is expected to consist of the north extension of the main turning basin, berths 1, 2, and 3, off the bulkhead through the channel entrance. Dredging for 2008 is expected to involve global improvements to the Port Harbor entrance channel to the Dania Cut-off Canal and all bottom areas in between. The U.S. Army Corps of Engineers serves as the project managers, and the Florida Department of Environmental Protection ensures that water quality standards will be met. In general, dredging is managed through current processes at the state and federal levels (Allan Sosnow, Port Everglades Authority, communication).

- The use of manatee exclusion structures (i.e., grates) on culverts/outfalls in the Port Basin to minimize manatee mortality associated with this type of water control structure. Grates are also used in other areas of the Port, including the discharge canal, the Dania Cut-off Canal, and in older areas of the port. Culverts are usually exposed during the dry season as manatees are not usually found in these areas during the rainy (summer) season (Allan Sosnow, Port Everglades Authority, communication).

- The enforcement of appropriate vessel docking procedures, accompanied by annual educational reviews and training for Port employed line handlers, to avoid manatee entrapments. Appropriate docking procedures typically involve a pilot who is on board (physically or practically) and who controls vessels, tug assisted or non-assisted, by seeing that some have bow thrusters. Linesmen examine bulkhead lines when a vessel is leaving the dock. Arrivals do not normally involve linesmen (someone watching for manatees) (Allan Sosnow, Port Everglades Authority, communication).

- The utilization of fencing along the entire length of the FPL Port Everglades Discharge Canal to prevent interaction between Port visitors and manatees.

- The monitoring of access to the FPL Port Everglades Discharge Canal so as to limit it to researchers authorized by the U.S. Fish and Wildlife Service or contractors working on Port projects.

- The distribution and use of the educational booklet entitled "With Respect for Nature - Port Everglades Manatee Awareness and Other Environmental Programs."

Recommendations in the comprehensive plan state that future actions should consider the following:

- Though "fresh water attractants" are not deemed a problem at the current time, if changing conditions are observed, the investigation of how much fresh water is entering the port basin and berthing areas should occur to determine if it is in significant or periodic volumes to attract manatees. There are several sources of data about freshwater flows at the Port that could be used:

e.g., new sampling data from existing surface water monitoring sites; periodic checks of manatee congregating areas with an eye toward assessing the role that freshwater plays in their gatherings. Research could also be done to find out how other ports obtain and utilize fresh water flow information.

- The use of the Harbor Safety Committee as appropriate, to develop measures to enhance manatee protection, with a focus on reducing the risks from large vessels. These could also include efforts to assist the Florida Inland Navigation District staff in their periodic evaluation of the adequacy of Manatee zone and boating safety signage at the Port.

V. BOAT FACILITY ANALYSIS & CRITERIA

A. Introduction

The following section outlines permit requirements and review processes of federal, state, and county permits needed for boat facilities. This section is the "boating facility siting element" as referenced in Florida Statutes, Chapter 370.12 (2) (t) 3. This section also fulfills Objective 13-A.3 of the Broward County Comprehensive Plan, Conservation Element:

> "Ensure that new marinas/boat facilities and boat ramps will, through proper facility siting and construction techniques, be located on sites that would minimize potential manatee/boat overlap, injury to manatees and disturbance of manatee habitat."

In addition to existing Comprehensive Plan language that outlines protective measures for manatees, Broward County has developed the following boat facility siting strategy that attempts to address long-term cumulative and secondary impacts to manatees from the development of boating facilities. The goal of this section is to reduce boat interaction that could lead to manatee injury or death.

Areas that are deemed acceptable for new or expanded facilities by manatee and natural resource criteria may not have appropriate zoning or future land use classifications. Changes in zoning and future land use classification are based on social needs and political decisions which may occur independently of natural resource considerations. A presumption of this document is that zoning, future land use classification and present financial constraints might not be limiting factors for future facility development. In addition, it is recognized that databases for manatee distribution, habitat, and boat use may also change or that new data may become available that suggest changes to the document.

Therefore, this plan should be updated at intervals consistent with updates of the Broward County Comprehensive Plan.

The provisions of the facility siting method do not pertain to single-family residences or projects involving construction or expansion of facilities with up to five wet or dry slips. For the purposes of this siting methodology, one boat slip, dry slip, or parking space designated for a boat trailer will be considered to be numerically equivalent. The recommendations in this document do not pre-empt existing rules or ordinances, or create requirements outside the authority of local, state, and federal regulations.

The first step in boat facility siting addresses manatee protection issues. The development of the manatee protection boat facility siting criteria is consistent with Objective 13-A.3 and Policy 13-A.3.2 of the Broward County Comprehensive Plan (Conservation Element). The second step in the evaluation of facility siting is to determine the presence or absence of coastal wetlands or SAV.

B. General Assumptions

Due to the lack of complete data and in an effort to balance resource protection with the need for siting new boat facilities, several assumptions have been made while analyzing the data and developing recommendations for siting:

1. The greater number of slips at a facility, the greater the potential risk to manatees.
2. Slips for transitory use are potentially a greater risk to manatees than permanent slips. Transitory sites (boat ramps, restaurant slips, hotel slips, etc.) generate a higher level of boat traffic than permanent slips or slips used for repair, and thus pose a higher risk of adverse boat/manatee interactions.
3. Inlets in Broward County are frequent boating destinations areas for both recreational and commercial traffic, and facilities located at a greater distance from inlets pose a greater potential risk to manatees than facilities located closer to inlets.
4. Facilities proposed far from the ICW or inlets present a potentially greater risk to manatees due to the fact that boats have to travel through areas where manatees travel or rest, increasing the probability of adverse boat/manatee overlap.

5. There is a regional impact that boaters produce from a facility, frequently referred to as the boater's area of influence. This area represents the area of highest vessel traffic generated from a facility, due to vessels traveling to and from the proposed facility.

C. Data Trend Observations

After a review of various information, several factors which play a major role in the decision making process became apparent.

1) Under the existing Broward County Land Use Plan, the remaining undeveloped parcels cannot provide the number of housing units needed to accommodate projected future growth. Most available land in Broward County has already been developed to some degree. Therefore, redevelopment is inevitable, in order to accommodate growth and meet future demand for housing. Broward County has limited nonresidential land that could be re-designated for residential development. [Accommodating Population Growth in Broward County, 2000 to 2030, Broward County OUPR, Planning Services Division, August 2003.]

2) The Broward County waterways shoreline appears to be approaching build out with respect to wet mooring capacity.

3) Aerial synoptic survey data, along with data from FPL power plant surveys, indicate that manatee use of Broward County appears to be increasing.

4) Some shifts in the relative distribution of manatees has probably occurred as a result of increased warm water discharge from the Lauderdale Power Plant.

5) Manatee mortality, including human-related mortality, is also increasing. In addition, the ratio of watercraft-related deaths to the total number of manatee deaths is higher than the statewide average. Port related deaths may decrease the mortality caused by recreational boats.

6) Boat registration is increasing at a 6% growth rate, which can be considered basically flat relative to statewide growth. This increase is the lowest of all 13 key counties (Table 6).

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D. Boat Facility Siting Evaluation

It appears that the risks to manatees from vessel collisions continue despite existing manatee protection speed zones. However, the number of boat-related deaths in Broward County is less than most Florida counties. It is also likely that the risks to manatees from boat collisions has remained high, or is increasing. This emphasizes the need for a comprehensive Manatee Protection Plan that includes all aspects of manatee protection, not just speed zones. Please refer to the Population Status section for addition information on the need for manatee protection.

E. Methods

1. Sector Analysis

Analysis of the various datasets began with a sector analysis. Beginning at the Broward County line in the southern part of the county, one-mile radius circles (sectors) were drawn along the waterways with the centers one mile apart. The majority of the waterways where manatees can be frequently found were delineated in this manner. Sectors were analyzed using ArcGIS, with various datasets included within each circle, including the average number of manatees seen per aerial survey flight, the number of watercraft, perinatal and total deaths, the area of water, the number of existing boat slips and the number of boat ramps. In addition, the aerial survey and mortality data were divided by the area of water to produce a "density" of each dataset for each circle. The mean for each aerial survey and mortality dataset, for the absolute number as well as the density number, was then derived from these sectors.

2. Waterway Analysis

The second step in the analysis was to compare and combine the data in the various sectors to delineate areas with similar dataset results, to create larger areas that have similar characteristics. From this analysis, and based on input from County staff, waterway areas were delineated into polygons and then the data for each polygon was evaluated. This list of waterways includes:

1) Port Everglades Power Plant discharge
2) Ft. Lauderdale Power Plant discharge
3) Hillsboro Canal
4) Hillsboro River
5) Hillsboro Inlet
6) ICW Central Part A
7) ICW Central Part B
8) ICW Port to Dania
9) ICW South
10) Cypress Creek
11) Middle River

12) Port Everglades Inlet
13) New River Junction
14) New River North Fork
15) New River South Fork
16) Stranahan River and Canal System
17) Dania Cut-Off Canal West
18) Dania Cut-Off Canal East
19) Dania Cut-Off Canal C-10

F. Boat Facility Siting Screening Criteria

The main parameters that were considered in analyzing the relative importance of areas to manatees and potential risks to manatees in the above referenced waterways were the following:

1. Distance to inlets
2. Speed zones (presence, absence, and level of restriction; manatee protection and boating safety)
3. Watercraft-related manatee deaths (1974 – December 2003)
4. Perinatal manatee deaths (1974 – December 2003)
5. Total manatee mortality (1974 – December 2003)
6. Aerial sightings (adults + calves, seasonal components; 48 flights excluding tributaries 1/8/88 – 3/26/90 and12 flights including tributaries 11/6/1991 – 9/24/1992)
7. Estimated boat/manatee overlap (boat traffic patterns vs. manatee movement patterns)
8. Designated manatee travel corridor or essential habitat (Comprehensive Plan)
9. Power plant discharge corridors
10. Relative number and types of commercial slips
11. Satellite Telemetry Data (individual tracks and seasonal components, 1/1/90 – 12/31/94)
12. FPL winter aerial surveys and synoptic surveys (adults + calves, seasonal components)
13. Likelihood of vessel travel through areas of frequent manatee use

Table 4 represents a summary of boat facility siting criteria based upon several pertinent factors. Results are also displayed graphically in **Figure 29.** These criteria were analyzed using ArcGIS, and were determined in the following manner:

1) Watercraft-related deaths – The number of watercraft-related deaths located within a specific waterway polygon.
2) Watercraft-related deaths on route to the nearest inlet – The number of watercraft related deaths located outside of the stated waterway polygon but located in the most likely boater travel route to the nearest inlet.
3) Perinatal deaths - The number of perinatal (dependent calf) deaths located within a specific waterway polygon.
4) Live Calf - The number of calf sightings located within a specific waterway polygon for all available aerial surveys (AsBrowfv, AsEcofv, Synoptic).
5) Aerial Survey - The average number of manatees observed per aerial survey flight located within a specific waterway polygon.
6) Number of Slips - The number of boat slips (not including boat ramp parking spaces) located within a specific waterway polygon.
7) Distance to inlet – Estimated distance in miles from the farthest point in a waterway polygon to the nearest inlet.
8) Speed Zone - Established state or local, manatee protection or boating safety vessel speed zones located within a specific waterway polygon.
9) Comp Plan Habitat Designation – Areas designated by Broward County Comprehensive Plan (1989 Vol. 4, 13A-42) as either Manatee Travel Corridors or Manatee Essential Habitat.
10) Number of Tagged Manatees - The number of individual manatees fitted with satellite telemetry tags located within a specific waterway polygon.

These data were analyzed in many different ways using different parameters (spatially, seasonally, density, by month, by year, by night/day, manatee behavior, boat types, overlapping datasets, etc.). While many different parameters were considered using both the sector method and the waterway polygon method, due to the length of the description, not all of these analyses can be documented in this plan. A synthesis of this information resulted in prioritization of the criteria, including:

Deleted: so that some datasets have been weighted more importantly than others,

1. Watercraft-related deaths
2. Watercraft-related deaths en route to nearest inlet
3. The distance to the nearest inlet

All data was considered in an attempt to categorize areas of Broward County by importance and risk to manatees, balanced with the need to locate boat facilities. Important in this process was the consideration of manatee protection and boating safety speed zones that are already in place and the location of existing boating facilities. After this analysis, appropriate outcomes for the size and type of

facility that can be located in areas of the county will be provided. The outcomes will be based on the analysis of all the data and depends on the level of protection needed for manatees in the different areas of the county.

The ranges for the most readily quantifiable criteria were determined primarily on an equally divided basis and are characterized as in **Table 5**.

G. Recommended Levels of Protection

Table 6 indicates that Broward County is the second highest county in the State of Florida (of the 13 "key" counties) for the total number of watercraft registered for 2002. While the percent increase between the last two ten year dataset periods is minimal and the lowest of all 13 counties, the number of registered watercraft remains high and is significant compared to the other "key" counties.

As shown in **Figure 15 and Table 7**, Broward ranks 7th in manatee mortality, between Palm Beach and Miami-Dade of the 13 key counties, in terms of absolute numbers of watercraft-related deaths. Broward County is the second highest county in the State of Florida (of the 13 key counties) as a proportion of manatee watercraft deaths to total deaths from 1974 through June 2004. While the number of large ships in Port Everglades causing deaths may be lower than those caused by recreational boaters, it is impossible to prove with existing data. Some manatee mortality in Port Everglades is due to large seagoing ships, not recreational boaters. There is a higher probability of interactions with vessels associated with Port Everglades being involved in manatee mortality even though it is difficult to quantify using FWC necropsy reports, which do not specify the type vessel. There were a total of 31 manatee deaths in Port Everglades, more than half of all watercraft-related deaths for Broward County, and some these may be attributable to larger ships.

When comparing watercraft-related mortality to total mortality, watercraft-related mortality is not increasing as fast. However, the majority of the "other" types of deaths are primarily perinatal deaths. The logarithmic trend lines for watercraft-related, perinatal and all other types of deaths are depicted in **Figure 17**.

When perinatal deaths are separated from the other data, it appears to be increasing at the same rate as watercraft-related deaths. The remaining mortality is increasing at a slower rate than either watercraft-related or perinatal rates.

H. Levels of Protection: Reduction of Future Boat Traffic Congestion in Specific Areas

For this particular county, the development of an initial boat facility siting strategy is difficult due to the lack of comprehensive data available during the development of the initial draft. As stated in the Manatee Data section, the distributional comprehensive aerial survey data are limited and are more than ten years old; ongoing synoptic and power plant surveys only provide wintertime data. Manatee mortality data and satellite telemetry data have been relied upon, perhaps more heavily than in other counties that have developed manatee protection plans, due to the lack of updated manatee distributional data. However, mortality and telemetry data also have limitations when attempting to characterize manatee use of particular waterways. Ongoing efforts to collect new data (2005), such as manatee distributional aerial survey data, boating activity studies, and multifamily/private slip inventories were incomplete as of the first draft of this element but will be included in future versions as available.

However, it is also important to note that developing a boat facility siting strategy in this county might always be difficult. Many of the areas that appear to be high manatee use areas appear to also be high boat traffic areas, making it difficult to reduce boat/manatee overlap, an important goal of boat facility siting plans. Much of Broward's risks to manatees are inherent in its waterway configurations (lots of narrow waterways and canals far from boater destinations) and the fact that it has two significant warm water manatee refuges. Many of the areas with significant boat/manatee overlap already have slow zones, but watercraft deaths continue.

I. Recommended Outcomes as a Result of a Screening Matrix

Because of the importance of Broward County to the manatee population, it is recommended that there be several levels of protection to reduce future boat traffic congestion in areas where boat/manatee overlap is significant. For those areas where additional development is likely to result in a significant amount of boat/manatee overlap and the likelihood of additional manatee mortality, no additional

development should occur. However, it is clear that a certain amount of development must be allowed in order to fulfill this plan's intent to balance development and personal riparian property rights with manatee protection. Based on the analysis method described previously (Section IV, E), the main categories used in this plan to designate areas are as follows:

1. Prohibited: Essential Habitat Areas (power plan discharge canals) as defined in the Broward County Comprehensive Plan;
2. Single-Family Density (1:100): The minimal amount of development allowable; one powerboat per every 100 feet of linear shoreline owned.
3. Restricted: Those areas where watercraft deaths are still high, but proximity to an inlet and slow zones can offset some of the expected impacts. However, these areas do not represent appropriate places for unlimited development, and as such, existing facilities can expand without any limitations on the number of slips, and new facilities should only be developed at a level of 1:100.
4. Unrestricted: Those areas that are low in watercraft related deaths, are fairly close to inlets and/or are offset by slow speed zones, and allow unlimited number of slips for all types of boat facilities.
5. Intermediate: Those densities between single-family density and unrestricted, to be determined by the variance procedures described below.

After reviewing all the screening criteria, number values and range values, it was determined that three of the ten criteria were the most important in determining the recommended outcomes for boat facility siting. Those three weighted most heavily were:

1. Watercraft-related deaths
2. Watercraft-related deaths en route to nearest inlet
3. The distance to the nearest inlet

Exceptions and changes in zone boundaries were based on the need to balance development with the criteria (i.e., speed zones, habitat designation, etc.). The screening matrix to determine boat facility siting zone outcomes is in **Table 8** and allowance for transitory uses, including boat ramps, is shown in **Table 9**.

In order to balance development with manatee protection, an attempt was made to allow exceptions to restrictive outcomes for those areas that are inherently appropriate for development, although there may be significant boat/manatee overlap (Hillsboro Inlet, Stranahan River/Port Everglades Inlet). However,

the following factors should be noted: Hillsboro Inlet has navigational issues; Hillsboro Canal has a low bridge problem; and the Stranahan River area is primarily residential, built out, or closed to recreational development.

J. Establishment of Boat Facility Siting Zone Boundaries from Waterway Polygons

The final step in the process of developing a boat facility-siting plan is to review and modify the boundaries for specific areas (the establishment of boat facility siting zones or BFSZ). Boundaries of these zones were determined either by natural breaks in the data, configuration of waterways, or boundaries of existing speed zones. For those zone boundaries that differ from the waterway polygons, a brief explanation is provided below. Maps of these zones are located in **Figure 30 through Figure 33**.

Hillsboro Canal/Hillsboro River (Zone G/Zone F):

The Hillsboro Canal and the Hillsboro River were combined as one zone (G) due to similar data scores. The southern boundary for Zone G (the Hillsboro River) was determined by measuring no further than four miles to the Boca Raton Inlet.

Hillsboro Inlet/ICW Central Part A (Zone F/Zone G):

The southern boundary of Zone F was determined by the boundary for the end of the slow speed zone for the Hillsboro Inlet area.

ICW Central/Part A and Part B (Zone D):

For this portion of Zone D, the central parts of the ICW were combined due to similar data scores.

Stranahan River/ICW Central (Zone D/Zone F):

Due to the New River being an important travel corridor to a warm water refuge, the boundary of the boat facility-siting zone subdivides the Stranahan River/Canal system area to reduce adverse boat/manatee overlap. The division to the west was the mouth of the New River. The division to the

east was determined just south of the group of marinas along the river, to reduce adverse boat/manatee overlap and boat traffic congestion.

Middle River/Stranahan River (Zone C/Zone F):

The boundary for the BFSZ for Zone F is slightly north of the mouth of the Middle River, past a group of marinas to reduce adverse boat/manatee overlap and boat traffic congestion.

New River Junction/North Fork/South Fork (Zone C):

For this portion of Zone C, these portions of the New River were combined due to similar data scores. A slight outlier in these waterways is the North Fork. However, because of its significant distance to an inlet, it warrants the same categorization as the rest of the New River.

Dania Cut-Off Canal West/East/C-10 Canal (Zone C):

For this portion of Zone C, these portions of the Dania Cut-Off Canal were combined due to similar data scores, even though there are some differences.

K. Boat Facility Siting Zone Discussions

A discussion of how various data were considered and the approaches used to develop the boat facility outcomes have been described. Manatee data, habitat information, existing speed zones, waterway configuration, boat traffic, marina inventory, and other miscellaneous information were synthesized to create categories of potential boat facility siting zones (Zones A-G).

1. Zone A

Discussion: Port Everglades includes several large basins cut-in from the uplands, a large turning basin, and direct access to the Port Everglades Inlet. The Port is regulated as slow speed year-round. This area represents one of the highest areas of probable boat/manatee overlap in the County. However, due to direct access to the Inlet, the economic importance of the Port operations, and ongoing education and mitigation programs at the Port, this area is considered the most appropriate location for Port uses. An indirect effect of increased enforcement activities in the Port resulting from 9/11 and home security measures may be the level of boaters' compliance with current speed zones in the Port area.

Concentrated mortality at the Port and its reduction would help zone designatio n in nearby waterways, e.g. Dania Cut-Off area.

Outcome: For Zone A, it is recommended that *generally Port uses are possible for this area, based on a case-by-case review and if found to be consistent with manatee protection*.

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2. Zone B

Discussion: These zones are identical to the state-designated no-entry areas for the Port Everglades discharge canal and the Fort Lauderdale discharge canals and cooling ponds of the Lauderdale Power Plant. These warm water refuge areas are also designated by Broward County as Manatee Essential Habitat (1989 Comprehensive Plan Vol. 4, 13A-42). Broward County's Comprehensive Plan prohibits the construction of new or expansion of existing marinas, docking facilities and boat ramps, except those related to law enforcement, within Manatee Essential Habitat Areas (1997 Comprehensive Plan, Policy 13-A.3.1, Ordinance Number 96-39).

Outcome: For Zone B, the construction of new or expansion of existing marinas and boat facilities, except those related to law enforcement, shall be *prohibited.*

3. Zone C

Cypress Creek and Pompano Canal

Discussion: Adjacent to the middle portion of the county is the Cypress Creek system, which includes Cypress Creek and the Pompano Canal. Approximate distance to the Hillsboro Inlet is three or four miles. Manatee access to the internal canal system from Cypress Creek appears to be restricted as a result of water control structure S-37A. Sightings of manatees are relatively low, likely due to limitations of the available aerial survey data. The number of perinatal deaths is moderate compared to the rest of the County. This area represents a likely manatee calving and nursing area based on perinatal deaths. This area is regulated as slow or idle speed, by a combination of local and state manatee protection and boating safety speed zones. This area's importance as a possible calving area and

distance from major inlets suggests that this area is unsuitable for siting future water-dependent uses. In addition, it is unsuitable for creating new boater destinations, such as those associated with transitory uses. Such use is expected to increase the level of boat/manatee overlap to unacceptable levels.

New River Area

The New River area includes the New River beginning at Tarpon Bend, the Tarpon River, the North Fork of the New River, the North New River Canal and the South Fork of the New River to the South New River Canal. This portion of the county is located far from any inlet, and most of the waterway (except Tarpon River) is a designated manatee travel corridor. This area is a major travel corridor to the Lauderdale Power Plant discharge. Sightings of manatees are relatively low, likely due to limitations of the available aerial survey data. Perinatal deaths and watercraft-related deaths are relatively high compared to the rest of the County. Several areas within this zone are possible calving/nursing areas, including the canal system on the North New River Canal and the North Fork of the New River. This area is characterized as having a significant number of commercial slips relative to the rest of the County. This area is regulated as slow or idle speed, by a combination of local and state manatee protection and boating safety speed zones. This area's importance as a possible calving area, travel corridor and distance from major inlets suggests that this area is unsuitable for siting future water-dependent uses. In addition, it is unsuitable for creating new boater destinations, such as those associated with transitory uses.

Dania Cut-off Area

Other portions of the Dania Cut-off Canal, Whiskey Creek, the South New River Canal, and the C-10 Canal are also a designated as manatee travel corridors. Most of this area is a major travel corridor to the Lauderdale Power Plant discharge. The portion of the Dania Cut-off Canal that is adjacent to the Lauderdale Power Plant has a high number of perinatal deaths and high live calf sightings from aerial surveys, indicating that this area represents a likely manatee calving and nursing area. Sightings of manatees are relatively low, likely due to limitations of the available aerial survey data. Watercraft-related deaths, perinatal deaths and the total number of deaths are relatively moderate compared to the

rest of the County. This area is characterized as having a significant number of commercial slips relative to the rest of the County. This area is regulated as slow or idle speed, by a combination of local and state manatee protection and boating safety speed zones.

While a portion of the zone is in close proximity to Port Everglades Inlet, the proximity to the Port Everglades warm water refuge and the travel corridor to the Fort Lauderdale warm water refuge (the Dania Cut-off Canal) outweighs any potential reduction in boat/manatee overlap that might occur from being located near an inlet. This area's importance as a travel corridor and the distance from major inlets for most of the zone suggests that this area is unsuitable for siting future water-dependent uses. In addition, it may also be unsuitable for creating new boater destinations, such as those associated with transitory uses. Such use is expected to increase the level of boat/manatee overlap to unacceptable levels. However, data are limited and suggest the need for future studies and possibly different treatment of portions of the Dania Cut-off area.

The Dania Cut-off area, excluding the C-10 canal, is seen as an important area for potential development of boat facilities. To realize this potential, an effective manatee risk mitigation program must be developed for this area as well along the route to the nearest inlet which includes the Port Everglades area. We recommend setting up a task force to undertake this study. Broward County and interested stakeholders intend to carry out a study of the Dania Cut-off area and route to nearest inlet to identify ways to mitigate the construction of additional marinas. The study would review other mitigating technologies besides enforcement that may permit these facilities to be built. The study will focus on the travel route of boaters from the Dania Cut-off to the inlet.

Outcome: For all areas in Zone C, it is recommended that a *minimum level of development be allowed for all types of facilities, with no transitory uses.* An appropriate minimum level of development is that which would be allowed for single-family development, or one powerboat slip for every one hundred feet of shoreline owned.

4. Zone D

Discussion: The middle portion of Broward County includes canals, canal systems and the ICW. This portion of the county is located far from any inlet, and is a designated manatee travel corridor. It is expected that many manatees that travel to and through Broward County use this area. Portions of this area are regulated for manatee protection as idle speed on weekends in winter and 25 mph with 50' slow speed buffer the remainder of the year. There are also idle speed boating safety zones along portions of the ICW around bridges. A local idle speed zone exists in Lake Santa Barbara and Lettuce Lake. There are groupings of animals, including mothers and calves, in the canals along the ICW in the vicinity of the entrance to the Cypress Creek system. This area's importance as a migratory corridor and distance from probable boater destinations suggests that this area is unsuitable for siting future water-dependent uses.

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The southern part of Broward County south of the Port includes West Lake and the ICW to the Broward/Miami-Dade county line. Most portions of this area are located far from any inlet, and the ICW in this area is a designated manatee travel corridor. Many manatees that travel to and through Broward County are likely to use this area. Portions of this area are regulated for manatee protection as slow speed in winter, 25 mph with 50' slow speed buffer the remainder of the year, 25 mph year-round, idle and slow speed by a combination of local and state manatee protection and boating safety speed zones. This area's importance as a migratory corridor, proximity to warm water refuges and/or their travel corridors, and distance from probable boater destinations suggests that this area is unsuitable for siting future water-dependent uses.

Outcome: For all areas in Zone D, it is recommended that a *minimum level of development be allowed for all types of facilities, with transitory uses allowed.* This minimum level is allowable because these areas represent a major travel corridor for boats as well as manatees. An appropriate minimum level of

development is that which would be allowed for single-family development, or one powerboat slip for every one hundred feet of shoreline owned.

5. Zone E

Discussion: The Middle River area includes a North Fork, South Fork and Middle River Canal. The area is nearly all residential. Boat use is restricted in this zone because of the low, fixed bridge on Sunrise Boulevard and George English Park. Manatee access west of the Middle River Canal appears to be restricted as a result of water control structure S-36. Sightings of manatees are relatively low, likely due to limitations with the available aerial survey data. Only three manatee deaths have occurred in this system, two of undetermined causes and one floodgate/canal lock-related. No tagged animals have been observed in this area. This area is regulated as slow or idle speed by a combination of local and state manatee protection and boating safety speed zones. The boat/manatee overlap in this area is believed to be extremely low, suggesting that this area is suitable for unrestricted siting of most future water-dependent uses. However, boaters must travel through one of the highest areas of probable boat/manatee overlap in the County, the Stranahan River/New River Sound area. To reduce the potential increase in the level of overlap, this area should be considered unsuitable for creating new boater destinations, such as those associated with transitory uses.

Outcome: For all areas in Zone E, it is recommended that an *unrestricted level of development be allowed for all types of facilities, with no transitory uses*.

6. Zone F

Discussion: The Hillsboro Beach and Pompano Beach area includes the Hillsboro Inlet, canal systems and the ICW, a designated manatee travel corridor. Land use in the inlet area is primarily high-end residential. The number of manatees seen per aerial survey flight is slightly higher in this portion of the ICW compared to other, similar portions of the ICW, with some groupings of mothers and calves in this area. There may be foraging resources that attract manatees to this area, such as seagrasses. Portions of this area are regulated for manatee protection as slow speed on weekends in winter and 25 mph with 50' slow speed buffer the remainder of the year. There is also a slow speed boating safety zone along portions of the ICW and inlet areas. There have been six watercraft-related deaths in this area around the Inlet and all have occurred in the winter (December through February) when the stricter speed zones are

in effect. Locating boat facilities near inlets (probable boater destinations) will likely reduce the amount of time vessels travel on the water, reducing the likelihood of boat/manatee overlap.

The Stranahan River area (Zone F) includes the Stranahan River to the area south of the mouth of the New River. Land use in this area is also high-end residential Watercraft-related and total manatee deaths are relatively high in this area compared to other areas of the county. This area includes major travel corridors to both warm water aggregation sites: 1) through the New River to the ultimate destination of the Lauderdale Power Plant discharge and 2) to the Port Everglades discharge canal. These two routes are designated by Broward County as manatee travel corridors. Use of this area is well documented by tagged manatees. This area is also characterized as having a significant number of commercial slips relative to the rest of the County. Portions of this area are regulated for manatee protection as slow speed on weekends in winter and 25 mph with 50' slow speed buffer the remainder of the year (the ICW down to Burnham Point). Portions of this same area are locally regulated as slow speed, 15" maximum wake all year. Other portions of this area are regulated as slow or idle speed by a combination of local and state manatee protection and boating safety speed zones. However, this area is in fairly close proximity to the Atlantic Ocean through the Port Everglades Inlet (the farthest distance is approximately 3-4 miles). As is the case with the other inlets, locating boat facilities near this inlet (also a probable boater destination; preliminary data from the boat activity study) is expected to reduce the amount of travel on the water, reducing the likelihood of boat/manatee overlap in other parts of the County. It is possible that the wide variety of speed zones in this area is confusing to boaters, contributing to reduced compliance with speed zones.

Outcome: Both of these areas in Zone F are believed to be the highest areas of probable boat/manatee overlap in the County. However, in order to balance the needs of development with manatee protection, it is recommended that an *unrestricted level of development be allowed for the expansion of existing facilities, new facilities should not be developed at a density higher than 1:100, and no transitory uses should be allowed.* These areas have the potential to be a preferred (or unrestricted) area for new facilities as well, but possible issues with the existing speed zones, posting and compliance suggest that currently a more conservative approach should be taken until these issues are resolved.

7. Zone G

Discussion: The northern part of Broward County near Palm Beach County includes the Hillsboro River, canals and the ICW. Manatee deaths attributed to watercraft-related causes, perinatal and all causes of death (total) are low, relative to the rest of the County. This area is located approximately within four miles of the Boca Raton Inlet, a probable destination for many boaters. Several slow and idle speed zones exist within this area and the Boca Raton Inlet. While portions of this area are within the Broward County designated manatee travel corridor (1989 Comprehensive Plan Vol. 4, 13A-43), this area is still in fairly close proximity to the Atlantic Ocean through the Boca Raton Inlet. Locating boat facilities near boater destinations will likely reduce the amount of boat travel, therefore reducing the likelihood of boat/manatee overlap. However, low bridges will significantly limit any future development of boating facilities in this zone, and the land use in the surrounding areas is primarily high-end residential.

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Outcome: For Zone G, it is recommended that an *unrestricted level of development be allowed for all types of facilities, with transitory uses*.

L. Other Considerations

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While the available, existing data has been analyzed in order to draft the previous sections of this boat facility-siting plan, it has become apparent through this analysis process that new, updated information is needed for manatee distribution and boat traffic patterns. Another consideration is whether the enforcement strategy of law enforcement could be improved to ensure better speed zone compliance. It appears that improved coordination between all levels of law enforcement could develop a more effective strategy to enforce both state and local manatee protection and boating safety zones. It may also be that posting is inadequate or confusing and contributes to non-compliance. If compliance is increased and risks to manatees continue to occur, it may be appropriate to evaluate the existing speed zones to determine if they are adequate.

The goal of a plan is not only to provide direct protection to manatees, but also to ensure preservation of manatee habitat. To this end, additional considerations for facility siting include water depth and the presence of submerged aquatic vegetation (primarily seagrasses), which should be evaluated for each project reviewed, using the following guidelines.

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1. Water Depth

For the purposes of this plan, the draft of vessels for a proposed project shall be appropriate for the existing water depths. Adequate water depth shall be defined as follows:

1) Adequate water depth is considered a minimum of one-foot clearance between the deepest draft of the vessel (with the engine in the down position) and an unvegetated bottom or the top of submerged resources (if present) at mean low water; and

2) This vessel clearance must be provided for all mooring areas, turning basins, and ingress and egress pathways.

If dredging is required to meet adequate water depth requirements, dredging shall only be considered if the amount of dredging can be minimized. Vessel draft restrictions may be required as an alternative to dredging, if appropriate. The Broward County Comprehensive Plan (Policy 13-A.3.3) states that "marinas, docking facilities or boat ramps shall be located so as to require minimal or no dredging." If dredging is required, "both initial and maintenance dredging shall be minimized."

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2. Seagrass

Prohibiting the placement of new facilities within seagrass areas or coastal wetlands is consistent with Objective 13.7, Policy 13.7.2 and 13.7.10 of the Comprehensive Plan (Conservation Element). Existing seagrass data indicate that very little seagrass is present in Broward County; however, the listed, endangered Johnson's Seagrass (*Halophila johnsonii*) has been observed in the County. Limited seagrass beds may be present in the Port Everglades area and the Hillsboro Inlet area. Foraging resources available to manatees in Broward County is particularly important, since the further they have to travel during cold weather to forage (such as to another county), the more susceptible they may become to cold stress.

For each proposed project, a seagrass survey of the site must be conducted, especially *Halophila johnsonii*. This survey should be conducted to identify the seagrass bed locations and edges. Quantitative seagrass information must be collected using a scientifically acceptable method and collected during April 1st through September 30th. The survey will include the footprint of a boating

facility/marina (including all docks, access walkways, finger piers, mooring areas, turning basins, and ingress and egress pathways) that will be adversely impacted. An area greater than 500 square feet of seagrass damaged or lost shall be considered significant. If *Halophila johnsonii* is observed onsite, the amount of allowable adverse impacts will be determined on a case-by-case basis.

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3. Additional Mitigation/Conservation Measures

The following are typical conditions that will be required for facilities when appropriate to protect manatees and educate the public. While typical, conditions for projects are not limited to these measures and additional conditions may be recommended on a case-by-case basis.

The permittee shall comply with the following manatee protection construction conditions as specified by the FWC through permitting and licensing authorizations of regulatory agencies:

1. Any culvert greater than 7 and less than 60 inches in diameter, shall be covered with grates or screens with spaces less than 7 inches wide in order to prevent manatee entrapment. These grates/screens shall be maintained to prevent upland flooding.

2. For all approved construction or expansion of 10 moorings or greater, permanent manatee educational signs must be installed and maintained as per the Florida Fish and Wildlife Conservation Commission's Imperiled Species Management Section guidelines.

3. For all approved construction or expansion of 30 moorings or greater, a comprehensive marina manatee educational program must be implemented before completion of project construction. Such a plan shall be developed with the assistance of and approved by the Florida Fish and Wildlife Conservation Commission's Imperiled Species Management Section. The program shall include, at a minimum, permanent signs and kiosks, speed zone booklets, and manatee educational brochures and pamphlets. The permittee will be responsible for the cost of the signs and the printing of the pamphlets. Signs and kiosks should be installed prior to facility opening and beginning operations, be replaced in the event of fading or becoming damaged, and be ongoing for the life of the permitted docking facilities. The permittee shall request, in writing, guidance in developing and approving this marina manatee educational program by contacting:

FWC/ISM, 620 South Meridian Street, 6A, Tallahassee, Florida, 32399-1600 (850-922-4330). While this provision addresses facility construction or expansion of 30 moorings or greater, the County has the discretion to require any facility to incorporate additional educational elements if appropriate.

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4. Variance Procedures

Variances to the MPP can be requested for an individual project; however, full consultation with the federal and state wildlife agencies as well as the county will be required, including section 7 consultations by the United States Fish and Wildlife Service (USFWS). A determination of whether a variance is granted will depend on a case-by-case review of the manatee data, existing manatee protections and the adequacy of manatee protections in relation to current and future development.

Notwithstanding the boating facility siting provisions of the comprehensive plan, boating facilities may be considered at locations that are otherwise not consistent with the recommended siting criteria, provided that the location and density is approved by the FWC, the USFWS and the county based on a finding that the facility will not have a significant adverse effect on manatees. Nothing in this section shall exempt any marina from obtaining the usual required permits and/or authority from all applicable reviewing agencies with proper jurisdictional authority.

If a proposed project has been determined by all required agencies to meet all of the following criteria, it may be permitted to increase the powerboat-to-shoreline ratio.

a) The waters adjacent to and channels leading to the facility are designated "slow speed" or "idle speed" as authorized by the Florida Manatee Sanctuary Act or Boating Restricted Areas.

b) The facility is not located within, or within one mile of, a cold-weather aggregation area or other area where sensitive manatee activities occur.

c) The facility must provide net benefit to manatees and/or their habitat. For example, facilities may include a conservation easement, restoration of adjacent wetlands such as mangrove or seagrass restoration to increase the net coverage of the nearby area, requiring prop guards on any high traffic vessels such as water taxis or dive boats or rental boats, etc. The marina construction and subsequent uses will neither destroy nor negatively impact mangrove and benthic (seagrass, hard bottom, etc.) communities and the water quality.

d) The facility must have sufficient water depth in the marina basin and in any access channel, and does not require any new dredging or filling (this may exclude maintenance dredging, or pile

installation). Entrance/exit channels near marinas shall be adequately marked if marina repairs or expansion are proposed.

e) The site shall contain appropriate signage (including vessel speed and manatee information signs), and provide educational material advising boaters of essential manatee habitats in the vicinity.

f) The marina has adequate water circulation, tidal flushing, and meets State of Florida and local water quality standards.

g) In traveling to principal destinations or from principal origination or launch points, vessels using the facility should minimize travel through manatee travel corridors, cold weather aggregation areas or Essential Habitat areas.

h) Before expanding and exceeding the allowable powerboat slips defined above, an existing facility must demonstrate not less than 85% occupancy over the previous 2 years of operation. New facilities should be able to demonstrate the need for additional boat slips in the vicinity based on occupancy of existing marina slips within the boater sphere of influence. The boater's sphere of influence shall be a five (5) mile radius.

One of the tools for attaining variance may be enhanced by law enforcement. As the crux of the speed zone criterion is regulated through federal and state law, or county ordinance, applicants are unable to create new speed zones in areas that do not currently contain them. Increasing compliance in existing speed zones is an area that applicants can affect through a variety of means. Applicants have several options to increase compliance in the speed zones that are currently in place near their project area. Funds can be allocated for signage and/or buoys to help delineate the zones, or applicants may provide funds for additional law enforcement.

M. Law Enforcement Recommendations

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The enforcement of existing boat-related speed zones is critical for high compliance rates, which are expected to offset adverse impacts to manatees from boats. A Law Enforcement task force should be developed that is representative of all enforcement entities (county, municipal, state and federal) with on-water manatee regulatory zone enforcement. This task force could:

1. Conduct coordinated patrols of Broward County's waterways
2. Provide ongoing information on manatee/law enforcement related issues in the region, such as seasonal changes in speed zones or areas of high or increasing watercraft-related mortality

3. Reduce the number of watercraft related manatee mortalities through coordinated enforcement of manatee regulatory zones
4. Coordinate for joint marine enforcement training as it relates to enforcement of manatee regulatory zones
5. Coordinate for Special Marine Events as it relates to enforcement of manatee regulatory zones

N. Ongoing Studies to be Completed Prior to Interim BFSP

1) Multifamily and private multi-slip inventories;
2) Boating activity studies (aerial surveys, mail-out surveys);
3) Manatee distributional aerial surveys.

O. Recommended Future Studies to be Completed Prior to Final BFSP

1) Identification of fresh water sources;
2) Determination of whether speed zones need to be evaluated to propose changes that simplify zones to improve compliance;
3) Boating demand;
4) Evaluation of local speed zones and signs to determine compliance level;
5) Assessments of current county and city enforcement efforts;
6) Manatee risk mitigation study for the Port Everglades area;
7) Data Cut-off Call study, including analysis of manatee mortalities by FWC pathobiologist, updated Marine Master Plan preferred sites, boater compliance with speed zones, cumulative impacts with respect to watercraft related deaths en route to nearest inlet.

The continuation of this work is essential in order to effectively evaluate the status of the Broward County manatee population. As a result, the development of future management plans and revisions to the MPP can be based on the most current, accurate scientific data.

P. Periodic MPP Review and Revision

The Broward County Manatee Protection Plan will be routinely evaluated consistent with the County's Comprehensive Plan review cycle. Changes and amendments can be considered in a shorter amount of time at the request of the Board of County Commissioners.

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<#>Provide coordinated marine-related response to search and rescue incidents¶
<#>Reduce marine-related theft through coordinated enforcement targeting "hot spots"¶
<#>Provide coordinated marine-related response during natural disasters¶
<#>Provide coordinated marine-related response to domestic security incidents¶
<#>Coordinate to enforce net limitation laws/rules¶

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Citrus
Brevard

Definitions or FAC codes
Broward County Speed Zones: The Florida Manatee Sanctuary Act. Florida Wildlife Commission Chapter 68C-22.010

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FAC 370 Natural Resources; Conservation, reclamation, and use
370.12 Marine animals; regulation-
(2) Protection of manatees or sea cows

Acknowledgments

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