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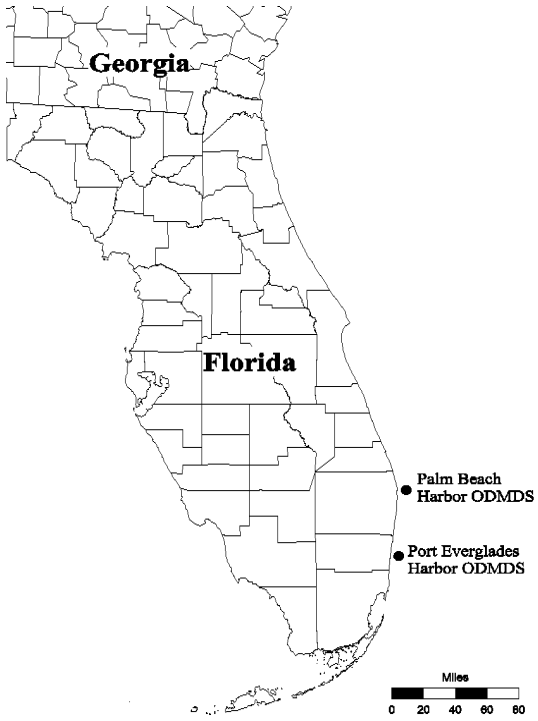
Final Environmental Impact Statement (FEIS) for Designation of the Palm Beach Harbor Ocean Dredged Material Disposal Site and the Port Everglades Harbor Ocean Dredged Material Disposal Site

July 2004



United States Environmental Protection Agency

U.S. EPA Region 4
61 Forsyth Street, SW
Atlanta, GA 30303

FINAL ENVIRONMENTAL IMPACT STATEMENT (FEIS) FOR DESIGNATION OF THE PALM BEACH HARBOR OCEAN DREDGED MATERIAL DISPOSAL SITE AND THE PORT EVERGLADES HARBOR OCEAN DREDGED MATERIAL DISPOSAL SITE

July 2004

Prepared by:

EPA Region 4
61 Forsyth Street, SW
Atlanta, GA 30303

In cooperation with:

Army Corps of Engineers
Jacksonville District
Jacksonville, Florida

With the assistance of:

G.E.C., Inc.
Federal Programs Division
Environmental Services
Baton Rouge, Louisiana

FINAL ENVIRONMENTAL IMPACT STATEMENT (FEIS) FOR DESIGNATION OF THE PALM BEACH HARBOR OCEAN DREDGED MATERIAL DISPOSAL SITE AND THE PORT EVERGLADES HARBOR OCEAN DREDGED MATERIAL DISPOSAL SITE

U.S. Environmental Protection Agency
Region 4
Atlanta, Georgia

Comments on this administrative action should be addressed to:

Mr. Wesley B. Crum, Chief
Coastal Section
U.S. Environmental Protection Agency
61 Forsyth Street, SW
Atlanta, GA 30303
(404) 562-9352
email: crum.bo@epa.gov

Comments must be received no later than:

_____, 30 days after publication of the notice of availability in the Federal Register for the Final EIS.

For further information contact:

Mr. Christopher J. McArthur, P.E.
Coastal Section
U.S. Environmental Protection Agency
61 Forsyth Street, SW
Atlanta, GA 30303
(404) 562-9391
email: mcarthur.christopher@epa.gov

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR DESIGNATION OF THE PALM BEACH HARBOR OCEAN DREDGED MATERIAL DISPOSAL SITE AND THE PORT EVERGLADES HARBOR OCEAN DREDGED MATERIAL DISPOSAL SITE

Reviewed by:

U.S. Environmental Protection Agency
Region 4
Water Management Division
61 Forsyth Street, SW.
Atlanta, GA 30303
(404) 562-9345

James D. Giattina, Director
Water Management Division

Approved and Submitted by:

U.S. Environmental Protection Agency
Region 4
Office of the Regional Administrator
61 Forsyth Street
Atlanta, GA 30303
(404) 562-8357

J. I. Palmer, Jr.
Regional Administrator

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FINAL ENVIRONMENTAL IMPACT STATEMENT

1.0 INTRODUCTION

1.1 Summary

1.1.1 Major Findings and Conclusions

The U.S. Environmental Protection Agency (EPA) with the cooperation of the U.S. Army Corps of Engineers (USACE), Jacksonville District, investigated alternative ocean dredged material disposal sites off the east coast of Florida, one to accommodate Palm Beach Harbor and one to accommodate Port Everglades Harbor. The purpose of this investigation was the final designation of an Ocean Dredged Material Disposal Site (ODMDS) for each location. The environmental amenities in the vicinity of each alternative site were investigated to determine the suitability of each location as an ODMDS. The physical, chemical, and biological characteristics of each site were examined. The fate of dredged materials dispersants from each site was considered. Non-ocean alternatives for dredged material disposal were also evaluated.

Investigations showed that the preferred ODMDSs for Palm Beach Harbor and Port Everglades Harbor were the alternative sites located 4.5 and 4 nautical miles (nmi) offshore, respectively. The preferred sites (each approximately 1 square nmi (3.4 square kilometers [km^2]) consist of primarily soft-bottom habitat. Each site is located on the upper continental slope on the western edge of the Florida Current. The depth of each site exceeds 150 meters (m) (492 feet [ft]). Based on EPA and USACE surveys, it was concluded that no natural reefs, no natural or cultural features of historical importance, and no areas of special scientific importance are located within or near the preferred sites. Each site meets all evaluation criteria for use as an ODMDS. The conclusion is that the preferred sites are suitable for designation for disposal of dredged material.

1.1.2 Areas of Controversy

A scoping letter on the Port Everglades Harbor ODMDS designation dated April 17, 1995, was sent by the USACE to Federal, State, and local governmental offices and agencies and other concerned entities. Eleven letters were received in response to that letter from surrounding businesses and state agencies. A second scoping letter for the Palm Beach Harbor ODMDS designation dated September 26, 1997 was sent by the USACE to Federal, State, and local government offices and agencies and other concerned entities. Three letters were received in response to that letter. Copies of the original scoping letters and response letters are appended to this document (Appendix A).

The areas of controversy identified during the scoping process included proximity to nearshore reefs and the potential for transport of fine-grained material to these reefs; proximity to other significant marine resources; the recency and adequacy of the designation surveys; the scope, frequency, and costs of monitoring effects of disposal at the proposed sites; potential conflicts with the South Florida Testing Facility (SFTF); and the potential for reductions in beneficial use projects such as beach nourishment due to the availability of an offshore disposal option.

The USACE has sponsored modeling of the dispersion of disposed dredged material in order to address concerns about impacts to nearby hardbottom and reef communities. EPA conducted additional designation surveys to identify any significant marine resources in the vicinity of the candidate sites and to characterize the sites. One of the Port Everglades Harbor alternative ODMDSs was moved to avoid the SFTF. Draft Site Management and Monitoring Plans (see Appendix L) has

been developed to establish a framework for the scope, frequency, and cost management of monitoring the effects of disposal at the candidate sites.

1.1.3 Issues to be Resolved

The issues of potentially reducing the opportunity for beneficial use of the dredged material, such as beach nourishment and placement, due to the availability of ocean disposal have yet to be completely resolved. Resolution of this issue is beyond the scope of this action. The Federal Standard is defined as the least costly dredged material disposal or placement alternative identified by the USACE that is consistent with sound engineering practices and meets all Federal environmental requirements. Establishing the Federal Standard is not the same as selecting a disposal alternative, but rather establishes a base plan which defines the disposal or placement cost assigned to the navigation purpose of the project. When material meets the standards for beach placement, beach placement is likely to be the Federal Standard, and the federal share for beach placement will be 100%. However, if some of the material does not meet the standards for beach placement or for other reasons beneficial use is not the base plan, the USACE has various legislative authorities to share the incremental costs of the beneficial use or beach placement above the base plan. This base plan may or may not be ocean disposal. EPA and the USACE strongly support beneficial use projects. However, in some cases, beneficial uses will not be available and ocean disposal will be needed. The success of beneficial use projects depends on the creation of partnerships between Federal and non-Federal interests and requires local leadership and local financial commitments to succeed. The National Dredging Team and Regional Dredging Teams co-chaired by EPA and the USACE have been formed in part to promote these partnerships.

Essential fish habitat (EFH) consultation has not been completed (see Section 3.6). NOAA Fisheries raised a number of concerns related to potential impacts of site designation on EFH. EPA has prepared an EFH Assessment for each ODMDS (see Appendix I) and is still in the consultation process. Site designation will not be finalized until the EFH consultation has been completed.

1.1.4 List of all Federal Permits, Licenses, and Other Entitlements Prior to Proposal Implementation

In 1972, Congress enacted the Marine Protection, Research, and Sanctuaries Act (MPRSA). The MPSRA controls the transportation and the subsequent dumping of materials into ocean waters. The Act disallows the dumping of materials into the ocean except in accordance with permits issued by EPA. In the case of dredged material, permits allowing dumping activities are issued by the USACE. Permits are issued pursuant to criteria required under Section 103 (a) of the MPSRA. However, the primary users of the sites will be the Federal projects of maintenance dredging in Palm Beach and Port Everglades harbors and permits are not issued for Federal projects. A process of coordination and concurrence was conducted through the distribution of the Draft Environmental Impact Statement (DEIS) for this proposed action to Federal and Florida state agencies, offices, and organizations having authority over issues associated with this action. The Final Environmental Impact Statement (FEIS) includes letters of concurrence, recommendations, or approvals from all cooperating entities (Appendix B).

1.1.5 Relationship of Alternative Actions to Environmental Protection Statutes

The relationship of the alternative actions to environmental protection statues and other environmental requirements is presented in Table 1.

1.2 PURPOSE OF AND NEED FOR THE ACTION

1.2.1 Need for Action

The proposed action addressed in this DEIS is the designation by EPA of two environmentally acceptable and economically feasible ODMDSs in the Atlantic Ocean, one located east of the Lake Worth Inlet and Port of Palm Beach, Florida, and one located east of Port Everglades, Florida. The purpose of these ODMDSs is to accommodate maintenance-dredged material from both the Palm Beach Harbor Federal Project and the Port Everglades Harbor Federal Project. The need for ocean disposal is based primarily on the lack of economically, logistically, and environmentally feasible alternatives for the disposal of the projected quantities of dredged material deemed unsuitable for beach re-nourishment or beach placement. Cost comparisons of ocean and non-ocean disposal of the dredged material based on environmental, engineering, and economic criteria were conducted for the areas of Palm Beach Harbor (Appendix C) and Port Everglades Harbor (Appendix D).

Palm Beach Harbor

Currently, there exists a need for disposal of maintenance material from the Palm Beach Harbor turning basin. Maintenance dredging of the turning basin, which contains non-beach quality material, is needed on a frequency of every three years (see Appendix C). Dredged material volumes will vary from dredging event to dredging event depending on the amount of shoaling. Shoaling rates for the turning basin are projected to average 10,300 cy per year (Appendix C). However, during years when the turning basin is dredged, material from the inner channel and entrance channel, which is typically dredged annually and placed on the beach, will likely also be disposed with the turning basin material in the ocean. Total disposal volumes (turning basin and entrance channel) for the years in which the turning basin is dredged (and hence ocean disposal is needed) are expected to average in the range of 75,000 to 100,000 cy with volumes as large as 200,000 cy (Murphy, 2004). Disposal volumes of 75,000 to 100,000 cy every three years equates to annual averages of 25,000 to 35,000 cy. Placement of beach quality sand on the beach or other beneficial use rather than in the ocean during these routine maintenance events is subject to the suitability of the material for the beneficial use (see Section 2.2) and any agreements established under the various legislative authorities which authorize cost sharing for the incremental cost of the beneficial use or beach placement.

Port Everglades Harbor

Currently, there exists a need for disposal of maintenance material from Port Everglades Harbor. Annual shoaling rates at Port Everglades Harbor have been estimated at 16,500 cy per year for the turning basin (Appendix D) and 15,600 cy for the entrance channel (Olsen & Assoc., 2003) for a total of approximately 30,000 cy per year. Dredging frequency has ranged from 6 to 20 years with project volumes in the range of 26,000 to 144,000 cy (Brodehl, 2003). The infrequent dredging has been due to the lack of available disposal options; with an available ocean disposal site, the frequency is expected to increase to every 3 to 5 years (Brodehl, 2004). Some or all of the maintenance material may be placed on the beach or utilized for other beneficial use when possible. However, placement of beach quality sand on the beach or other beneficial use is subject to the suitability of the material for the beneficial use (see Section 2.2), the need for the material, the cost relative to ocean disposal, and any agreements established under the various

Table 1. Relationship of Alternatives to Environmental Requirements

Federal Statues	No Action	Proposed Palm Beach ODMDS	Proposed Port Everglades ODMDS
Archeological & Historic Preservation Act, as amended, 16 USC 469, *et seq*. PL 93-291	FC	FC	FC
Clean Air Act, as amended, 42 USC 1857h-7, *et seq.* PL 91-604	FC	FC	FC
Clean Water Act, as amended, (Federal Water Pollution Control Act) 33 USC 1251, *et seq.* PL 92-500	FC	FC	FC
Coastal Barrier Resources Act, 16 USC 3501 *et seq*. PL 97-348	NA	NA	NA
Coastal Zone Management Act, as amended, 16 USC 1451, *et seq.* PL 92-583	FC	FC	FC
Endangered Species Act, as amended, 16 USC 1531, *et seq*. PL 93-205	FC	FC	FC
Estuary Protection Act, 16 USC 1221, *et seq.* PL 90-454	NA	NA	NA
Federal Water Project Recreation Act, as amended, 16 USC 460-1(12), *et seq.* PL 89-72	FC	FC	FC
Fish and Wildlife Coordination Act, as amended, 16 USC 661, *et seq.* PL 85-624	FC	FC	FC
Land and Water Conservation Fund Act, as amended, 16 USC 4601-1601-11, *et seq.* PL 88-578	FC	FC	FC
Magnuson-Stevens Fishery Conservation and Management Act, as amended, 16 U.S.C. 1801, *et seq*. PL 94-265	FC	FC	FC
Marine Mammal Protection Act 16 USC 1361, *et seq.* PL 92-522	FC	FC	FC
Marine Protection, Research, and Sanctuaries Act, 33 USC 1401, *et seq.* PL 92-532	FC	FC	FC
National Historic Preservation Act, as amended, 16 USC 470a, *et seq*. PL 89-655	FC	FC	FC
National Environmental Policy Act, as amended, 42 USC 4321, *et seq.* PL 91-190	FC	FC	FC
River and Harbor Act, 33 USC 401, *et seq.*	FC	FC	FC
Watershed Protection and Flood Prevention Act, 16 USC 1001, *et seq.* PL 83-566	NA	NA	NA
Wild and Scenic Rivers Act, as amended, 16 USC 1271, *et seq*. PL 90-542	NA	NA	NA
Executive Orders			
Coral Reef Protection (EO 13089)	FC	FC	FC
Floodplain Management (EO 11988)	NA	NA	NA
Protection of Wetlands (EO 11990)	NA	NA	NA
Protection and Enhancement of Environmental Quality (EO 11514, as amended EO 11991)	FC	FC	FC
Protection and Enhancement of the Cultural Environment (EO 11593)	NA	NA	NA
Federal Compliance with Pollution Control Standards	FC	FC	FC
State Policies			
Florida Coastal Management Program	FC	FC	FC

FC= Full Compliance NA= Not Applicable

legislative authorities which authorize cost sharing for the incremental cost of the beneficial use or beach placement.

1.2.2 National Environmental Policy Act

The National Environmental Policy Act (NEPA) of 1969, as amended, requires the preparation of an Environmental Impact Statement (EIS) for major Federal actions that may significantly affect the quality of the human environment. This EIS implements EPA policy of voluntarily preparing NEPA documents (FR Doc. 98-29019 [29 October 1998]) as part of the designation process of an ODMDS under Section 102 of the Marine Protection, Research, Sanctuaries Act (MPRSA) of 1972. This EIS will satisfy the USACE need for NEPA documentation relating to ocean disposal site suitability for permitting under Section 103 of the MPRSA. Suitability of any proposed dredged material for ocean disposal will be determined on a case-by-case basis.

1.2.3 Marine Protection, Research, and Sanctuaries Act

The transportation and disposal of dredged material in ocean waters, including the territorial sea, is regulated under the MPRSA (Public Law 92-532, 86 Stat. 1052, 33 U.S.C. §§1041 *et se*q.) as amended by Title V of the Water Resources Development Act of 1992 (WRDA 92; Public Law 102-580). Section 102(a) of the MPRSA authorizes EPA to establish and apply regulations and criteria for ocean dumping activities. Consequently, EPA issued in October, 1973, and revised in January, 1977, Ocean Dumping Regulations and Criteria (40 CFR 220-229). These regulations establish control of ocean dredged material disposal primarily by two activities, designation of sites for ocean dumping and the issuance of permits for dumping.

MPRSA Section 102(c), authorizes EPA to designate recommended sites for ODMDSs. An ODMDS is a precise geographical area within which ocean disposal of dredged material is permitted or authorized under conditions specified in MPRSA Sections 102 and 103. The primary purpose of site designation is to select sites that minimize adverse environmental effects and minimize the interference of dumping activities with other uses of the marine environment. The designation of an ODMDS by EPA is based on compliance with general (Part 228.5) and specific (228.6[a]) site evaluation criteria. Final site designation under Section 102(c) must be based on environmental studies of each site and on historical knowledge of the impact of dredged material disposal on areas similar to such sites in physical, chemical, and biological characteristics. EPA has the primary responsibility for site designation. A site may be selected by the USACE under MPRSA Section 103(b), with EPA concurrence, if no EPA-designated site is available.

The transportation of dredged material for the purpose of disposal into ocean waters (i.e., the actual use of the designated site) is permitted by the USACE (or authorized in the case of federal projects) under MPRSA Section 103(e) applying environmental criteria established in EPA's Ocean Dumping Regulations and Criteria. MPRSA Section 104(a)(3) provides that ocean disposal of dredged material can occur only at a designated site and Section 103(b) requires the USACE to utilize dredged material disposal sites designated by EPA to the maximum extent feasible. Prior to issuing a dredged material permit or authorizing a federal project involving the ocean disposal of dredged material, the USACE must notify EPA, who may disapprove the proposed disposal.

1.2.4 Other Needs

The USACE anticipates that the new ODMDSs offshore from Palm Beach Harbor and Port Everglades Harbor will be used initially for the disposal of suitable maintenance-dredged material from the existing Palm Beach Harbor and Port Everglades Harbor Federal Navigation Projects, respectively. The sites may also be used for other Federal or private dredging projects near Palm Beach Harbor and Port Everglades Harbor, provided the dredged material meets the criteria specified in the MPRSA. Additional testing of dredged material and NEPA documentation would also be required for the transportation of dredged material. Only suitable dredged material (dredged material that meets EPA Ocean Dumping Criteria [40 CFR 220-229]) would be placed in the site. A need for use of the proposed ODMDSs must also be shown for all dredging activities.

Potential projects and their associate disposal volumes for each proposed ODMDS are provided below.

Palm Beach Harbor

Up to 1,000,000 cy of suitable material may be placed at the ODMDS in 2007 as a result of proposed construction dredging. This construction dredging has been proposed at the recommendation of a recent reconnaissance study by the USACE which stated that deepening of the existing Federal project at Palm Beach Harbor was justified. The USACE will perform a feasibility study to examine the plan in greater detail and evaluate disposal alternatives.

Additional volumes that may be placed at the Palm Beach Harbor ODMDS include 9,000 cy from the North Turning Basin Extension (cited in the August 1984 Feasibility Report).

Port Everglades Harbor

Additional volumes of material resulting from proposed construction activities are presented in Table 2.

Table 2. Quantity Breakdown for Port Everglades Draft GRR (In Development)

Contract	Component	Fiscal Year	Quantity
1	Widener	2006	770,000
	Dania Cutoff Canal	2007-	1,945,000
	Turning Notch	2008	372,000
	Subtotal		3,087,000
2	Outer Entrance Channel	2009	872,000
	Inner Entrance Channel	2009	390,000
	Main Turning Basin	2010	1,476,000
	South Turning Basin	2011	322,000
	Subtotal		3,060,000
3	Southport Access Channel	2012	1,232,400
	Total New Work Quantity for Disposal		**7,379,400**
---	Maintenance - Non Federal	2024	40,000
	Maintenance - Federal	2024	660,000
	Total Maintenance Quantity for Disposal		700,000
	Total Quantity for Disposal		**8,079,400**

Source: USACE, 2004.

The above quantities include Drilling and Blasting, Mechanical Dredging, and Pipeline Dredging Volumes for Channels and Berths from Draft General Re-Evaluation Report Micro Computer-Aided Cost Engineering System (GRR MCACES). This estimate also includes volumes associated with revisions made for the June 2003 ship simulation study. These quantities are estimates and are subject to change depending on further revisions of channel designs, updated bathymetric information, and/or revision of techniques used to calculate volumes. The assignment of components to individual contracts (phases) and the dates associated with each phase were determined based on limitations of the upland disposal sites. These are subject to change if the ODMDS becomes a viable option for disposal.

2.0 ALTERNATIVES CONSIDERED

2.1 No-Action

The No-Action Alternative is defined as not designating an ODMDS pursuant to Section 102 of the MPRSA for Palm Beach Harbor and Port Everglades Harbor. The No-Action Alternative would not provide an acceptable EPA-designated disposal sites for use by the USACE or other entities for the disposal of dredged material. Without final-designation disposal sites, the maintenance of the existing Federal Navigation Projects at Palm Beach Harbor and Port Everglades Harbor would be adversely impacted with subsequent effects upon the local and regional economies. Interim designated ODMDSs are not available (see discussion under 2.4). Alternative dredged material disposal methods would be required or the dredging and dredged material disposal would have to be discontinued.

In the absence of a designated ODMDS, the USACE could select an alternative pursuant to Section 103 of MPRSA. In this case, the ocean site selected for disposal would be evaluated according to the criteria specified in Section 102(a) of the MPRSA and EPA's Ocean Dumping Regulation and Criteria 40 CFR Part 228, and EPA concurrence is required. A site so selected can be used for five years without EPA designation, and can continue to be used for another five years if:

- No feasible disposal site has been designated;
- Use of the alternative site is necessary to maintain navigation and interstate commerce; and
- EPA determines continued site use does not pose an unacceptable risk to human health, aquatic resources, or the environment.

Accordingly, the No-Action Alternative would not provide a long-term management option for dredged material disposal.

2.2 Non-Ocean Alternative Disposal

Alternatives to ocean disposal are considered, as required by Section 103 of the MPRSA, and include upland disposal and beach re-nourishment. Cost effective upland disposal options are not available in the intensively developed areas around Port of Palm Beach and Port Everglades (see appendices C and D, respectively). Many of the potential upland disposal sites were considered environmentally valuable in their own right, and none of them or combination of them was more cost-effective than ocean disposal. As a result, land disposal is not a viable option for the placement of dredged materials from the Palm Beach Harbor and Port Everglades Harbor Federal Navigation Projects.

Beach re-nourishment of suitable dredged material is the preferred disposal alternative for all dredging projects. Only beach quality material may be used in beach re-nourishment projects. The State of Florida's Beach Management Rule, Chapter 62B-41.007, Subsections 5(j)-5(k) defines beach quality material as material that maintains the general character and functionality of material occurring on a beach and in adjacent dunes and coastal systems. Such material is predominantly carbonate, quartz, or other similar material with a particle size distribution ranging from 0.062 millimeters (mm) and 4.76 mm, must be similar in color and grain size distribution to existing material at the placement site, and must not contain any of the following:

Greater than 5 percent (%), by weight, silt, clay, or colloids passing the #230 sieve;
Greater than 5%, by weight, fine gravel retained on the #4 sieve;
Coarse gravel, cobbles, or material retained on the ¾-inch sieve in a percentage or size greater than that of material on the native beach;
Construction debris, toxic material, or other foreign matter; and
Any materials or characteristics that would result in cementation on the beach.

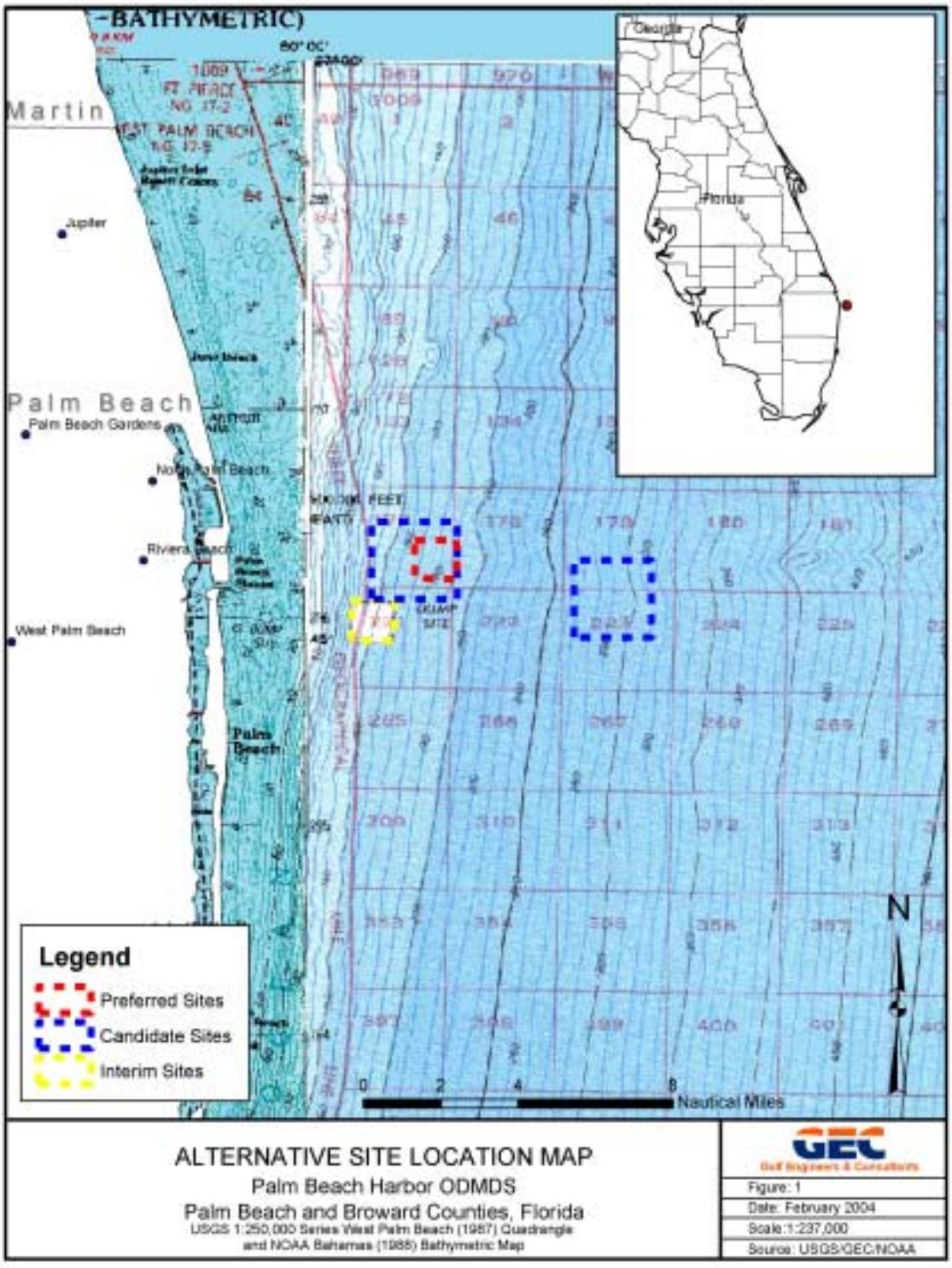
Sandy sediment derived from the maintenance of coastal navigation channels is deemed suitable for beach placement with up to 10% fine material passing the #230 sieve, provided that it meets the above criteria and appropriate water quality standards. Such material containing 10-20% fine material passing the #230 sieve and meeting all other sediment and water quality standards is considered suitable for placement on nearshore portions of beaches.

As some of the dredged material at the Port Everglades Harbor and Palm Beach Harbor may not always meet these criteria, alternative disposal options to beach re-nourishment or placement are needed.

2.3 Alternative Sites

In the nearshore areas of Palm Beach Harbor and Port Everglades Harbor, hard bottom habitats supporting coral/algal and worm reef communities are concentrated on the continental shelf. Disposal operations on the shelf could adversely impact these reef habitats. The outer continental shelf is narrow near the proposed sites, with a width of about 0.63 nmi (1.17 kilometer [km]) at Port of Palm Beach and 0.63 nmi (1.16 km) at Port Everglades (Uchupi, 1968). Consequently, the transport of dredged materials for disposal beyond the shelf is both practical and economically feasible.

Alternative sites considered for the Port of Palm Beach include the offshore interim site, the 3-mile site, the 4.5-mile site and the 9-mile site (Figure 1). The interim and 4.5-mile sites are approximately one square mile in size. The 3-mile site is four square miles in size. The 9-mile site was originally one square mile in size, but was subsequently increased to approximately four square miles based on deposition modeling to insure that most of the material deposits within the disposal site boundaries. The 3-mile site was dropped from further consideration in favor of the 4.5-mile site as it was determined that a four square mile site was not necessary. Note that the deeper depths at the 9-mile site result in a larger disposal footprint necessitating the larger disposal site. The distances to shore of the various alternatives are summarized below:



ALTERNATIVE SITE LOCATION MAP

Palm Beach Harbor ODMDS

Palm Beach and Broward Counties, Florida

USGS 1:250,000 Series West Palm Beach (1987) Quadrangle and NOAA Bahamas (1985) Bathymetric Map

GEC Gulf Engineers & Consultants

Figure: 1
Date: February 2004
Scale:1:237,000
Source: USGS/GEC/NOAA

Palm Beach Harbor Alternatives	Distance from shore to western edge of site
Offshore Interim Site	2.9 nautical miles
3-Mile Candidate Site	3.3 nautical miles
4.5-Mile Site (Preferred)	4.3 nautical miles
9-Mile Candidate Site	8 nautical miles

The 4.5-mile and 9-mile sites have been carried forward for detailed analysis with the 4.5-mile site as the preferred alternative. The interim site is discussed further in the following section.

Alternative sites considered for the Port of Port Everglades include the interim site, the 4-mile site and the 7-mile site (Figure 2). The interim and 4-mile sites are approximately one square mile in size. The 7-mile site was originally one square mile in size, but was subsequently increased to approximately four square miles based on deposition modeling to insure that most of the material deposits within the disposal site boundaries. The distances to shore of the various alternatives are summarized below:

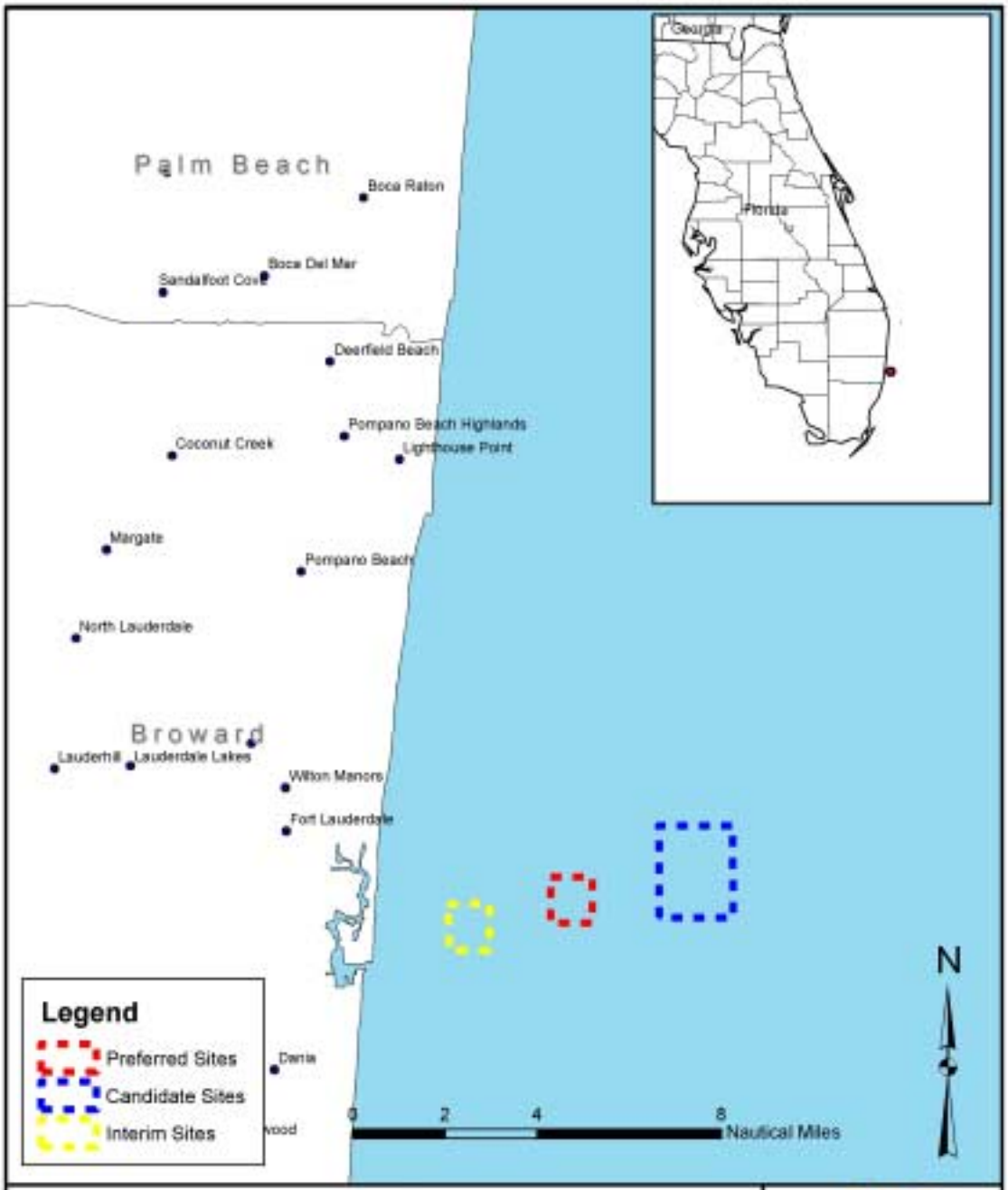
Port Everglades Harbor Alternatives	Distance from shore to western edge of site
Interim Site	1.6 nautical miles
4-Mile Site (Preferred)	3.8 nautical miles
7-Mile Candidate Site	6 nautical miles

The 4-mile and 7-mile sites have been carried forward for detailed analysis with the 4-mile site as the preferred alternative. The interim site is discussed further in the following section.

2.4 EPA Interim-Designated Ocean Dredged Material Disposal Site

Interim-designated ocean disposal sites have historically been used for the disposal of dredged material from Palm Beach Harbor and Port Everglades Harbor. Two interim sites were designated for Palm Beach Harbor, one of which is located nearshore at the port entrance, with the other located approximately 2.9 nmi (4.5 km) offshore. The nearshore interim site was not considered an alternative for final designation. Use of these sites was discontinued as a result of the implementation of the WRDA of 1992. WRDA 92 prohibited after January 1, 1997 issuance of any permit or MPRSA Section 103(e) authorization for an EPA ODMDS which does not have a final designation. Following discussions with the State of Florida, a zone of siting feasibility was established eliminating from consideration any areas within 3 nmi (4.5 km) of shore to avoid direct impact to natural reefs in the area. As a result, both Palm Beach Harbor interim sites were not considered further.

The interim site for Port Everglades Harbor is located 1.7 nmi (3.2 km) offshore. A 1984 survey conducted by EPA indicated that some damage to nearby inshore, hard bottom areas may have occurred due to the movement of fine material associated with disposed dredged material. In light of the survey findings, disposal at the Port Everglades Harbor interim site was discontinued and the site was eliminated from further consideration.



ALTERNATIVE SITE LOCATION MAP

Port Everglades ODMDS

Palm Beach and Broward Counties, Florida

USGS 1:250,000 Series West Palm Beach (1957) Quadrangle and NOAA Bahamas (1988) Bathymetric Map

GEC Gulf Engineers & Consultants

Figure: 2
Date: February 2004
Scale:1:210,000
Source: USGS/GEC/NOAA

2.5 Considered Alternative ODMDSs

The proposed action is the designation of new ODMDSs for the areas of Palm Beach Harbor and Port Everglades Harbor. These sites were evaluated and selected with the full cognizance of the five general and 11 specific site selection criteria set forth in 40 CFR 228.5 and 228.6 (Ocean Dumping Criteria). The extent to which these candidate sites meet the criteria is addressed in Section 4.3.2, *Evaluation Using General and Specific Criteria*, of this document.

2.5.1 Palm Beach Harbor

4.5-Mile Site (Preferred Site)

The preferred site near Palm Beach Harbor proposed for ODMDS designation is an area approximately one square nmi (3.4 km^2) located east northeast of the Lake Worth Inlet and approximately 4.5 nmi (8.3 km) offshore (see Figure 1). The preferred site for this new ODMDS near Palm Beach Harbor is defined by the following boundary coordinates (NAD 83):

(NW)	26°47'30" N	79°57'09" W
(NE)	26°47'30" N	79°56'02" W
(SW)	26°46'30" N	79°57'09" W
(SE)	26°46'30" N	79°56'02" W

The site is centered at 26°47'00" N, 79°56'35" W. Depths in the site range from 525 ft (160 m) to 625 ft (190 m).

9-Mile Candidate Site

The 9-mile site is also considered a candidate site for ODMDS designation. The site is located approximately 9 nmi (16.7 km) offshore (see Figure 1). The 9-mile site is defined by the following boundary coordinates (NAD 83):

(NW)	26°45’00” N	79°53’00” W
(NE)	26°45’00” N	79°51’00” W
(SW)	26°47’00” N	79°53’00” W
(SE)	26°47’00” N	79°51’00” W

The site is centered at 26°46’00” N, 79°52’00” W. Depths in the site range from 855 ft (260 m) to 985 ft (300 m).

2.5.2 Port Everglades Harbor

4-Mile Site (Preferred Site)

The preferred site at Port Everglades Harbor proposed for ODMDS designation is an area approximately one square nmi (3.4 km^2) located east northeast of Port Everglades and approximately 4 nmi (7.4 km) offshore (see Figure 2). The preferred site for this new ODMDS at Port Everglades Harbor is defined by the following boundary coordinates (NAD 83):

(NW) 26°07'30" N 80°02'00" W
(NE) 26°07'30" N 80°01'00" W
(SW) 26°06'30" N 80°02'00" W
(SE) 26°06'30" N 80°01'00" W

The site is centered at 26°07'00" N, 80°01'30" W. Depths in the site range from 640 ft (195 m) to 705 ft (215 m).

7-Mile Candidate Site

The 7-mile site is also considered a candidate site for ODMDS designation. The site is located approximately 7 nmi (13.0 km) from offshore (see Figure 2). The 7-mile site is defined by the following boundary coordinates (NAD 83):

(NW) 26° 06'30" N 79°57'30" W
(NE) 26° 06'30" N 79°59'30" W
(SW) 26° 08'30" N 79°59'30" W
(SE) 26° 08'30" N 79°57'30" W

The site is centered at 26°07'30" N, 79°58'30" W. Depths in the site range from 785 ft (240 m) to 920 ft (280 m).

2.6 Selection of Preferred Alternative

The characteristics of the alternative sites with respect to EPA's five general (40 CFR 228.5) and 11 specific (40 CFR 228.6) criteria for site selection are compared in sections 4.3.2 through 4.3.5. These comparisons are used as the basis for selection of the preferred alternatives. Detailed information on the physical, biological, and socioeconomic environment and potential impacts of the proposed action are presented in chapters 3 and 4.

2.6.1 Palm Beach Harbor Preferred Alternative

Based on comparison of the alternative sites to the general and specific criteria, the 4.5-mile site was selected by EPA and the USACE as the preferred alternative. This site was selected for the following reasons:

- Sediment surveys of the site indicate that sediments within the 4.5-mile and 9-mile sites are similar to the dredged material proposed for disposal.
- No significant impacts to resources or amenity areas (e.g., offshore coral reefs) are expected to result from designation of either the 4.5-mile or 9-mile site.
- Potential impacts to surface and mid-water dwelling organisms are expected to be insignificant regardless of which of the alternative sites is used for dredged material disposal.
- Potential impacts to bottom-dwelling organisms are considered significant at either of the considered alternative sites. However, the area of impact is expected to be greater at the 9-mile site due to the greater footprint of disposed dredged material at this site. The 9-mile site would require a four square nmi site to contain the footprint of the disposal mound within the site boundaries compared to a one square nautical mile site for the 4.5-mile site.

- Designation of the 4.5-mile site would require significantly less consumption of resources (e.g., fuel, federal dollars) than the 9-mile site for transportation of dredged material for disposal.
- Designation of the 4.5-mile site would result in significantly less air emissions from the disposal vessel than the 9-mile site.
- Monitoring of the 4.5-mile site would be less costly and less difficult than monitoring the 9-mile site due to the 9-mile site's greater depths and distance from shore.

2.6.2 Port Everglades Harbor Preferred Alternative

Based on comparison of the alternative sites to the general and specific criteria, the 4-mile site was selected by EPA and the USACE as the preferred alternative. This site was selected for the following reasons:

- Sediment surveys of the site indicate that sediments within the 4-mile site are similar to the dredged material proposed for disposal. Sediments in the northern portion of the 7-mile site are also sandy and similar to proposed dredged material. However, the southern portion of the 7-mile site consists of low relief limestone hard bottom. Disposal of dredged material in this area would result in a significant change in the benthic characteristics.
- No significant impacts to resources or amenity areas (e.g., offshore coral reefs) are expected to result from designation of either the 4-mile or 7-mile site.
- Potential impacts to surface and mid-water dwelling organisms are expected to be insignificant regardless of which of the alternative sites is used for dredged material disposal.
- Potential impacts to bottom-dwelling organisms are considered significant at either of the considered alternative sites. However, the area of impact is expected to be greater at the 7-mile site due to the greater footprint of disposed dredged material at this site. The 7-mile site would require a four-square nautical mile site to contain the footprint of the disposal mound within the site boundaries compared to a one square nautical mile site for the 4-mile site. In addition, disposal of dredged material on the low relief limestone hard bottom within the southern half of the 7-mile site would likely result in a change from a hard bottom to a soft bottom benthos.
- Designation of the 4-mile site would require significantly less consumption of resources (e.g., fuel, federal dollars) than the 7-mile site for transportation of dredged material for disposal.
- Designation of the 4-mile site would result in significantly less air emissions from the disposal vessel than the 7-mile site.
- Monitoring of the 4-mile site would be less costly and less difficult than monitoring the 7-mile site due to the 7-mile site's greater depths and distance from shore.

3.0 AFFECTED ENVIRONMENT

3.1 General Environmental Setting

This section contains a description of the existing environment that may be affected by the disposal of dredged materials at the proposed ODMDSs. This information serves as a basis for projecting environmental impacts that could result from the disposal of dredged material in these regions of the Atlantic Ocean. The information presented in this section was synthesized from both literature and field evaluations.

Site location maps for the Palm Beach Harbor and the Port Everglades Harbor preferred sites are presented in figures 1 and 2, respectively. The alternative sites are located on the Florida-Hatteras Slope off the East Florida Escarpment. East of the Florida-Hatteras Slope lies the Florida Channel, a narrow natural channel running between the slope and the Bahama Banks.

Significant river systems are not abundant in southeastern Florida, and thus riverine runoff does not heavily influence the coastal waters in which the sites are located. The movement of ocean currents such as the Gulf Stream serves as a primary influence on water characteristics in the area.

3.2 Geological Characteristics

3.2.1 Geologic History

The Florida peninsula is the exposed portion of a wide, relatively flat geological feature known as the Florida Platform, which separates the deep waters of the Gulf of Mexico from those of the Atlantic Ocean (Florida Geological Survey, 1994). During the Paleogene Subperiod (66-24 million years ago [Ma]), the Florida Platform was very similar to the modern Bahama Banks, and consisted of a broad area over which carbonate sediments were deposited. The carbonate sediments were deposited by biological processes and consisted largely of the fossil remains of marine organisms. Very little siliciclastic material (sand, silt, and clay) was deposited on the Platform due to the scouring action of a marine current similar to the modern Gulf Stream. In the late Paleocene the renewed uplift of the Appalachian Mountains produced large volumes of siliciclastic sediments that inundated the Platform and encroached upon the carbonate-depositing environments. Siliciclastic deposition became dominant in the Neogene Subperiod (24-2 Ma), with carbonate deposition occurring only as thin beds and lenses within siliclastic deposits. Phosphate deposition also began at this time, in response to upwelling phosphorus-rich water from deep ocean basins. Ice ages in the Quaternary Period (2-0 Ma) exposed large areas of the Platform and allowed the erosion and dissolution of carbonate deposits, resulting in the ubiquitous karst topography found throughout Florida. The subsequent sea level rise following glaciation intervals submerged much of the Platform again. Siliciclastic and carbonate deposition continue to occur in modern times, although the action of the Gulf Stream serves to restrict the amount of sediment deposited.

3.2.2 Physiography

The Florida Platform has an arbitrary termination that coincides with the 300-ft bathymetric contour of the surrounding waters. The Platform extends approximately 100 miles offshore in the Gulf of Mexico, but extends only three to four miles offshore from Palm Beach Harbor to Miami. Water depths increase rapidly within relatively short distances from the edge of the Platform, creating what is known as the Florida Escarpment. The Florida Escarpment is divided into segments according to geographic location; the East Florida Escarpment is the segment located near the project sites. The continental shelf in the vicinity of the East Florida Escarpment is very narrow relative to more northern portions of the Atlantic coastline. Shelf width in the vicinity of the project areas is less than 1.25 miles off the coast, compared with a shelf width of 75 miles off the coast of Georgia (Uchupi, 1968, Murray, 1961). Near Miami, the East Florida Escarpment terminates in a shelf-like platform known as the Miami Terrace. This terrace extends from latitude 26°30’ to latitude 25°20’ and has a maximum width of 22 km. The depth of the terrace ranges from 245-350 m (804-1148 ft) (Uchupi, 1968). The Miami Terrace appears to represent a relict carbonate platform.

The alternative ODMDSs for both areas are situated on the Florida-Hatteras Slope, which lies immediately east of the East Florida Escarpment. The continental shelf width near the proposed Palm Beach Harbor ODMDSs is 1.17 km (0.73 miles); shelf width near the proposed Port Everglades Harbor ODMDSs is approximately 1.16 km (0.73 miles) (Uchupi, 1968). The Florida-Hatteras Slope has a declivity in the Georgia-Florida region of approximately 1° to depths of 300-500 fathoms (1,800-3,000 ft).

3.2.3 Palm Beach Harbor

4.5-Mile Site (Preferred Site)

The preferred site for the proposed Palm Beach Harbor ODMDS is situated on the Florida-Hatteras Slope. Depths at the proposed site range from about 509 ft (155 m) to 607 ft (185 m). The depth at the center of the proposed site is approximately 558 ft (170 m). A bathymetric map of the vicinity of the proposed ODMDS is presented as Figure 3.

Siliciclastic sediments dominate the area. A January 1989 survey report indicates that surficial sediments in the proposed ODMDS area are comprised primarily of fine-to-very-fine sand sediment texture. Sediment samples from sample stations to the northwest and south-southwest of the proposed site are largely medium-to-fine sand and finer sediments (less than 25% silt), respectively.

A sidescan sonar survey (Appendix E) conducted at the alternative ODMDSs by EPA in August 1998 revealed a relatively uniform fine sandy bottom throughout the site and in areas two miles north and south of the 4.5-mile site. Mean grain size for samples taken at the site ranged from 0.14-0.17 mm, with silts and clays comprising approximately 25-35% of total sediments. No areas of hard bottom or potential wrecks were identified through the sidescan record within the site or in the two-mile areas north and south of the site.

9-Mile Candidate Site

The 9-mile site is also situated on the Florida-Hatteras Slope. Depths at this site range from 855 ft (260 m) to 985 ft (300 m). Bathymetric data for this site can be found in Figure 1.

Sidescan sonar data from the 1998 EPA survey indicated that the seafloor at the site consists of relatively uniform fine sandy bottom. Mean grain size was 0.21 mm, with silts and clays accounting for 18-23% of total sediments. A few scattered acoustical targets were detected within the site boundaries. These sites are not believed to represent any significant resources.

3.2.4 Port Everglades Harbor

4-Mile Site (Preferred Site)

The preferred site for the proposed Port Everglades Harbor ODMDS is also situated on the Florida-Hatteras Slope. Based on studies conducted in the area, depths at the proposed site range from approximately 640 ft (195 m) to 705 ft (215 m). The depth at the center of the proposed site is approximately 656 ft (200 m). Bathymetric data for this site is presented in Figure 3.

PROJECT AREA BATHYMETRY

Palm Beach/ Port Everglades FEIS

Palm Beach and Broward Counties, Florida

USGS 1:250,000 Series West Palm Beach (1987) Quadrangle and NOAA Bahamas (1988) Bathymetric Map

GEC Gulf Engineers & Consultants

Figure: 3
Date: February 2004
Scale:1:370,000
Source: USGS/GEC/NOAA

Video/sidescan sonar surveys conducted in March and October 1986 found surficial sediments in the proposed ODMDS area to be comprised primarily of fine-to-coarse grained sand substrate with small isolated patches of cobbles or coralline rubble scattered over the site.

The August 1998 EPA sidescan sonar survey of the proposed ODMDS site indicated a relatively uniform sandy bottom with an east-west oriented low relief ridge in the center of the site and an east-west oriented low relief ridge to the northwest of the site. Samples exhibited a mean grain size of approximately 0.18 mm with silts and clays comprising 16% of total sediments. A number of scattered acoustic targets of varying size were observed in the survey area. Three small targets were located within the site boundaries and one small target was located immediately adjacent to the site. Outside of the site, one acoustical target appears to represent craters or freshwater vents and five acoustical targets were identified as possible wrecks. None of these targets, however, is found within or immediately adjacent to the proposed site.

7-Mile Candidate Site

The 7-mile site is located on the Florida-Hatteras Slope. Depths at the site range from 785 ft (240 m) to 920 ft (280 m).

The August 1998 EPA sidescan sonar survey of the site indicated a transition from a relatively uniform sandy bottom in the north to a relatively uniform low relief hard bottom in the south. Rock samples taken from the site consisted of slightly dolomitic fossiliferous limestone with magnesite dendrites. Mean grain size in the northern portion of the site was approximately 0.22 mm with silts and clays comprising 10-18 % of total sediments. A few scattered acoustical targets were detected during the survey. These targets, which were not identified, appeared on the receiving equipment as dark acoustic signals with shadows.

3.3 Threatened or Endangered Species

Several threatened and endangered species could pass through the vicinity of the alternative ODMDSs. Marine species classified by the U.S. Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), and the Florida Fish and Wildlife Conservation Commission (FFWCC) as endangered or threatened in shore or coastal waters off Palm Beach Harbor and Port Everglades Harbor are listed in Table 3. Marine species classified as candidate species by NMFS are listed in Table 4. Candidate species are not protected under the Endangered Species Act, but concerns about their status indicate that they warrant listing in the future. Federal agencies and the public are encouraged to consider these species during project planning so that future listings may be avoided.

Blue whales (*Balaenoptera musculus*) are found in all oceans of the world, inhabiting waters ranging from tropical to polar. The species feeds primarily on krill. Most populations of blue whales are migratory. Populations typically spend winter in low latitude waters, migrate toward the poles in spring, feed in high latitude waters during summer, and migrate back toward low latitude waters in fall. Blue whales inhabit open ocean waters.

Table 3. List of Threatened or Endangered Species that Might be Found in the Vicinity of the Alternative Palm Beach Harbor and Port Everglades Harbor ODMDSs

Common Name	Scientific Name	Status
Mammals		
Blue whale	*Balaenoptera musculus*	Endangered
Finback whale	*Balaenoptera physalus*	Endangered
Humpback whale	*Meqaptera novaeangliae*	Endangered
Right whale	*Eubalaena glacialis*	Endangered
Sei whale	*Balaenoptera borealis*	Endangered
Sperm whale	*Physeter catodon*	Endangered
West Indian Manatee	*Trichechus manatus*	Endangered
Reptiles		
Green sea turtle	*Chelonia mydas*	Endangered[(1)]
Hawksbill sea turtle	*Eretmochelys imbricata*	Endangered
Kemp's Ridley sea turtle	*Lepidochelys kempi*	Endangered
Leatherback sea turtle	*Dermochelys coriacea*	Endangered
Loggerhead sea turtle	*Caretta caretta*	Threatened
Fish		
Shortnose sturgeon	*Acipenser brevirostrum*	Endangered
Smalltooth sawfish	*Pristis pectinata*	Endangered
Seagrasses		
Johnson’s seagrass	*Halophilia johnsonii*	Threatened

Notes: (1) Green sea turtles are listed as threatened, except for breeding populations of green sea turtles in Florida and on the Pacific Coast of Mexico, which are listed as endangered.

Source: USFWS, FGFWFC, 1997; NMFS, 2002.

Table 4. List of Candidate Species that Might be Found in the Vicinity of the Alternative Palm Beach Harbor and Port Everglades Harbor ODMDSs

Common Name	Scientific Name	Status
Fish		
Dusky shark	*Carcharhinus obscurus*	Candidate
Sand tiger shark	*Odontaspis taurus*	Candidate
Night shark	*Carcharhinus signatus*	Candidate
Speckled hind	*Epinephelus drummondhayi*	Candidate
Atlantic sturgeon	*Acipenser oxyrhinchus oxyrhinchus*	Candidate
Mangrove rivulus	*Rivulus marmoratus*	Candidate
Opossum pipefish	*Microphis brachyurus lineatus*	Candidate
Key silverside	*Menidia conchorum*	Candidate
Goliath grouper	*Epinephelus itajara*	Candidate
Warsaw grouper	*Epinephelus nigritus*	Candidate
Nassau grouper	*Epinephelus striatus*	Candidate

Source: NMFS, 2002.

Finback whales (*Balaenoptera physalus*) also have a cosmopolitan distribution, occurring in all of the world oceans. The species feeds primarily on krill and small schooling fish. Aerial surveys conducted for USFWS in 1980-1981 failed to detect the presence of this species (Fritts *et al*., 1983). Darnell *et al*. (1983) illustrate finback whale habitat as waters at the continental slope and deeper, possibly accounting for the recorded absence of this species during the survey.

Humpback whales (*Megaptera novaeangliae*) are a coastal species that feed primarily on krill and fish. Humpbacks have cosmopolitan distributions and exhibit distinct seasonal migratory patterns. This species can be found in the northernmost reaches of the Atlantic Ocean from spring through early fall. In early fall, they migrate to the Caribbean for calving and breeding. Humpbacks have been sighted in deep water off southeast Florida (Schmidly, 1981).

Right whales (*Eubalaena glacialis*) are the most endangered cetacean species in the western Atlantic. The population size in the Atlantic is currently unknown. Right whales are specialized "skimmers" that feed primarily by swimming slowly through dense concentrations of copepods with their mouths open. They typically feed at or just below the water surface. These whales commonly pass along the coast from North Carolina to Florida during their winter and spring migrations (Schmidly, 1981). The study area is located south of right whale critical habitat.

Sei whales (*Balaenoptera borealis*) usually travel in groups of two to five individuals, feeding primarily on copepods, krill, and small schooling fish (Schmidly, 1981). The migratory patterns of this species are poorly known. Apparently, sei whales are present off the coast of New England

during winter. However, the distribution pattern of this species in the western North Atlantic during other times of the year is unknown (Schmidly, 1981). These large cetaceans generally inhabit the continental slope and deep oceanic waters; however, they are occasionally sighted near shore (Schmidly, 1981).

The West Indian manatee (*Trichechus manatus*) inhabits primarily inshore waters of southeastern Florida throughout the year (Provancha and Provancha, 1988). Manatees tend to concentrate in areas at least 2 m deep with submerged aquatic vegetation (Zieman, 1982) and an availability of warm water during winter cold snaps.

Although marine turtles occasionally enter estuaries, they generally prefer higher salinity waters. Nesting may occur throughout the most of their range, but most nesting occurs on restricted areas of beach that turtles return to each nesting season. Foraging areas are often distant from nesting beaches and in order to nest, turtles may migrate long distances. Mating generally takes place in offshore waters near the nesting beach and males rarely come ashore (Fuller, 1978).

Green sea turtles (*Chelonia mydas*) are most abundant between 35° N latitude and 35° S latitude, particularly in the Caribbean. The green sea turtle usually frequents shallow reefs, shoals, lagoons, and bays where marine grasses and algae are plentiful. Its preferred nesting sites are steep, sloped beaches, well above high tide, in the Yucatan Peninsula, Caribbean, and Florida (Minerals Management Service [MMS], 1989).

The loggerhead sea turtle (*Caretta caretta*) occurs throughout the warm and temperate oceanic waters worldwide. The species has been observed as far as 500 miles offshore. Loggerheads frequent natural and manmade structures, including oil and gas platforms, where they forage on benthic invertebrates, fish, and aquatic vegetation. About 90% of the total nesting in the United States occurs on the south Atlantic coast of Florida (Fritts *et al*., 1983). Loggerhead densities seem to be highest during summer months (Fritts *et al*., 1983).

The leatherback sea turtle (*Dermochelys coriacea*) has a pantropical distribution and is probably are the most oceanic of all sea turtles, preferring deep waters (Rebel, 1974). Leatherback sea turtles migrate widely and have been reported as far north as Nova Scotia (Lazell, 1980). Major rookeries are rare for this species and dispersed nesting is common.

Hawksbill sea turtles (*Eretmochelys imbricata*) inhabit reefs and shallow coastal areas and passes in water less than 15 m deep, where they feed on benthic invertebrates and vegetation (Fuller *et al*., 1987). The hawksbill is a solitary nester between 25° N latitude and 25° S latitude, including the southeast coast of Florida.

The Kemp's Ridley sea turtle (*Lepidochelys kempi*), while having a pantropical distribution, is probably the most endangered of the sea turtles. Ridley sea turtles commonly inhabit shallow coastal and estuarine waters. Their nesting is restricted to a small stretch of beach near Rancho Nuevo, Ramaulipas, Mexico.

The shortnose sturgeon (*Acipenser brevirostrum*) inhabits the Atlantic seaboard of North America from New Brunswick, Canada to Florida. The species is anadromous, migrating from salt water to spawn in fresh water. It spends most of its life in its natal rivers or estuaries. The species feeds on a variety of bottom-dwelling organisms including worms, aquatic insect larvae, plants, snails, shrimp,

and crayfish. The shortnose sturgeon population in Florida inhabits primarily nearshore and estuarine environments in northern portions of the state.

The smalltooth sawfish (*Pristis pectinata*) may also occur in the project area, although the species has not been documented in the project area vicinity. The species inhabits shallow coastal waters and estuaries. It is usually found in shallow waters very close to shore over muddy and sandy bottoms and is often found in sheltered bays, on shallow banks, and in estuaries or river mouths. The smaltooth sawfish feeds primarily on fish, but also ingests crustaceans. The current range of this species has contracted to peninsular Florida, and smalltooth sawfish are relatively common only in the Everglades region at the southern tip of the state. No accurate estimates of abundance trends over time are available for this species.

Johnson's seagrass (*Halophilia johnsonii*) is a very small (no larger than 2 inches) flowering marine plant with a very limited geographic distribution. The species grows on a variety of sediment types ranging from mud to coarse sand. It is found in estuaries and coastal lagoons along the Florida Coast from Sebastian Inlet to Biscayne Bay. Large patches of this species are reported to occur in Lake Worth Lagoon, south of West Palm Beach. Johnson's seagrass most frequently grows from the intertidal zone to a depth of approximately 6 ft below mean tidal height, although it has been reported at depths of 12 ft or deeper in clear water and tidal deltas adjacent to inlets.

In a letter received 24 May 2004, NMFS indicated that adverse impacts were unlikely to occur to the shortnose sturgeon, smalltooth sawfish, or any of the whale and turtle species listed above as a result of project activities (see Appendix B).

This FEIS will serve as a Biological Assessment for purposes of coordination in accordance with Section 7 of the Endangered Species Act. Designation of the Palm Beach Harbor ODMDS and Port Everglades Harbor ODMDS is not expected to adversely impact any threatened or endangered species.

3.3.1 Palm Beach Harbor

In a letter dated November 19, 1986, NMFS concurred with the Biological Assessment (BA) prepared by the USACE, which determined that populations of endangered/threatened species would not be adversely affected by the designation and use of an ODMDS for the Palm Beach Harbor. However, in light of the date of this initial coordination, an updated BA has been written to reflect current conditions and data. This BA was submitted to NMFS for concurrence as part of the DEIS. A copy of the updated BA is included in Appendix F.

3.3.2 Port Everglades Harbor

A similar updated BA was submitted to NMFS for the Port Everglades Harbor preferred site. A copy of this updated BA is included in Appendix G.

3.4 Hardgrounds

Areas of hard bottoms are scattered throughout the continental shelf of the southeastern United States. These areas have been termed "live bottoms" because they generally support a diversity of

sessile invertebrates such as corals and sponges. Because of their biological and physical complexity, live bottom habitats attract both commercial and recreational fish species.

From West Palm Beach to the Florida Keys, there are generally three separate series of reefs or hard bottoms. Typically, there is a sand and rubble zone between the first and second hard bottom areas and more abundant sand pockets between the second and third hard bottom areas. The biological communities in and adjacent to these proposed hardbottom areas are relatively consistent, although their exact species composition may vary from site to site based on physical parameters such as distance from shore and hardground profile. No hardbottom natural reefs have been observed within the proposed project areas. The regional hardbottom habitat and the locations of hard bottom natural reefs near the proposed project areas are provided in figures 4 and 5, respectively.

Exposed nearshore and surf zone hard bottom in Palm Beach County consists of outcrops of coquina rock that are part of the Anastasia Formation. These outcrops, commonly referred to as "beach rock," are comprised of coquina shells, sand and calcareous limestone (Hoffmeister *et al*., 1967). The Anastasia formation extends from St. Augustine to slightly south of Boca Raton, where it grades into the contemporaneous Miami Oolite formation (Lovejoy, 1987). The Miami Oolite formation, outcropping in Broward County, is composed of minute calcareous spherules or ooids formed in seawater by precipitation of lime and eventually become bound by secondary calcite to form a hard substrate (Hoffmeister *et al*., 1967).

The classic reef distribution pattern described for southeast Florida reefs north of Key Biscayne consists of an inner reef in approximately 15 ft (8 m) to 25 ft (8 m) of water, middle patch reef zone in about 30 to 50 ft (9 to 15 m) of water, and an outer reef in approximately 60 ft (18 m) to 100 ft (30 m) of water. This general description was first published by Duane and Meisburger (1969) and has been the basis of descriptions of hardground areas north of Miami (Goldberg, 1973; Courtenay *et al*., 1974; Lighty *et al*., 1978; Jaap, 1984). The reefs north of Palm Beach Inlet do not show the same orientation to shore as those to the south and the classical "three reef" hardgrounds description begins to differ north of that inlet (Avent *et al*., 1977; Continental Shelf Associates, Inc., 1993).

The composition of hardground biological assemblages along Florida's east coast has been detailed by Goldberg (1970; 1973), Marszalek and Taylor (1977), Raymond and Antonius (1977), Marszalek (1978), Continental Shelf Associates, Inc. (1984; 1985; 1987; 1993), Wheaton (1987), and Blair and Flynn (1989). Although there is a large variety of hard coral species growing on the reefs north of Miami, these corals are no longer actively producing the reef features. The reef features seen north of Miami have been termed "gorgonid reefs" (Goldberg, 1970; Raymond and Antonius, 1977) because they support such an extensive and healthy assemblage of octocorals. Goldberg (1973) identified 39 species of octocorals from Palm Beach County waters. EPA (1992) lists 46 species of shallow water gorgonids as occurring along southeast Florida. Surveys by Continental Shelf Associates, Inc. (1984; 1985) identified 33 sponges, 21 octocoral, and 5 hard coral species on the offshore reefs off Ocean Ridge and 40 sponges, 18 octocoral, and 14 hard coral species on the offshore reefs off Boca Raton. Wheaton (1987) identified 17 octocoral species on the deep reefs off the City of Palm Beach. Blair and Flynn (1989) compared the reefs and hard bottom communities to

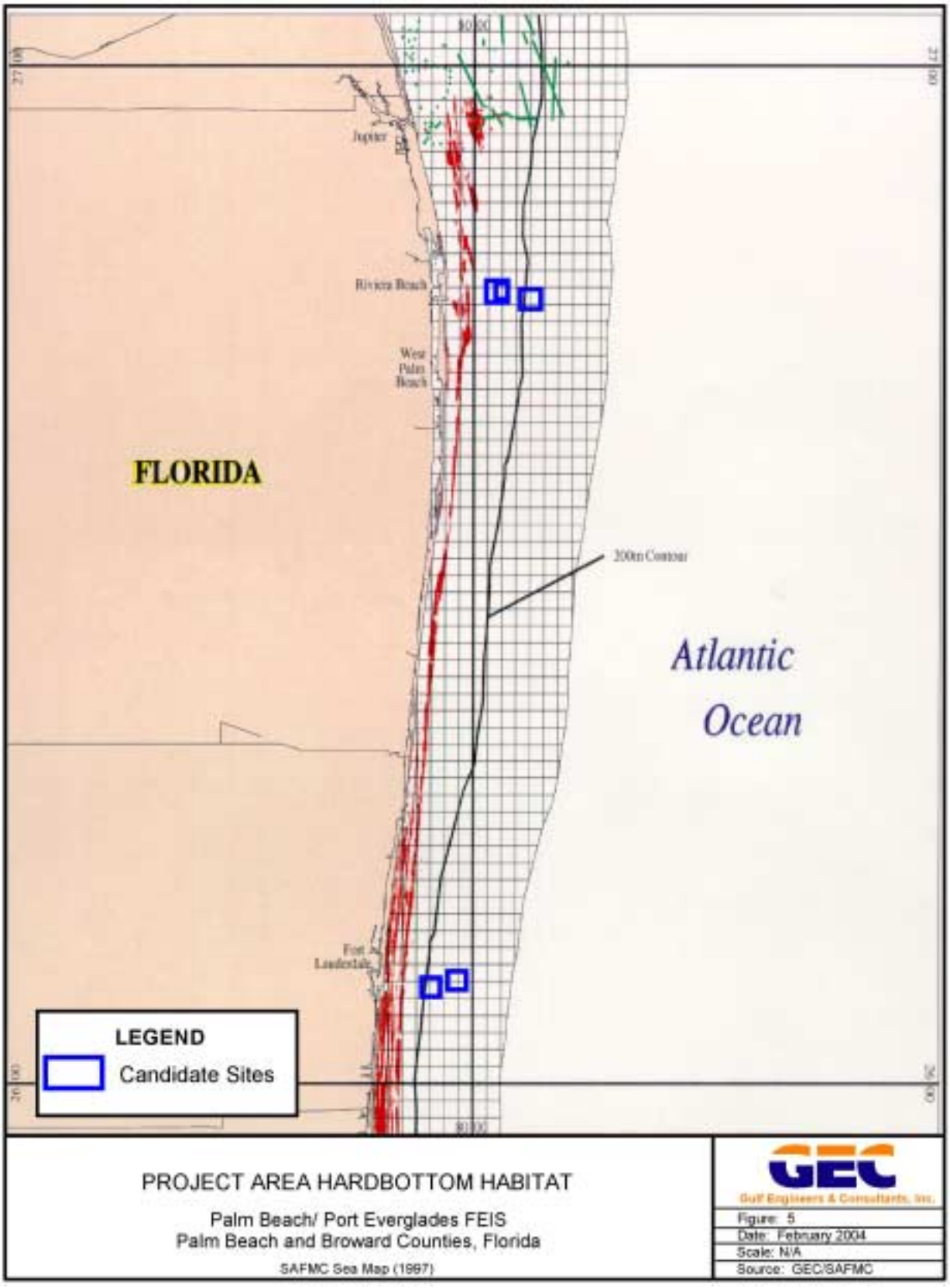
ATLANTIC COAST CONTINENTAL SHELF HABITAT

Palm Beach/ Port Everglades FEIS
Palm Beach and Broward Counties, Florida

SAFMC Sea Map (1997)

GEC
Gulf Engineers & Consultants, Inc.

Figure: 4
Date: February 2004
Scale: N/A
Source: GEC/SAFMC


Jupiter
Riviera Beach
West Palm Beach
FLORIDA
200m Contour
Atlantic Ocean
Fort Lauderdale
LEGEND
Candidate Sites
PROJECT AREA HARDBOTTOM HABITAT
Palm Beach/ Port Everglades FEIS
Palm Beach and Broward Counties, Florida
SAFMC Sea Map (1997)
GEC
Gulf Engineers & Consultants, Inc.
Figure: 5
Date: February 2004
Scale: N/A
Source: GEC/SAFMC

the offshore reef communities from Broward and Palm Beach counties. They documented a decrease in the hard coral species density moving northward from Dade County to Palm Beach County. Despite this gradual decrease in the density of hard coral species present, the overall hardground assemblage of hard corals, soft corals, and sponges seen along southeast Florida's offshore reefs remains remarkably consistent.

Several distribution surveys of hermatypic (reef-building) and ahermatypic (solitary) corals have been conducted near the proposed ODMDSs (Goldberg, 1973; Reed, 1980; Parker *et al*., 1983; and for overviews see Jaap, 1984; Porter, 1987). Typically, reef-building corals occur in the shallow water photic zone due to their symbiotic relationship with zooxanthellae (Jaap, 1984; Porter, 1987). Zooxanthellae are dinoflagellates, which require light to photosynthesize.

Ahermatypic corals can be found in deeper water since they do not have an obligate relationship with zooxanthellae. These types of corals require hard substrate to settle and survive. Colonies of the deep-water coral *Oculina varicosa* have been observed as scattered, isolated forms in the vicinity of the preferred (4.5-mile) site for Palm Beach Harbor (around 26°45'N and 79°59'W) (Reed, 1980). Colonies of *Oculina* in general extend north from Palm Beach Harbor and parallel the break between the edge of the continental shelf and the Florida-Hatteras slope, which parallels the 80°W meridian. The *Oculina* reefs occur approximately 1.7 nmi (3.2 km) west of the preferred (4.5-mile) site for Palm Beach Harbor and 7.4 nmi (13.7 km) west of the 9-mile candidate site; the reefs are not known to be in the vicinity of Port Everglades Harbor. Video surveys conducted by Continental Shelf Associates (CSA) did not reveal the presence of such substrates in the preferred (4.5-mile) ODMDS for Palm Beach Harbor.

The polychaete worm family Sabellariidae forms extensive reefs in shallow marine waters. These polychaetes use sand particles and a proteinaceous cement to build their dwelling tubes. As development continues, these tubes eventually form large colonies in the surf zone on shores exposed to the open sea. These colonies provide habitat to large invertebrate faunal communities of mostly crustaceans and molluscs, and provide food and shelter for transient and permanent fish faunas (Kirtley, 1974; Gore *et al*., 1978; Van Montfrans, 1981; Gilmore *et al*., 1981). Sabellarid reefs occur south of Cape Canaveral and near shore in up to 33 ft (10 m) of water along Palm Beach and northern Broward counties (Jones *et al*., in Seaman, 1985).

Rock outcrops serve as a habitat for epibenthic species that can secure themselves to the hard substrate. The exact composition of the community developed around such outcrops depends upon the physical features of the specific outcrop, its distance from shore, and its vertical relief. The width and vertical profiles of an outcrop formation determine its overall significance both as a biological resource and as a natural wave break. Larger outcrops normally show an increase in habitat heterogeneity, which in turn is reflected in increased biomass, greater species abundance, and increased biodiversity (Peters and Nelson, 1987; Luckhurst and Luckhurst, 1978; Vare, 1991).

The epibenthic community associated with low profile, smooth, intertidal and subtidal rock outcrops is best characterized as an algal mat community dominated by a number of filamentous algal species, including *Cladophora* sp., *Chaetomorpha linum*, and *Gelidiopsis panicularis*. Other algal species observed commonly only on subtidal rocks include *Jania rubens*, *Wrangelia argus*, and *Bryothamnion seaforthii*. The green alga *Ulva lactuca* and the barnacle *Tetraclita squamosa* are dominant species on exposed intertidal rocks (Continental Shelf Associates, Inc., 1984). Along rock outcrops offering greater profile, the algal community is dominated by *Caulerpa sertularioides*,

Dasycladus vermicularis, *Pidina* sp., *Dictyota* sp., *Halimeda* sp., and *Lyngbya* sp. (Vare, 1991). Other large macroalgal species characteristic of southeast Florida nearshore rock outcrops are *Bryothamnion seaforthii*, *Wrangelia argus*, *Codium* sp., *Gracilaria* sp., and *Caulerpa racemosa* (Continental Shelf Associates, 1985). The type of marine algae present at a given location is dependent upon the chemical nature of the substratum and the physical nature of the environment at that location. Taylor (1979) suggested that along the nearshore rock outcrops of southeast Florida, wave action and sand scouring are the factors controlling algal community distribution.

Commercially, the most important invertebrate species directly associated with these hardground areas is the Florida lobster, *Panulirus argus*. The reefs are also economically important as the foundation for a thriving sports diving industry. Herrema (1974) listed 206 species of primary reef fish as occurring off Palm Beach and Broward counties. This assemblage is numerically dominated by wrasses, damselfishes, sea basses, parrotfishes, grunts and angelfishes. The precise composition of the fish assemblage associated with any given location along these hardground areas is dependent upon the structural complexity of the reef at that location.

3.5 Fish and Wildlife Resources

Several species of marine mammals, in addition to those listed in Section 3.3 above, may occur in area waters. The most abundant and widespread inshore mammal is the bottlenose dolphin (*Tursiops truncatus*) while the spotted dolphin (*Stenella plagiodon*) is probably the most common species offshore (Schmidly, 1981). There have been numerous reports of stranding of the short finned pilot whale (*Globicephala macrorhyncha*) along the southeast coast of Florida. Other marine mammals are infrequently (sometimes singular or unverified) reported from the eastern coast of Florida include the Antillean beaked whale (*Mesoplodon europaeus*), pygmy sperm whale (*Kogia breviceps*), goose-beaked whale (*Ziphius cavirostris*), killer whale (*Orcinus orca*), common dolphin (*Delphinus delphis*), long-snouted dolphin (*Stenella longirostris*), and the California sea lion (*Zalophus californianus*).

The biological communities addressed in the following sections are plankton, benthos including benthic macrofauna, benthic meiofauna, and epibenthic invertebrates, and nekton. Species of special concern, which may utilize the proposed vicinity of the proposed ODMDSs, are also addressed. Disposal impacts on planktonic communities are generally considered to be temporary, while larger, motile organisms (nekton) are able to avoid disposal operations and localized areas of poor water quality.

3.5.1 Plankton

Plankton includes plants and animals that live in the water column and are passively carried by the currents. There are two types of plankton: tiny plants called phytoplankton, and weak-swimming animals called zooplankton. Some are larval forms that will grow into non-planktonic adults. Others will remain planktonic for their entire lives.

Specific studies of plankton are lacking in the vicinity of the alternative ODMDSs. Many species of phytoplankton and zooplankton are cosmopolitan. Endemic planktonic populations are rare (Lackey, 1967; Wood, 1965; Steidinger, 1973). As a result, it is expected that planktonic species similar to those reported from southeastern U.S. estuaries and coastal waters are present in the vicinity of the alternative ODMDSs. Over 900 species of diatoms and 400 species of dinoflagellates have been reported from waters along southeastern United States and Gulf coasts (Simmons and Thomas, 1962;

Hurlburt, 1967; Marshall, 1971; Dardeau *et al*., in press). The dominant components of the phytoplankton community are diatoms (*Skeletonema costatus*, *Chaetoceros* spp., *Coscinodescus* spp., *Nitzschia seriata*, *Rhizosolenia* spp., *Thalassiothrix frauenfeldii*, *Thalassionema nitzschioides*, and *Asterionella japonica*) and dinoflagellates (*Ceratium hircus*, *Gymnodinium splendens*, *Glenodinium* spp., *Gyrodinium* spp., *Polykrikos* spp., *Peridinium* spp., *Gonyaulax* spp., and *Goniodoma* spp.) (Dardeau *et al*., in press). Other macroplankton from the surface to depths of 750 m included eight heteropod and 15 thecosome species (Michel and Michel, 1991).

Species abundance and density of phytoplankton is usually inversely related to increasing salinity (i.e., from the head of the estuary seaward) (Hurlburt, 1967; Kinne, 1967). However, the highest species diversity has been reported from areas affected by river discharge where both riverine and oceanic species coexist. Seasonally, phytoplankton biomass and production is highest during warmer months in estuarine and nearshore waters (Dardeau *et al*., in press). This seasonality is thought to be influenced by riverine flow rates into estuaries and estuarine discharge into nearshore waters. Two surveys comparing phytoplankton assemblages over the continental shelf of Florida and in the Gulf Stream detected some differences in species composition and abundance. Over the shelf and western border of the Gulf Stream, diatoms were the dominant component of the phytoplankton community. In the Gulf Stream, coccolithophores, pyrrhophyceans, and silicoflagellates increased in diversity and abundance (Hurlburt, 1967; Marshall, 1971).

Copepods are normally the dominant component of the zooplankton community, but other organisms, particularly the larvae of benthic organisms, can be seasonally abundant (Dardeau *et al*., in press). The copepods *Acartia tonsa* and *Paracalanus crassirostris*, and the appendicularian *Oikopleura dioica*, can be expected to dominate the zooplankton community. Copepods typically dominate estuarine and nearshore zooplankton communities throughout the south-eastern United States. *Acartia tonsa*, because of its large size, most frequently dominates the zooplankton community biomass (Dardeau *et al*., in press). Typically, zooplankton abundance and biomass are highest during summer months.

3.5.2 Benthos and Nekton

The benthos consists of plants and animals that live permanently in or on soft and rocky bottoms. Benthic animals are found at all depths and are associated with all substrates. Epifauna contains the largest amount of benthic animals. Specifically, these are the animals that live on or are attached to the surface of rocky areas or firm sediments. Animals that live buried in the substrate are associated with soft sediments such as sand or mud.

The macrofauna are the animals retained by mesh sieves greater than 0.5 mm. Meiofauna are microorganisms that can be caught in sieves with holes ranging between 0.062 mm and 0.5 mm. Individuals belonging to meiofaunal group include foraminifera, copepods, nematodes, and podocopid ostracods.

The nekton characterizes those species that actively swim and move freely in the ocean. The only invertebrate animals among this group are the squid and a few species of shrimp. The other members of the nekton are vertebrates such as fishes, reptiles and mammals.

3.5.3 Palm Beach Harbor

A 1989 report of a survey conducted by CSA in the vicinity of the preferred (4.5-mile) site showed that annelids, molluscs, and arthropods were the dominant benthic taxonomic groups in terms of abundance and number of taxa. The percentage of total abundance (number of taxa) was 59% (38) for annelids, 25% (33) for molluscs, and 6% (40) for arthropods. This survey verified the findings of a November 1984 survey, which showed similar macrofauna distribution. One station in this survey was located close to the vicinity of the preferred (4.5-mile) ODMDS and showed that the percentage of total abundance (number of taxa) was 67% (52) for annelids, 23% (15) for molluscs, and 3% (12) for arthropods. Data was further collected in 1998. This data indicated that annelids and arthropods dominated the alternative sites.

The 1989 study showed 124 families and a mean density of 2,246 individuals/m^2 (CSA, 1989). Annelids (51%) and arthropods (9%) were the most abundant groups of the total fauna.

In a 1998 survey, EPA collected taxonomic data for the alternative sites. The taxonomic composition consisted of 1,318 individuals and 160 taxa across 71 families (see Appendix H). Densities ranged from 305 to 592 individuals/m^2 with a mean density of 421 individuals/m^2. This contrasted with a 1984 study that found 392 taxa present and a mean density of 2,840 individuals/m^2 (Barry Vittor and Associates, 1985).

The 1998 survey contained information regarding the infaunal composition of the alternative sites. At the preferred (4.5-mile) site, annelids and arthropods comprised 42% and 13% of the total community respectively. The mean number of taxa at the site was 46 and the mean density was 405 individuals/m^2. The candidate (9-mile) site contained annelid and arthropod assemblages comprising 80% and 5%, respectively, of the total community. The mean number of taxa at this site was 62; the mean density at the site was 433 individuals/m^2.

The most abundant macrofaunal taxonomic group represented in samples from the vicinity of the preferred (4.5-mile) site was bivalves, which could not be identified to family levels. Polychaete families characteristic of the area included Paraonidae and Spionidae. The isopod family Anthuridae was found in high numbers only at one station of the survey area and was absent from some of the other stations.

Vare (1991) listed a total of 42 encrusting and 33 non-encrusting macroinvertebrate species found along the nearshore rock outcrops of Palm Beach County. Six phyla were observed in order of descending percent composition: 45% for Cnidaria (26% for Hydrozoa and 19% for Anthozoa), 17% for Porifera, 11% for Mollusca, 11% for Arthropoda, 9% for Echinodermata, and 7% for Annelida. Those species with the highest frequency of occurrence were the star coral (*Siderastrea radians*), various species of wine glass hydroids (*Campanularia* spp.), several species of tube type sponges, the boring sponge (*Cliona celata*), the worm rock building polychaete (*Phragmatopoma lapidosa*), and the fire coral hydroid (*Millipora alcicornis*) (Vare, 1991). The encrusting macroinvertebrate community does not appear to vary significantly by season (Continental Shelf Associates, Inc., 1985). Mobile epibenthic species such as sea urchins, brachyuran and xanthid crabs, and the Florida lobster, *Panulirus argus*, were more frequently observed in the spring and summer than in the winter. Most of these species were seen in holes and crevices along the vertical face of rock outcroppings (CSA, 1985; Vare, 1991).

Benthic epifauna were collected by trawl from the vicinity of the preferred (4.5-mile) site. The most common invertebrates collected were Caribbean shrimp of the family Pandalidae. Only 34 individual invertebrates were collected in this survey. The dominant fish collected was the Gulf Stream flounder (*Citharichthys arctifrons*). Other fish species frequently represented in samples include the spot (*Leiostomus xanthurus*), the blackmouth bass (*Synagrops bellus*), and the small scale lizardfish (*Saurida caribbaea*) (CSA, 1989).

Surf zone fish communities are typically dominated by relatively few species (Modde and Ross, 1981; Peters and Nelson, 1987). Vare (1991) observed seven species of fish considered independent of reef or hard bottom outcrops in the nearshore sand bottom areas off Palm Beach County. Listed in order of their frequency (most common to least), these fish were the Atlantic threadfin herring (*Opisthonema oglinum*), blue runner (*Caranx crysos*), spotfin mojarra (*Eucinostomus argenteus*), southern stingray (*Dasyatis Americana*), greater barracuda (*Sphyraena barracuda*), yellow jack (*Caranx bartholomaei*), and the ocean triggerfish (*Canthidermis sufflamen*), none of which are of local commercial value. Most of the fish making up the inshore surf community tend to be either small species or juveniles (Modde, 1980).

Vare (1991) indicates that the most frequently observed, year-round resident fish species along the nearshore rock outcrops of Palm Beach County include the sergeant major (*Abudefduf saxatilis*), spottail pinfish (*Diplodus holbrooki*), cocoa damselfish (*Pomacentrus variabilis*), slippery dick (*Halichoeres bivittatus*), and doctorfish (*Acanthurus chirurgus*). All these species are considered to be reef fish with no commercial value and can be assumed to be drawn to the nearshore rock outcrops because of the hard substrate habitat (Starck, 1968).

According to the USFWS (1982), nekton of the nearshore Atlantic Ocean along West Palm Beach can generally be grouped with association to reefs, open waters off West Palm Beach and open waters of the Atlantic. The most abundant reef species include red snapper, king mackerel, cero, mutton snapper, yellowtail snapper, red grouper, gray snapper, grunts, Warsaw grouper, great barracuda, jewfish, tripletail, lane snapper, Nassau grouper, black grouper, gag, greater amberjack, wrasses, parrotfish, damselfish, butterflyfish, and surgeonfish. The major invertebrates at reef sites are the stone crab and spiny lobster. Species in open waters off West Palm Beach include sharks, skates, rays, grouper, mullet, snapper, spotted seatrout, red drum, black drum, gulf kingfish, sheepshead, striped mullet, Florida pompano, bluefish, cobia, Atlantic spadefish, little tunny, Spanish mackerel, king mackerel, sea catfish, bay anchovy, tarpon, ladyfish, permit, yellowtail snapper, red grouper, gray snapper, grunts, great barracuda, jewfish, snook, gag, greater amberjack, pinfish, white mullet, crevalle jack, silver perch, striped mojarra, blue runner, Atlantic bottlenose dolphin, Atlantic spotted dolphin, short-finned pilot whale, pygmy sperm whale, and killer whale. The major invertebrates in open water are the pink shrimp, blue crab, stone crab, and spiny lobster. Species that generally may be found in open waters of the Atlantic Ocean include cero, Atlantic bonito, sailfish, vermilion snapper, tilefish, dolphin, black grouper, greater amberjack, swordfish, blue marlin, white marlin, skipjack tuna, and blackfin tuna.

3.5.4 Port Everglades Harbor

Surveys conducted in February and November of 1984 (Barry Vittor and Associates, 1985) near the preferred (4-mile) site showed that annelids, molluscs, and arthropods were the dominant benthic taxonomic groups in terms of abundance and number of taxa. The November survey showed the percentage of total abundance (number of taxa) was 65% (55) for annelids, 10% (22) for molluscs, and 13% (21) for arthropods. Goldberg et al. (1985) reported polychaetes as the dominant taxon

from his infaunal survey off northern Broward County. Data collected by EPA in 1998 indicated that annelids and arthropods dominated the alternative sites.

In the 1998 EPA survey of the alternative sites, the taxonomic composition consisted of 1,973 individuals and 159 taxa across 65 families (Appendix H). Densities ranged from 488 to 1,239 individuals/m^2 with a mean density of 756 individuals/m^2. This contrasted with a 1984 study that found 453 taxa present and a mean density of 4,637 individuals/m^2 (Barry Vittor and Associates, 1985).

The 1998 survey revealed that annelids were the most abundant group at the alternative sites, representing 50% of the total fauna. The arthropods were the second largest group overall with 37% of the total fauna. Overall, macrofaunal samples were dominated in numbers by annelids and arthropods. All alternative sites were similar in that they had a similar number of taxa dominated by the same major taxonomic groups.

At the preferred (4-mile) site, arthropods were the most abundant group overall representing 53% of the total fauna. The ampeliscid amphipods comprised 24% and annelids comprised 37% of the total fauna. Mean densities among stations at the site ranged from 392 to 440 individuals/m^2 and total taxa ranged from 73 to 77. Conversely, annelids and arthropods comprised 62% and 23%, respectively, of the total fauna at the candidate (7-mile) site. Mean densities at this site varied from 488-1,239 individuals/m^2, while total taxa ranged from 38 to 79.

Larger members of the invertebrate macrofauna seen occasionally in these offshore soft bottom areas between the second and third reef lines include the queen helmet (*Cassia madagascariensis*), the king helmet (*Cassia tuberosa*), Florida fighting conch (*Strombus alatus*), milk conch (*Strombus costatus*), Florida spiny jewel box (*Arcinella cornuta*), decussate bittersweet (*Glycymeris decussata*), calico clam (*Macrocallista maculata*), tellin (*Tellina* sp.), and cushion star (*Oreaster reticulates*) (Courtenay *et al*., 1974). The Florida lobster moves through this area as they migrate from offshore to nearshore areas.

Benthic epifauna in the area of the alternative ODMDS for Port Everglades Harbor is likely to be similar to those in the Palm Beach Harbor area. The composition of benthic communities in Broward County has been detailed by Marsh *et al*. (1980) and Turberville and Marsh (1982).

Fish assemblages associated with beach rock outcrops along the southeastern Florida coastline essentially comprise a mixture of coastal pelagic, surf zone, and reef fishes attracted to the cover and food source provided by these nearshore hard substrates. The coastal pelagic species seen are primarily migratory species including the Spanish mackerel (*Scomberomorus maculatus*), bluefish (*Pomatomus saltatrix*), mullets (*Mugil* sp.), and some jacks (*Caranx* sp.) of which only the Spanish mackerel and mullet are of any local commercial value. These species may be seen near rock outcrops during their migrations but they are not specifically attracted to them. Surf zone fishes as a group are those species that typically occur on open sand or shell bottom throughout the western Atlantic and Gulf of Mexico. Typical surf zone fish species seen along the rock outcrops of southeast Florida include Atlantic croaker (*Micropogonias undulates*), pompano (*Trachinotus carolinus*), jacks, snook (*Centropomus undecimalis*), anchovies (*Anchoa* sp.), and herrings (*Clupea* sp.). These species are not confined to nearshore rock outcrops and occur along the sandy periphery of such outcrops when they exist in the nearshore zone (Herrema, 1974; Futch and Dwinnell, 1977; Gilmore, 1977; Gilmore *et al*., 1981). Reef fishes are always associated with some form of bottom

structure, man-made or natural. Although reef fish reach their peak abundance along the offshore reefs, the presence of the Anastasia and Miami Oolite Formations in the nearshore environment attracts some of these species. Species seen along the nearshore rock outcrops include grunts, snappers, groupers, and wrasses as well as some of the damselfish, blennies, gobies, angelfishes and parrot fishes of which only the snappers and groupers are of any local commercial value (Courtenay *et al*., 1980).

Herrema (1974) reported over 300 fish species as occurring off southeast Florida. Approximately 20% of these species were designated as "secondary" reef fish. Secondary reef fish are fish species that, although occurring on or near reefs, are equally likely to occur over open sand bottoms. Many of these species such as sharks, jacks, mullet, bluefish, sailfish, and marlin (none of which have significant local commercial value) are pelagic or open water species and are transient through all areas of their range. Fish species specifically associated with the sand flats and soft bottom areas between the first and second reefs include lizardfish (*Synodus* sp.), sand tilefish (Malacanthus *plumieri*), yellow goatfish (*Mulloidichthys martinicus*), spotted goatfish (*Pseudupeneus maculates*), jawfish (*Opistognathus* sp.), stargazer (*Platygillellus (Gillellus) rubrocinctus*), flounder (*Bothus* sp.), and various species of gobies and blennies. None of these fish have significant local commercial value.

3.5.5 Comparison with Miami ODMDS

Table 5 presents a comparison of faunal assemblages between the alternative ODMDSs and an ODMDS off the coast of Miami.

Although abundance values differ between the sites, annelids, molluscs, and arthropods comprise the majority of taxa at all three sites. Annelids constitute a majority or plurality of taxa at all three sites. Shrimp are the most common invertebrates at the two sites sampled, although the dominant and common fish species differ. Despite the variation in individual species, the three sites appear to contain similar environments. It may be surmised from this comparison that the habitat at each of the proposed sites is representative of southeastern Florida slope environment and does not constitute a unique resource.

3.6 Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act, as amended, PL 104-208, addresses the authorized responsibilities for the protection of Essential Fish Habitat (EFH) by NMFS in association with regional fishery management councils (FMC). EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." This definition extends to habitat specific to an individual species or group of species; whichever is appropriate within each Fishery Management Plan (FMP). Habitat Areas of Particular Concern (HAPC) have also been designated for the Southeast. These areas are subsets of EFH that are rare, susceptible to human degradation, ecologically important or located in an ecologically stressed area. Any Federal agency that proposes any action that potentially affects or disturbs any EFH must consult with the Secretary of Commerce and Fishery Management Council authority per the

Table 5. Faunal Assemblage Comparison by Site

Biological Community	Taxonomic Group	Palm Beach ODMDSs*	Port Everglades ODMDSs*	Miami ODMDS
Benthic Macrofauna	Annelids	59% (51%)	65% (50%)	37%
Benthic Macrofauna	Molluscs	25%	10%	14%
Benthic Macrofauna	Arthropods	6% (9%)	13% (37%)	33%
Epibenthic	Common Invertebrates	Caridean shrimp (*Pandalidae*)	Not specified	Pink shrimp (*Penaeus duorarum*)
Nekton	Dominant Fish	Gulf Stream flounder (*Citharichthys arctifrons*)	Not specified	Largescale tonguefish (*Symphurus minor*)
Nekton	Common Fish	Spot Blackmouth bass Smallscale lizardfish	Not specified	Longspine scorpionfish Freckled skate Horned searobin Spotted hake

Note: *Percentages in parentheses reflect data from the 1998 EPA Survey.

Source: Palm Beach and Port Everglades ODMDS DEIS, Miami ODMDS FEIS, EPA 1999.

Magnuson-Stevens Act, as amended. Interim final rules were published on December 19, 1997 in the Federal Register (Vol. 62. No. 244) to establish guidelines for the identification and description of EFH in fishery management plans. These guidelines include impacts from fishing and non-fishing activities as well as the identification of actions needed to conserve and enhance EFH. The rule was established to provide protection, conservation, and enhancement of EFH.

The areas proposed for designation as disposal sites for this project fall under the jurisdiction of the South Atlantic Fishery Management Council (SAFMC). The SAFMC has identified and described EFH for hundreds of marine species covered by 20 FMPs. A list of species managed by the SAFMC can be found in Table 6. The SAFMC extends from the northern coast of North Carolina south to the Florida Keys. The SAFMC has identified several types of EFH that occur in estuarine and marine conditions. These EFH types and their corresponding categories can be found in Table 7. Additional information on EFH with respect to the proposed project is included in the EFH Assessments (Appendix I).

Table 6. Species and Highly Migratory Species Managed by the South Atlantic Fishery Management Council

Managed Species		Highly Migratory Managed Species	
Brown shrimp	Mutton snapper	Albacore tuna	Oceanic whitetip shark
White shrimp	Blackfin snapper	Atlantic bigeye tuna	Bigeye thresher shark
Pink shrimp	Silk snapper	Atlantic bluefin tuna	Great hammerhead shark
Rock shrimp	White grunt	Atlantic skipjack tuna	Nurse shark
Royal red shrimp	Greater amberjack	Atlantic yellowfin tuna	Blacktip shark
Red drum	Blueline tilefish	Swordfish	Bull shark
Snowy grouper	Golden tilefish	Blue marlin	Lemon shark
Yellowedge grouper	King mackerel	White marlin	Blacknose shark
Warsaw grouper	Spanish mackerel	Sailfish	Finetooth shark
Scamp	Cobia	Longbill spearfish	Scalloped hammerhead shark
Speckeled hind	Dolphin (fish)	White shark	Dusky shark
Jewfish	Golden crab	Bignose shark	Sandbar shark
Wreckfish	Spiny lobster	Caribbean reef shark	Spinner shark
Red snapper	Coral	Night shark	Tiger shark
Vermilion snapper	Calico scallops	Silky shark	Sand tiger shark
Grey snapper		Longfin mako shark	Bonnethead shark
Red porgy		Shortfin mako shark	Atlantic sharpnose shark
		Blue shark	

Source: NMFS, February 2002.

3.7 Physical Oceanography

3.7.1 Tides and Currents

Circulation over most continental shelves is governed primarily by tides and winds. In addition to these factors, circulation off the southeast coast of Florida is strongly influenced by the nearby Florida Current. The Florida Current is the portion of the Gulf Stream system that connects the Loop Current in the Gulf of Mexico to the Gulf Stream as it proceeds through the Straits of Florida and into the open Atlantic Ocean (Lee and Mayer, 1977). The degree of coastal influence exerted by this current is variable and reflects the dynamic nature of the Gulf Stream system.

The Florida Current has a variable influence on circulation in the vicinity of the alternative sites depending on the degree of intrusion over the continental shelf (EPA, 1973). At certain times of the year, the southward flow of continental shelf surface waters is interrupted by intrusions of the Florida Current onto the shelf, which then carries shelf waters north. When the western edge of the Florida Current is seaward of the continental shelf, cyclonic "spin-off" eddies (current reversals), with average diameters of 10 km to 30 km, are formed (Lee, 1975; Lee and Mayer, 1977). These cyclonic eddies flow to the north at speeds of 20 to 50 cm/sec, replacing coastal waters with those from the

Table 7. Essential Fish Habitat and Habitat Areas of Particular Concern Identified for Management by the South Atlantic Fishery Management Council

Essential Fish Habitat		HAPC
Estuarine Areas	**Marine Areas**	**Area Wide**
Estuarine emergent wetlands	Live/Hard bottoms	Council designated artificial reef special management zones
Estuarine scrub/shrub mangroves	Coral and coral reefs	Hermatypic coral habitat and reefs
Submerged aquatic vegetation	Artificial/manmade reefs	Hard bottoms
Oyster reefs and shell banks	*Sargassum*	Hoyt Hills
Intertidal flats	Water column	*Sargassum* Habitat
Palustrine emergent and forested wetlands		State designated areas of importance to managed species
Aquatic beds		Submerged aquatic vegetation
Estuarine water column		
		Florida
		Blake Plateau (manganese outcroppings)
		Biscayne Bay
		Card Sound
		Florida Bay
		Florida Keys National Marine Sanctuary
		Jupiter Inlet Point
		Mangrove habitat
		Marathon Hump
		Oculina Bank
		Phragmatopoma reefs
		The Wall (Florida Keys)

Source: NMFS, February 2002.

Florida Current (Lee, 1975; Lee and Mayer, 1977). Consequently, cyclonic eddies can play an important role in coastal exchange processes. Eddy formation occurs approximately once a week and is thought to be related to local atmospheric forces (Lee and Mayer, 1977).

The western boundary of the Florida Current is distinguished from the inshore waters by a sharp rise in sea surface temperature. Fornshell (2000) studied the movement of the western boundary near Fort Pierce for 51 days in January to March, 1998. The results of the study indicated that the average distance from the shore to the western boundary of the Florida Current was 29.3 km, in the range of 8 to 60 km. Five incursions of the Florida Current onto the continental shelf occurred during a study, with an average recurrence interval of 10 days. This periodicity is approximately equal to that of the spin-off eddies reported by Lee (1975) and Lee *et al*. (1977) based on measurements made south of

the study area. At the site of the study, the distance from shoreline to the shelf break is about 40 km, although the study area is north of the current proposed project area.

Bottom currents over the continental shelf and slope in the project areas generally flow from south to north with minor variations in direction. Current velocity decreases substantially with increasing depth (Emery *et al*., 1970). Bottom currents at the shelf break have an estimated range of 20-40 cm/sec (Emery *et al*., 1970). It is expected that ocean currents near the alternative ODMDSs generally move along a north-south axis. The predominant current is to the north, and current speeds are highest in surface waters, decreasing with depth. Mean current speeds in surface waters can range from 62 cm/sec in winter to 95 cm/sec during spring and summer (Lee and Mooers, 1977). Maximum currents are 50-150 cm/sec to the north and 50 cm/sec to the south, and a mean northerly flow in near-bottom waters of 3.5 cm/sec has been reported (Lee and Mooers, 1977). Maximum currents are 50-150 cm/sec to the north and 50 cm/sec to the south. A mean northerly flow in near-bottom waters of 3.5 cm/sec, with maximum flows of 27 cm/sec to the north and 23 cm/sec to the south has been reported (Lee and Mooers, 1977).

The USACE Water Experiment Station (WES) has a major database of wave information including storm events near U.S. coastlines. Wave data collected from five stations close to the project sites are presented in Appendix J. A summary of those data is provided in Table 8.

In 1998 WES conducted an initial dredged material fate study, *Dispersion Characteristics for Palm Beach and Port Everglades ODMDSs*. EPA later expressed concern regarding the applicability of data collected from the Navy Acoustic Doppler Current Profiler (ADCP). In 2001, WES conducted an additional study, *Port Everglades/Palm Beach Dredged Material Fate Studies*, for further analysis as well as to reanalyze the representative velocities of the region. The Palm Beach Harbor alternative sites are about 70 km north of the ADCP. Despite these efforts, WES was not able to collect any additional data closer to the Palm Beach Harbor site. The results of the study indicate that the predominant current flowing along the shelf is expected to be similar in magnitude at the Palm Beach Harbor and Port Everglades Harbor sites. This similarity is due to a dominant northward current (steered by the shelf break) as well a mean Gulf Stream position located a similar distance from shore at both locations. Concern has been expressed by EPA regarding the fate of the dredged material disposed at the proposed ODMDSs due to their proximity to the Gulf Stream and its spin-off eddies. The study results note that the small distance between shoreline and shelf break in the study region (about 10 km) should constrain the formation and propagation of eddies (about 10 to 30 km in diameter), compared to the areas where the shelf is much wider. Eddies would be constrained in a similar way, however; consequently, similar effects of spin off eddies would be expected at the ODMDS and ADCP sites due to the similarity of shelf bathymetry at three sites. Therefore, the currents at all sites are expected to be similar in the light of the length scale of eddies, similarities in proximity to the western boundary of the Florida Current, and similarities in shelf bathymetry.

At the ADCP site, velocity data from 1995-1997 were analyzed by north/south and east/west components (WES, 1998). The results are tabulated in tables 9 and 10. The average east/west and average north/south velocities are the residual velocity components for each year. Detailed discussion and figures of these velocity components are presented in Appendix K.

Table 8. Summary of Wave Information in the Vicinity of Project Sites

Station	Summary of wave information (1976-1995)		
Station 9 26.00 N 80.00 W Depth: 220 m	Max Hm0 (m): 6.9	Max wind speed (m/sec): 29	Mean Hm0 (m): 0.9
	Max Tp (sec): 10	Max wind direction (deg): 65	Mean Tp (sec): 7
	Max Dp (deg): 54		
Station 10 26.25 N 80.00 W Depth: 183 m	Max Hm0 (m): 7.3	Max wind speed (m/sec): 25	Mean Hm0 (m): 1.0
	Max Tp (sec): 11	Max wind direction (deg): 55	Mean Tp (sec): 8
	Max Dp (deg): 50		
Station 11 26.50 N 80.00 W Depth: 90 m	Max Hm0 (m): 6.8	Max wind speed (m/sec): 23	Mean Hm0 (m): 1.0
	Max Tp (sec): 10	Max wind direction (deg): 15	Mean Tp (sec): 8
	Max Dp (deg): 40		
Station 12 26.75 N 80.00 W Depth: 45 m	Max Hm0 (m): 6.4	Max wind speed (m/sec): 23	Mean Hm0 (m): 1.0
	Max Tp (sec): 11	Max wind direction (deg): 60	Mean Tp (sec): 8
	Max Dp (deg): 54		
Station 13 27.00 N 80.00 W Depth: 45 m	Max Hm0 (m): 7.6	Max wind speed (m/sec): 30	Mean Hm0 (m): 1.1
	Max Tp (sec): 11	Max wind direction (deg): 45	Mean Tp (sec): 9
	Max Dp (deg): 72		

Notes: Hm0: significant wave height.
Tp: spectral peak period (corresponds to the highest peak in the frequency spectrum)

Source: http:// bigfoot.wes.army.mil/c201.html

Table 9. East/West Velocity Components in the Vicinity of the Project Sites

Direction	Depth	Velocity (cm/sec)		
		Years		
		1995	1996	1997
Max. East	Surface water (6m -10 m)	**150**	**150**	125
	Deep water (102 m –106 m)	45	50	50
Max. West	Surface water (6m -10 m)	80	**235**	135
	Deep water (102 m –106 m)	40	50	25
Avg. East	Surface water (6m -10 m)	25	25	25
	Deep water (102 m –106 m)	5	5	5
Avg. West	Surface water (6m -10 m)	8	12	15
	Deep water (102 m –106 m)	5	2	2
Avg. East/West*	Surface water (6m -10 m)	20	20	25
	Deep water (102 m –106 m)	0	2	0

Note: *Positive values indicate an eastward direction.

Source: WES, 1998.

Table 10. North/South Velocity Components in the Vicinity of the Project Sites

Direction	Depth	Velocity (cm/sec)		
		Years		
		1995	1996	1997
Max. North	Surface water (6m -10 m)	255	490	**530**
	Deep water (102 m –106 m)	100	130	30
Max. South	Surface water (6m -10 m)	150	**320**	150
	Deep water (102 m –106 m)	100	75	40
Avg. North	Surface water (6m -10 m)	75	70	100
	Deep water (102 m –106 m)	20	25	25
Avg. South	Surface water (6m -10 m)	25	20	10
	Deep water (102 m –106 m)	20	15	10
Avg. North/South*	Surface water (6m -10 m)	65	60	100
	Deep water (102 m –106 m)	0	20	20

Note: *Positive values indicate a northward direction.

Source: WES, 1998.

As presented in tables 9 and 10, maximum currents were observed at surface water, and minimum currents were observed in deep water. Maximum currents in each primary direction were indicated as bold in these tables.

Directional distribution of velocities as a function of depth was further examined from the ADCP data (WES, 1998). Four locations in the water column (bins) and twelve compass angle bands were defined during the analysis. Velocities with exceedances of 50% (V_{50}), 10% (V_{90}), 5% (V_{95}), and 1% (V_{99}) were identified for each angle band. The highest velocities were observed in bin 25 (at 10-m depth from the water surface) in 1997. These velocities were used in short-term and long-term dredged material fate studies (Table 11).

Table 11. Velocities Simulated in Fate Studies

Direction and Percentile	Velocity Magnitude (cm/sec)
W50	20
W90	27
W95	40
W99	57
N50	53
N90	128
N95	149
N99	200

Source: WES, 1998

The directional distribution of velocities reflected in the data indicates that the most prevalent currents are headed to north (Angle Band 1, 0-45 degrees) and these currents also have the greatest average velocity. With the shoreline orientation nearly north/south, only the first 5 degrees from Angle Band 1 could possibly direct sediment shoreward toward the reef system. This shoreward directed band (5 degrees) only occurred during 3-10% of the total data collection period. Angle Bands 5 (180-202.5 degrees) through 12 (337.5-360 degrees) also have shoreward directed currents. Shoreward directed currents from these angle bands occurred during 7.5-15.5% of the total data collection time period. Overall shoreward directed currents occurred during 17.5-19.4% of the total data collection period including the 5-degree portion of Angle Band 1 (WES, 1998). Detailed discussion of the velocity analysis, and the figures of directional distribution of velocities, cumulative probability distribution and velocity profiles for selected angle bands are presented in the original WES study included in Appendix K of this report.

3.8 Water Quality

EPA conducted an environmental characterization survey of the alternative ODMDSs in 1998. The methods and results of this survey are detailed in *Sediment and Water Quality of Candidate Ocean Dredged Material Disposal Sites for Port Everglades and Palm Beach, Florida*. This survey covers samplings for three alternative sites and one interim site for the Palm Beach Harbor ODMDS, and two alternative sites and one interim site for the Port Everglades Harbor ODMDS as determined by EPA and the USACE. Aspects of the water quality survey include the measuring of temperature, transmissivity, salinity, dissolved oxygen, turbidity and total suspended solids, trace metals,

pesticides and PCBs, and total petroleum hydrocarbons. The results of this survey along with previous surveys and studies conducted in the area are summarized below. Detailed discussion is provided in the original report, which is included in Appendix H.

3.8.1 Water Temperature

The Florida Ocean Sciences Institute (1971, in EPA, 1973) reported annual temperature variations of 21.1° Celsius (C) to 30.0 °C. Over the continental shelf, the water column is generally well mixed from mid-August to late April. Thermal stratification begins to appear in April and continues through mid-August with vertical temperature variations in the summer of up to 12° C at the 90 ft (27 m) depth contour.

Lee and Mooers (1977) reported annual mean water temperatures for the offshore area of Miami ranging from 26° C at 328 ft (100 m) to nearly 10° C at a depth of 656 ft (200 m). The authors also cite Brooks (1975), who reported two years of temperature data collected from a station located about 5.5 nmi (10 km) south of Miami in waters of a similar depth (689 ft; 210 m). Mean seasonal surface water temperatures varied from 24° C to 29° C, while bottom waters ranged from 7.9° C to 13.5° C. Seasonal surface-to-bottom thermal gradients ranged from about 14° C to 18° C. The lowest bottom water temperatures were recorded in the summer (Lee and Mooers, 1977). This phenomenon is thought to reflect both the seasonal wind-induced upwelling of cooler waters over the slope and the increased volume transport of the Florida Current in the summer.

A 1989 report of a survey conducted near the preferred Palm Beach Harbor disposal site (4.5-mile site) found water temperatures ranging from 11.6° C at the bottom 535 ft (163 m) to 26.3° C at the surface. Surface temperatures ranged from 24.0 °C to 26.3° C and bottom temperatures ranged from 11.6° C (at 163 m) to 16.6° C (in 135 m). Slight thermoclines were observed between 66 ft (20 m) and 197 ft (60 m) depth in the survey area.

Data from a November 1986 survey in the vicinity of the preferred Port Everglades Harbor disposal site (4-mile site) indicated water temperatures of 11.2° C at 686 ft (209 m), 22.5° C at 384 ft (117 m), and 26.1° C at 14.4 ft (4.4 m) (raw data obtained from Chris McArthur, EPA). A thermocline is indicated between 384 ft (117 m) and 686 ft (209 m).

The 1998 EPA survey of the Port Everglades Harbor and Palm Beach Harbor alternative ODMDSs reported that water temperatures ranged from a high of 31° C to a low of 7° C at the bottom (300m). Surface temperatures ranged from 25° to 31° C. Bottom temperature ranged from 7° to 11° C. In general, offshore stations were warmer than nearshore stations. Thermoclines were observed between 20 and 50 m at most stations. Measured water temperatures at Palm Beach Harbor and Port Everglades Harbor sites are listed in Table 12 and average temperature profiles are shown in figures 4 and 5 in Appendix H.

3.8.2 Transmissivity

The 1998 EPA survey reported that the water at all stations was clear, as expected in Gulf Stream waters. Transmissivity was highest near the surface and relatively constant over the upper 140 m, ranged from 62-70%, then decreased below 150 m, reaching ranges of 42-65%.

Table 12. Average Water Temperatures at Palm Beach Harbor and Port Everglades Harbor Alternative Sites

Alternative ODMDSs		Time	Surface Water Temperature (^{0}C)	Deep Water Temperature (^{0}C)
Palm Beach Harbor	4.5-mile site	April	25.5	8 (at 185 m)
		May	26	8.2 (at 185 m)
	9-mile site	April	26	10 (at 200 m)
		May	26.8	7.5 (at 300 m)
		August	31	7 (at 300 m)
Port Everglades Harbor	4-mile site	April	25	7 (at 220 m)
		May	26.5	7.3 (at 225 m)
	7-mile site	April	26	8 (at 255 m)
		May	26.2	8.5 (at 270 m)

Source: EPA, 1999.

The 1998 EPA survey revealed that in Palm Beach Harbor alternative sites transmissivity was constant over the upper 150 m, (65.5-70.5%) then decreased below 150 m, reaching ranges of 51-69.5%. In Port Everglades Harbor alternative sites transmissivity was constant over the upper 140 m (66-70.5%), decreased below 140 m, reaching ranges of 46.5-70%. Average tranmissivity profiles are seen in figures 6 and 7 in Appendix H.

3.8.3 Salinity Gradients

Salinity in the Atlantic Ocean ranges from approximately 34 parts per thousand (‰) to 37‰ and averages about 36.5‰ (EPA, 1973). Subsurface core waters of the Florida Current generally range from 36.2‰ to 36.6‰ (CH2M Hill, 1985). Surface waters of the Florida Current occasionally exhibit reduced salinities as a result of the entrainment of fresh water from the Mississippi River system by the Gulf Loop Current during periods of increased river flow (U.S. Department of the Interior, 1977).

The density of seawater between Palm Beach Harbor and Miami, based on average salinity and temperature values, averages 1.024 grams per cubic centimeter (g/cc) (EPA, 1973). The average depth of the pycnocline varies seasonally from approximately 60 ft (18 m) in the summer to about 150 ft (46 m) in the winter (Marble and Mowell, 1971; in EPA, 1973). An EPA (1973) winter reconnaissance survey found the pycnocline off Miami at a depth of about 325 ft (99 m). Densities recorded during this EPA survey ranged from 1.0236 g/cc at the surface to 1.0260 gm/cc to a depth of 380 ft (116 m).

The 1989 report of the CSA survey conducted near the preferred disposal site (4.5-mile site) showed salinities in the range of 31.48‰ to 36.68‰. Salinities were highest in the top 98 ft (30 m) with salinities gradually decreasing as depth increased.

Salinities in the area of Port Everglades are likely to be similar to those in the Miami area. A January 1986 survey (CCI, 1986) of the Miami ODMDS vicinity recorded salinities ranging from 35.5‰ to 36.8‰.

The 1998 EPA survey also reported that salinities within the alternative sites were within the range of 34.8-36.5‰. Salinities were highest in the upper 100 m and tended to increase from the surface to a depth of about 20- 80 m, and then decrease as depth increased. Average salinity profiles are shown in figures 8 and 9 in Appendix H.

3.8.4 Dissolved Oxygen

The 1998 EPA survey found dissolved oxygen (DO) levels in the water column ranged from 3.3 mg/l to 6.5 mg/l. The dissolved oxygen trend in the alternative sites is tabulated in Table 13 and average DO profiles are shown in figures 10 and 11 in Appendix H.

Table 13. Average Dissolved Oxygen Trend at Palm Beach and Port Everglades Harbor Candidate Sites

ODMDSs		Time	Upper DO (mg/l)	Lower DO (mg/l)
Palm Beach Harbor	4.5-mile site	April	6.0-6.5 (upper 50 m)	4.5 (at 150 m and remained between 4.5-4.7)
		May	4.3-4.6 (upper 50 m)	3.5 (at 120 m and remained between 3.4-3.6)
	9-mile site	April	5.8-6.6 (upper 100 m)	4.5 (at 160 m and remained same)
		May	4.3-4.5 (upper 50 m)	3.5 (at 140 m and remained between 3.4-3.7)
		August	3.8-4.5 (upper 50 m)	3.4 (at 120 m and remained between 3.3-3.9)
Port Everglades Harbor	4-mile site	April	5.9-6.4 (upper 50 m)	4.2 (at 130 m and remained between 4.2-4.8)
		May	4.5-4.7 (upper 50 m)	3.4 (at 130 m and remained between 3.4-4.3)
	7-mile site	April	5.7-6.3 (upper 50 m)	4.3 (at 150 m and remained between 4.3-4.7)
		May	4.5-4.6 (upper 50 m)	3.4 (at 140 m and remained between 3.4-3.6)

Source: EPA, 1999.

3.8.5 Turbidity and Total Suspended Solids

Turbidity values recorded in the 1998 EPA survey ranged from 0.65 NTU to 2.5 NTU. Higher turbidity values were observed at the Port Everglades Harbor alternative ODMDSs (0.75-2.5 NTU) than at the Palm Beach Harbor ODMDS (0.65-1.2 NTU). Total suspended solids values ranged from 3 mg/l to 26 mg/l.

Figures 12 and 13 in Appendix H show a box plot of turbidity and total suspended solid concentrations at both project areas.

3.8.6 Trace Metals, Pesticides, and PCBs

Water quality data collected in the 1998 EPA survey generally displayed very low levels for trace metals, PCBs, and pesticides. Mercury, copper, cadmium, and lead were the trace metals selected for analysis. Cadmium and mercury levels were below the limits of detection (1.0 ppb and 0.2 ppb respectively). Lead levels ranged from 1.3 to 6.4 ppb, and copper levels ranged from below the detection limit (0.1 ppb) to 3.9 ppb. For comparison, federal marine water quality criteria are presented below:

Priority Pollutant	Criteria Maximum Concentration (ppb)	Criteria Continuous Criteria (ppb)
Mercury	1.8	0.94
Copper	4.8	3.1
Cadmium	42	9.3
Lead	210	8.1

All samples analyzed for pesticides and PCBs yielded results below the detection limits.

3.8.7 Total Petroleum Hydrocarbons

Total petroleum hydrocarbon (TPH) concentrations, as measured in the 1998 EPA survey, were higher than expected for the offshore candidate sites. Concentrations ranged from below detection limits (100 ppb) to 6300 ppb. Box plots for TPH are shown in figures 15 and 16 in Appendix H.

3.9 Sediment Quality

Benthos characteristics of the area were also surveyed by EPA in 1998. Granulometry, sediment chemistry, and biotal characteristics were analyzed in this survey. The results of this survey are summarized below and detailed in Appendix H.

3.9.1 Granulometry

Table 14 provides the grain size composition and mean grain size of samples collected at Port Everglades Harbor and Palm Beach Harbor alternative ODMDSs.

Table 14. Grain Size Composition and Mean Grain Size of Samples

Alternative ODMDSs		Sand (%)	Silt and Clay (%)	Mean Grain Size (mm)
Palm Beach Harbor	4.5-mile site	70.0 (3 station avg.)	30.0 (3 station avg.)	0.14-0.175
	9-mile site	79.6 (4 station avg.)	20.4 (4 station avg.)	0.18-0.185
Port Everglades Harbor	4-mile site	83.9 (3 stations avg.)	16.1(3 stations avg.)	0.18-0.19
	7-mile site	85.7 (2 station avg.)	14.7 (2 station avg.)	0.22-0.23

Source: EPA, 1999.

3.9.2 Total Organic Carbon

The EPA 1998 survey did not give reliable TOC concentrations because of quality control issues. Previous sampling in the Palm Beach Harbor ODMDS reported results ranging from 0.3-0.6% (CSA, 1989), and in the Miami ODMDS area from 1.1-1.8% (CC, 1985).

3.9.3 Oil and Grease, TPHs, Pesticides and PCBs

Oil and grease, TPHs, and PCBs were all below detection limits in all samples collected during the survey.

3.9.4 Metals

Cadmium levels in survey samples ranged from below detection limits (0.1μg/g) to 0.15 μg/g. Copper levels were in the range of 1.8 to 4.8 μg/g in the survey area, with levels of 2.2 to 2.5 μg/g at both preferred ODMDSs (Figure 18, Appendix H). Lead levels ranged from 1.3 to 31.3 μg/g in the survey area, and 26 to 28μg/g at both preferred ODMDSs (Figure 19, Appendix H). Mercury was not detected (0.05 μg/g) at any station. The 1989 Palm Beach survey reported values of 0.03 to 0.05 μg/g for cadmium, 1.8 to 8.2 μg/g for lead and 0.01 to 0.3 μg/g for mercury (CSA, 1989).

3.9.5 Biotal Characteristics

Characterization of the benthos consists of macrofauna descriptions of the samples stations. Samples were collected in 1998 using various sampling techniques. The infaunal communities were described by a number of community parameters such as composition, dominant taxa, density, and species richness.

Overall, macrofaunal samples were dominated in numbers by annelids and arthropods. All alternative sites were similar in that they had a similar number of taxa dominated by the same major taxonomic groups. Benthic biotal characteristics are discussed further in Sections 3.5.3 to 3.5.5.

3.10 Air Quality

In response to Clean Air Act (CAA), EPA has established National Ambient Air Quality Standards (NAAQS) for the protection of human health and welfare. The NAAQS represent maximum levels of pollutants and exposure periods that pose no significant treat to human health or welfare. Air quality within the project area is good due to very little emission activity and the presence of offshore breezes. Both Palm Beach and Broward counties are classified as attainment areas for all NAAQS.

3.11 Noise

Noise is defined as "unwanted sound" and in the context of protecting public health and welfare, implies potential effects on people and, in general, the environment. Noise is one of the major concerns associated with dredging-related activities. Ambient noise levels at all the alternative ocean disposal sites is expected to be very low. Sound in the open ocean is generated by a broad range of sources, both natural and anthropogenic.

For noise above the ocean surface, ambient noise level is highly dependent on wind velocity (Bolt *et al*., 2003). Bolt *et al*. (2003) reported ambient sound levels ranging from 15 dB for little to no wind to 50 dB for winds up to 9 meters per second.

For noise beneath the ocean surface, natural geophysical sources of sound include wind-generated waves, earthquakes, precipitation, and cracking ice. Rain can raise noise levels by up to 35 dB across a range of frequencies. Natural biological sounds include whale songs, dolphin clicks, and fish vocalizations. Anthropogenic sounds are generated by a variety of activities, including commercial shipping, geophysical surveys, oil drilling and production, dredging and construction, sonar systems, and oceanographic research. Ambient noise ranges from 20 to 90 dB re 1µPa over a frequency range of 1-100,000 Hz. (NRC, 2003)

3.12 Aesthetic Resources

Aesthetic resources are natural resources, landform, vegetation, and man-made structures in the environment that generate one or more sensory reactions and evaluations by the observer, with particular emphasis on pleasurable response.

The alternative ODMDSs are located on the continental slope of the Atlantic Ocean. The open ocean is the only aesthetic resource in the area.

3.13 Recreation Resources

The project areas are located near the coastal waters of Broward and Palm Beach counties. These waters are used for swimming, skiing, sailing, boating, surfing, skin diving, and SCUBA diving. The alternative ODMDSs are too deep or too distant from shore for all of these activities except sailing.

3.13.1 Commercial and Recreational Fisheries

The alternative ODMDSs do not support significant recreational and commercial fisheries resources. Demersal fishes depend on invertebrates in sediments for forage. Local sediment alterations could affect fish populations. While pelagic fish may utilize the area, the heaviest fishing pressure along the southeastern coast of Florida is concentrated at the inshore natural and artificial reefs. In general, movement of nekton into the estuaries occurs mainly from January to June, while migration back into the Atlantic Ocean typically occurs from August to December (Table 15).

Commercial and recreational fishing activity is concentrated in inshore and nearshore waters or at offshore natural and artificial reefs. All considered alternative sites are located at least 2.3 nmi (4.3 km) from the natural or artificial reefs. All considered alternative sites are located within reported habitat (175 to 300 meters water depth) for the Golden Tilefish (Parker and Mays, 1998). EPA does not believe the Palm Beach Harbor preferred ODMDS provides the necessary malleable substrate from which the tilefish can construct shelter and that any impact to tilefish habitat at the Port Everglades Harbor preferred ODMDS will be minor (See Appendix I). Therefore, disposal activities are not expected to interfere with fishing activities.

Table 15. Migratory Behavior of Some Coastal Nekton Common to Coastal Florida

Month of Occurrence	Species Moving into Estuaries (or Nearshore Zone)	Species Moving from Estuaries
January	Southern hake, red drum (peak)	Menhaden, spadefish
February	Stingray, brown shrimp (post larvae)	
March	Gulf killifish, spot, cutlassfish, hogchoker, butterfish, rough silverside, flounder, tonguefish	Blue catfish, sheepshead minnow, longnose killifish
April	Gafftopsail and sea catfish, bluefish, bumper, sand seatrout, southern kingfish, skipjack, herring (in and out same month), adult croaker, black drum (peak), pinfish, Atlantic threadfin, toadfish, midshipman	Bighead searobin
May	Striped anchovy, lizardfish, sardine, Spanish mackerel, white shrimp (post larvae)	Menhaden, southern hake
June	Needlefish, pompano, crevalle jack, leatherjacket, Atlantic moonfish	Butterfish
July	Ladyfish, lookdown	
August		Ladyfish, Atlantic threadfin
September		Adult croaker, rough silverside
October	Menhaden, sheepshead minnow, bighead searobin	Sardine, bluefish, leatherjacket, Atlantic moonfish, sand seatrout, cutlassfish, Spanish mackerel
November	Blue catfish, juvenile croaker	Striped anchovy, gafftopsail catfish, needlefish, pompano, crevalle jack, bumper, lookdown, pinfish, tonguefish, toadfish, midshipman, white shrimp (juveniles)
December	Longnose killifish	Stingray, lizardfish, spot, southern kingfish, flounder, hogchoker

Source: Schomer and Drew, 1982.

Palm Beach Harbor

There are several documented artificial reefs located in the vicinity of the alternative sites for Palm Beach Harbor (Palm Beach County, undated). Table 16 provides amplifying information on artificial reefs in Palm Beach County, and Figure 6 provides geographic locations of the reefs with respect to the project area (Figure 6 also includes the location of the *Oculina* reef approximately 1.7 nmi (3.2 km) west of the preferred site discussed in Section 3.4). One cluster of two artificial reef sites is located 2.0 nmi (3.7 km) west of the western edge of the preferred (4.5-mile) site. Another cluster of four sites is located 3 nmi (5.5 km) west of the western edge. Two additional clusters, with six sites and five sites, respectively lie 4 nmi (7.4 km) and 4.4 nmi (8.15 km) west of the western edge (Table 16 and Figure 6).

Port Everglades Harbor

A number of documented artificial reefs are located in the vicinity of the alternative sites for Port Everglades Harbor (Palm Beach and Broward counties, undated). Table 17 provides amplifying information on artificial reefs in Broward County and Figure 7 provides geographic locations of the reefs with respect to the project area. One cluster of 17 structures is located approximately 2.25 nmi (14.2 km) northwest of the preferred (4-mile) site. Another cluster of three structures is located 2.8 mi (4.5 km) southwest of the southwestern edge of the preferred site. One structure is located approximately 3 nmi (5.5 km) west of the southwest ridge of the 7-mile candidate site (Table 17 and Figure 7).

3.13.2 Other Recreation

Broward and Palm Beach counties waters support a wide variety of recreational activities other than fishing. Coastal waters are also used for swimming, skiing, sailing, boating, surfing, skin diving, and SCUBA diving. Few of these activities occur in, and none is restricted to, the proposed ODMDSs.

3.14 Navigation

The preferred Palm Beach Harbor and Port Everglades Harbor ODMDSs are located to the northeast and 4.5 nmi (8.3 km) and 4.0 nmi (7.4 km) seaward of the entrance channels to Palm Beach Harbor and Port Everglades Harbor, respectively. The candidate Palm Beach Harbor and Port Everglades Harbor ODMDSs are located to the northeast and 9 nmi (16.7 km) and 7 nmi (13.7 km) seaward of the entrance channels to their respective channels. While there are no designated shipping lanes beyond the entrance channel, the general areas experience heavy commercial shipping traffic.

3.15 Military Usage

While the Atlantic Ocean off Palm Beach Harbor and Port Everglades Harbor may be used by the United States armed forces for training, testing, and research activities, the alternative ODMDSs do not lie within any designated fleet operating area as identified by the Department of the Interior (DOI) (1977). The preferred Port Everglades Harbor ODMDS is located approximately 1.5 miles north of the northern boundary of the Navy's South Florida Testing Facility (SFTF).

Table 16. Artificial Reef Locations in the Vicinity of the Proposed Palm Beach Harbor ODMDS

Name	Latitude	Longitude	Depth (ft)	Distance to (4.5-Mile) Preferred Site (mi)	Distance to (9-Mile) Candidate Site (mi)	Composition
Jupiter Inlet						
Ratican	26°58.96'N	80°00.89'W	90	14.5	16.3	Sailboat
Esso Bonaire III	26°57.85'N	80°00.48'W	90	13.2	14.9	Tanker
Miss Jenny	26°57.83'N	80°00.44'W	90	13.3	14.9	Barge
Jupiter Concrete	26°58.79'N	80°00.45'W	90	14.3	15.8	Concrete
Barge MG111	26°58.67'N	80°01.49'W	60	14.5	15.7	Barge, concrete
Tug Boat Reef	26°58.56'N	80°00.98'W	70	14.1	15.8	Tug boats (3)
Jupiter/Carlin Reef	26°54.83'N	80°03.54'W	14	11.5	14.5	Rock
Diamondhead Radnor	26°54.80'N	80°03.44'W	16	10.8	14.7	Rock
Sea Mist II	26°57.49'N	79°59.11'W	210	11.7	14.3	Freighter
Barge Conrad	26°54.75'N	80°03.44'W	18	10.8	14.7	Barge
Lake Worth Inlet						
Classic Barge P1	26°47.42'N	79°59.10'W	275	2.6	6.7	Barge
Classic Barge P6	26°47.30'N	79°59.38'W	235	2.9	7.0	Barge
Princess Anne	26°47.59'N	80°00.22'W	98	3.8	7.8	Ferry
Playground	26°47.37'N	79°59.79'W	130-150	3.3	7.6	Concrete
Spearman's Barge	26°47.59'N	80°00.35'W	70	4.0	8.0	Barge
Murphy's Barge II	26°48.13'N	80°01.10'W	75	4.8	8.8	Barge
Research Team Reef	26°47.36'N	80°01.00'W	70	4.6	8.7	Barges, concrete
Amaryllis	26°47.30'N	80°00.96'W	80	4.6	8.7	Freighter
Mizpah/PC1174	26°47.18'N	80°00.96'W	80	4.5	8.7	Vessels
Habitat Corridors	Connects Research Team Reef, Amaryllis, and Mizpah/PC1174		80	---	---	Rock

Table 16 (cont'd). Artificial Reef Locations in the Vicinity of the Proposed Palm Beach Harbor ODMDS

Name	Latitude	Longitude	Depth (ft)	Distance to (4.5-Mile) Preferred Site (mi)	Distance to (9-Mile) Candidate Site (mi)	Composition
EIDSVAG/Barge/ Rolls Royce	26°46.02'N	80°00.50'W	80	4.2	8.9	Vessels, car
Cross Current Reef	26°45.69'N	80°01.26'W	60	5.1	9.1	Barge, rock
TSO Paradise	26°45.79'N	80°01.29'W	60	5.1	9.1	Yacht
Tri-County Concrete	26°45.78'N	80°01.29'W	60	5.1	9.1	Concrete
PEP Reef	26°40.72'N	80°01.73'W	25-27	9.0	11.9	Modules
Kreusler Park	26°37.00'N	80°02.00'W	10-12	12.7	15.1	Concrete, rock
M/V Jed Carrier	26°47.28'N	79°59.54'W	N/A	3.1	7.2	Ship
Royal Park Bridge	26°47.68'N	80°01.05'W	75	4.2	9.0	Concrete
Shasha Boekanier	26°45.05'N	80°00.59'W	88	4.4	8.7	Vessel
St. Jacques	26°45.07'N	80°00.61'W	87	4.4	8.7	Vessel
Thozina	26°45.10'N	80°00.50'W	88	4.4	8.7	Vessel
Gilbert Sea	26°45.19'N	80°00.61'W	89	4.4	8.7	Vessel
Lake Worth Lagoon						
Sugar Sands Reef	26°47.61'N	80°02.69'W	23	6.3	10.4	Modules, rock
Rybovich Reef	26°45.03'N	80°02.59'W	23	6.6	10.5	Modules, rock
Boynton Inlet Reef	26°32.65'N	80°02.78'W	14	17.6	19.7	Rock
Lantana's Sportsman	26°35.10'N	80°02.80'W	9-13	14.5	15.8	Concrete
Boynton Beach Inlet						
Boynton Kiwanis Miller Lite Reef	26°33.24'N	80°01.06'W	200	16.4	18.1	Freighter
Becks	26°28.87'N	80°02.35'W	80	21.7	23.1	Freighter
Budweiser Bar	26°28.75'N	80°02.31'W	85	21.8	23.3	Freighter

Table 16 (cont'd). Artificial Reef Locations in the Vicinity of the Proposed Palm Beach Harbor ODMDS

Name	Latitude	Longitude	Depth (ft)	Distance to (4.5-Mile) Preferred Site (mi)	Distance to (9-Mile) Candidate Site (mi)	Composition
Swordfish	26°28.70'N	80°02.33'W	80	21.8	23.4	Treasure Hunter
Genesis Reef	26°28.65'N	80°02.40'W	80	21.8	23.4	Concrete
Boynton Corridors	---	---	80	---	---	Rock
Ocean Ridge North	26°31.97'N	80°02.62'W	18	21.9	20.1	Concrete
Ocean Ridge South	26°31.88'N	80°02.64'W	21	21.9	20.2	Concrete
Gulfstream North	26°30.15'N	80°03.03'W	11	20.4	22.1	Rock
Gulfstream South	26°30.03'N	80°03.05'W	11	20.5	22.1	Rock
M/V Castor	26°28.80'N	80°02.20'W	120	21.8	23.2	Cargo ship
Boca Raton Inlet						
CSA Modules	26°21.97'N	80°03.30'W	60	29.8	30.9	Concrete
Hydro Atlantic	26°19.49'N	80°03.04'W	165	32.1	33.5	Dredge
Sea Emperor	26°19.32'N	80°03.54'W	65	32.5	33.6	Barge, concrete
United Caribbean	26°19.27'N	80°03.54'W	72	32.5	33.6	Cargo ship
Noula Express	26°19.28'N	80°03.46'W	70	32.7	33.9	Freighter
Ancient Mariner	26°18.11'N	80°03.74'W	70	34.1	35.2	CG Cutter
Copenhagen(1)	26°12.35'N	80°05.11'W	16-31	40.9	42.0	Steamship

Notes: (1) State underwater archaeological preserve.

Source: Palm Beach County, Department of Environmental Resources Management, Artificial Reef Program Brochure, n.d; Palm Beach County website, 2004.

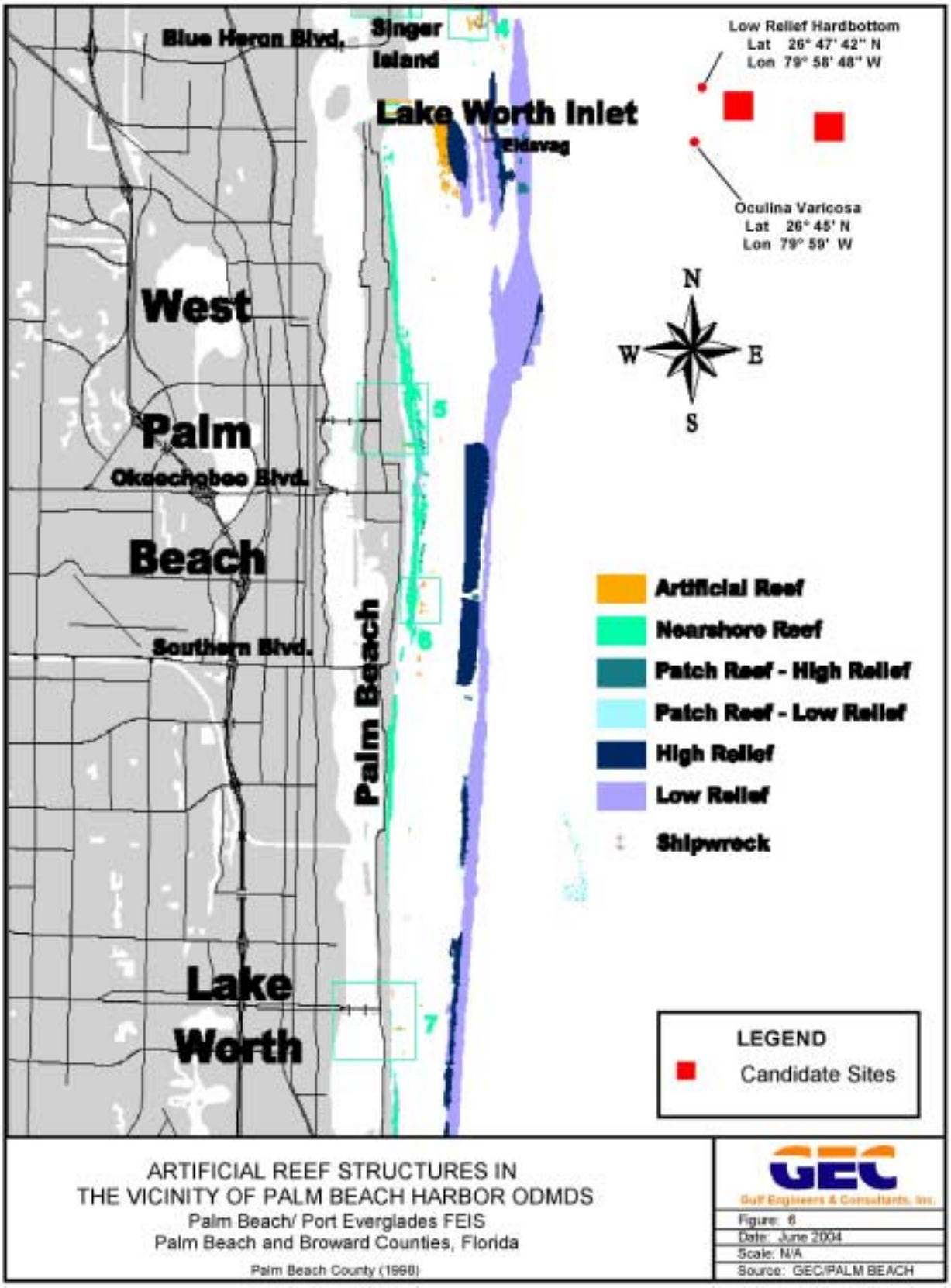

Blue Heron Blvd.
Singer Island
Lake Worth Inlet
Eldevag
Low Relief Hardbottom
Lat 26° 47' 42" N
Lon 79° 58' 48" W
Oculina Varicosa
Lat 26° 45' N
Lon 79° 59' W
N
W
E
S
West
Palm
Okeechobee Blvd.
Beach
Southern Blvd.
Palm Beach
Lake
Worth
Artificial Reef
Nearshore Reef
Patch Reef - High Relief
Patch Reef - Low Relief
High Relief
Low Relief
Shipwreck
LEGEND
Candidate Sites
ARTIFICIAL REEF STRUCTURES IN
THE VICINITY OF PALM BEACH HARBOR ODMDS
Palm Beach/ Port Everglades FEIS
Palm Beach and Broward Counties, Florida
Palm Beach County (1998)
GEC
Gulf Engineers & Consultants, Inc.
Figure: 6
Date: June 2004
Scale: N/A
Source: GEC/PALM BEACH

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Table 17. Artificial Reef Locations in the Vicinity of the Proposed Port Everglades Harbor ODMDS

Name	Latitude	Longitude	Loran C	Depth (ft)	Distance to (4-Mile) Preferred Site (mi)	Distance to (7-Mile) Candidate Site (mi)	Composition
Houseboat	26°08’51”N	80°05’00”W	---	95	4.2	6.9	Vessels
Bud Krohn	26°08’51”N	80°05’00”W	---	440	4.2	6.9	Freighter
Trio Bravo	26°08’51”N	80°05’00”W	---	145	4.2	6.9	Tug
FL League of Anglers	26°08’51”N	80°05’00”W	---	388	4.2	6.9	Minesweeper
Rebel	26°08’51”N	80°05’00”W	---	110	4.2	6.9	Freighter
Jim Atria	26°08’51”N	80°05’00”W	---	110	4.2	6.9	Freighter
Robert Edmister	26°08’51”N	80°05’00”W	---	70	4.2	6.9	Cutter
River Bend	26°08’51”N	80°05’00”W	---	98	4.2	6.9	Vessels
Bill Boyd Reef	26°08’51”N	80°05’00”W	---	265	4.2	6.9	Freighter
Hog Heaven	26°08’51”N	80°05’00”W	---	64	4.2	6.9	Barges, lighthouse
Jay Scutti	26°08’51”N	80°05’00”W	---	67	4.2	6.9	Schooner
Qualmann Barge	26°08’51”N	80°05’00”W	---	145	4.2	6.9	Barge
Osborne	26°08’51”N	80°05’00”W	---	73	4.2	6.9	Barge
Grouper Grotto	26°08’51”N	80°05’00”W	---	150	4.2	6.9	Tanks, pipes, concrete
Powell Barge, DB 24	26°08’51”N	80°05’00”W	---	314	4.2	6.9	Barge, concrete
Mariott Reef	26°08’51”N	80°05’00”W	---	71	4.2	6.9	Airplane
Mercedes	26°08’51”N	80°05’00”W	---	97	4.2	6.9	Freighter
Tracor/Navy Drydock	26°06’48”N	80°04’10”W	---	210	2.8	6.0	Vessels, drydock
Powell Barges	26°06’48”N	80°04’10”W	---	270	2.8	6.0	Barges
TE AMO	26°06’48”N	80°04’10”W	---	215	2.8	6.0	Vessel
Erojacks	26°06’43”N	80°05’43”W	---	14	4.4	7.5	Concrete erojacks
Berry Patch	26°18’07”N	80°03’45”W	---	65	13.0	13.4	Vessels (4)
Deerfield Pier	---	---	---	67	---	---	Unknown
Hydro Atlantic	26°19’30”N	80°03’02”W	---	184	14.7	14.5	Dredge

Table 17 (cont'd). Artificial Reef Locations in the Vicinity of the Proposed Port Everglades Harbor ODMDS

Name	Latitude	Longitude	Loran C	Depth (ft)	Distance to (4-Mile) Preferred Site (mi)	Distance to (7-Mile) Candidate Site (mi)	Composition
Noula Express	26°19'16"N	80°03'27"W	---	71	14.4	14.5	Vessel
Pennels Reef	26°19'11"N	80°04'05"W	---	30	14.4	14.7	Dredge Pontoon
Corey and Chris	26°13'52"N	80°03'26"W	---	244	14.4	9.0	Dredge Trident
Rodeo Divers Reef	26°13'51"N	80°04'02"W	---	78	8.3	14.8	Vessels
Wildlife Forever	26°14'03"N	80°03'40"W	---	156	8.4	9.4	Dredge
Buddy Merrit	26°14'09"N	80°03'22"W	---	414	8.5	9.2	Vessel Cradles
Caicos Express	26°12'30"N	80°03'40"W	---	240	6.8	7.9	Vessel
Cap. Dan Garsey	26°13'51"N	80°03'58"W	---	109	8.3	14.7	Vessel
Chevron Rodeo	---	---	14271.3 x 62097.1	170	---	---	Fuel Tanks
Fishamerica	26°13'38"N	80°03'54"W	---	115	8.0	9.0	Vessel
Guy Harvey	26°12'39"N	80°03'58"W	---	135	7.0	8.2	Vessel
Imor	26°13'03"N	80°03'45"W	---	165	7.3	8.3	Vessel
Johnny Morris Offshore Angler	26°14'23"N	80°03'25"W	---	215	8.7	9.5	Vessel
Kornahrens	26°12'30"N	80°03'11"W	---	140	6.6	7.5	Netting
Lowrance	26°13'12"N	80°03'38"W	---	200	7.5	8.6	Vessel
Mako	---	---	14272.0 x 62096.2	240	---	---	Hull Molds
Mariner I	26°14'25"N	80°03'30"W	---	108	8.8	9.5	Vessel
Mariner II	26°14'07"N	80°03'48"W	---	110	8.6	9.3	Vessel and Barge
Miller Lite	26°14'12"N	80°03'40"W	---	155	8.6	9.5	Vessel
Papa's Reef	26°14'06"N	80°03'23"W	---	260	8.4	9.2	Vessel
Renegade	26°13'22"N	80°03'37"W	---	190	7.6	8.5	Vessel
Rodeo 25"	26°13'53"N	80°03'49"W	---	122	8.2	9.1	Vessel

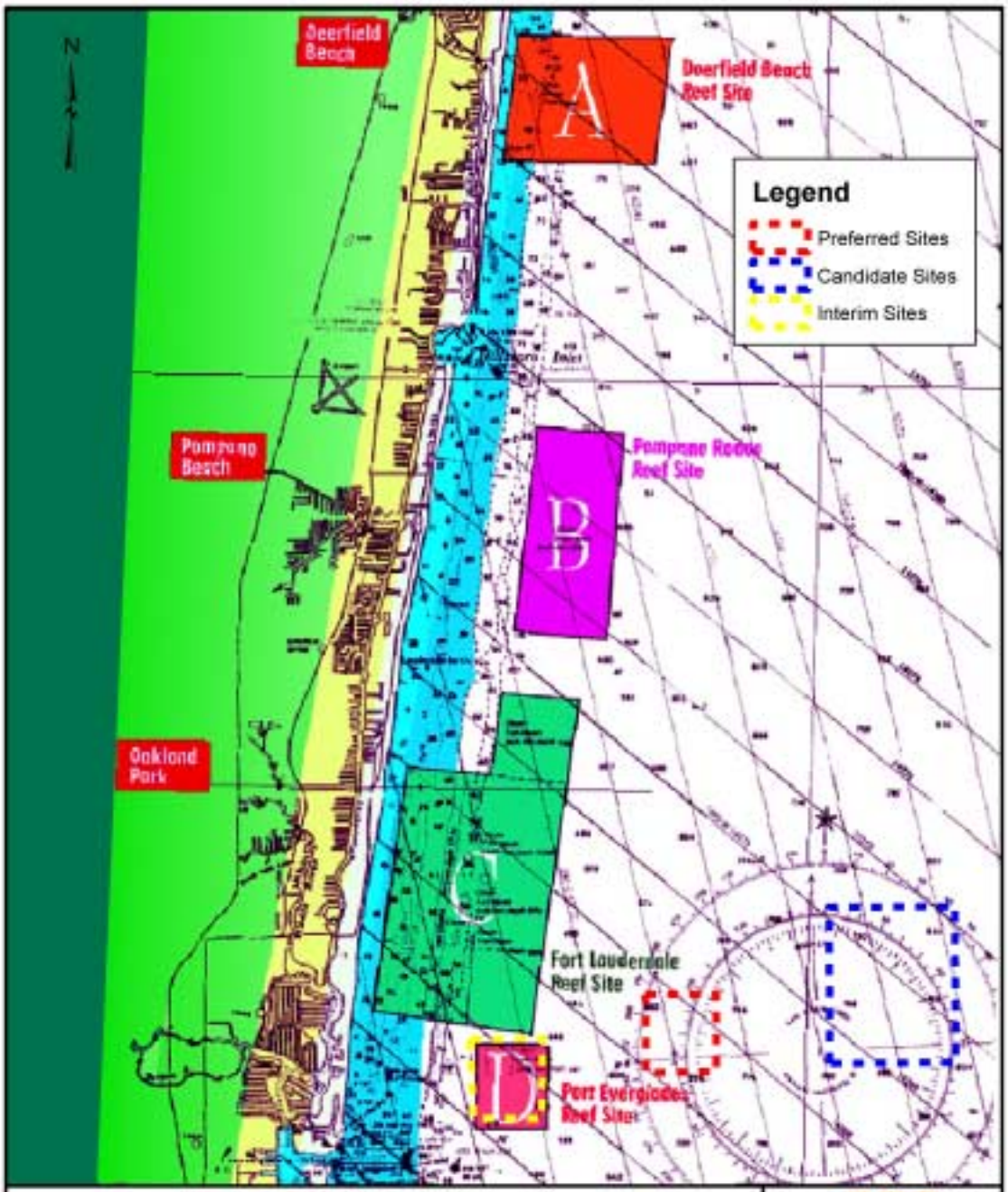
Table 17 (cont'd). Artificial Reef Locations in the Vicinity of the Proposed Port Everglades Harbor ODMDS

Name	Latitude	Longitude	Loran C	Depth (ft)	Distance to (4-Mile) Preferred Site (mi)	Distance to (7-Mile) Candidate Site (mi)	Composition
Ronald B. Johnston	26°13'53"N	80°03'27"W	---	122	8.2	8.9	Vessel
Tote Machines	---	---	14271.6 x 62096.4	200	---	---	Debris
Bruce Mueller	26°10'07"N	80°04'42"W	---	45	4.8	7.1	Vessel
Chevron 1"	26°07'24"N	80°04'33"W	---	73	4.8	6.3	Vessel
Chevron 3"	26°08'06"N	80°04'06"W	---	190	3.0	5.8	Vessel
Chris Coffman Reefball	26°07'30"N	80°04'24"W	---	22	3.1	6.0	Reefballs (11)
Corky M.	26°10'05"N	80°04'43"W	---	65	4.9	7.6	Vessel
Eagle Scout Reef	26°07'30"N	80°05'53"W	---	22	4.6	7.6	Reedfballs (25)
Great Lakes	---	---	14263.9 x 62105.1	170	---	---	Vessel
Harbor Town	---	---	14265.2 x 62106.3	70	---	---	Vessel
Bulk Trader	26°08'36"N	80°03'50"W	---	313	7.8	8.4	Vessel
Eben-Ezer 2	26°00'24"N	80°05'35"W	---	69	8.0	10.25	Vessel
Merci Jesus	26°09'38"N	80°04'45"W	---	72	4.6	6.9	Vessel
Moonshot	---	---	---	70	---	---	Vessel
Paul Sherman	---	---	14264.8 x 62106.6	70	---	---	Vessel
Peter B. McAllister	26°10'09"N	80°04'43"W	---	69	5.5	7.1	Vessel
Reef Balls (Deep)	26°07'48"N	80°04'25"W	---	144	3.2	6.2	Prefab Concrete
Reef Balls (Shallow)	26°07'31"N	80°04'25"W	---	23	3.1	6.1	Prefab Concrete
Reuben Reef	---	---	14262.5 x 62109.0	70	---	---	Vessels
Spaghetti Barge	---	---	14263.7 x 62106.7	105	---	---	Vessel

Table 17 (cont'd). Artificial Reef Locations in the Vicinity of the Proposed Port Everglades Harbor ODMDS

Name	Latitude	Longitude	Loran C	Depth (ft)	Distance to (4-Mile) Preferred Site (mi)	Distance to (7-Mile) Candidate Site (mi)	Composition
Wendy Rossheim	26°09'11"N	80°04'49"W	---	65	4.3	6.8	Vessel
NSWC	26°10'30"N	80°03'13"W	---	150	4.4	6.0	Cable Spools
AFDL-8	---	---	14261.2 x 62107.4	220	---	---	Drydock
Chris Craft Molds	---	---	14261.4 x 62107.2	70	---	---	Molds
FAD	---	---	14262.0 x 62107.2	110	---	---	Midwater Kites
Joe's Nightmare	26°06'48"N	80°04'13"W	---	217	2.8	5.9	Barge
Marriot	---	---	14261.4 x 62109.8	71	---	---	Airplane
Monomy	---	---	14263.2 x 62107.5	60	---	---	Vessel
NSWC Sea Con Reef	26°00'36"N	80°05'37"W	---	74	8.5	11.1	Acoustic Arrays (2) & Concrete
Port Everglades Reef	26°06'45"N	80°04'02"W	---	150	2.6	5.7	Concrete Piers
Capt. DeDe	26°00'34"N	80°05'36"W	---	75	8.6	11.0	Vessel
Cruz del Sur	25°58'10"N	80°04'38"W	---	230	10.7	12.5	Vessel
Curry Reef	26°00'39"N	80°05'36"W	---	75	8.4	11.0	Barge & Crane Boom
Donald G. McAllister	26°00'33"N	80°05'34"W	---	75	8.6	11.0	Vessel
Emmi Boggs	26°00'36"N	80°05'37"W	---	75	8.5	11.0	LCM
Hollywood Reef	26°07'30"N	80°05'53"W	---	73	4.6	7.6	Reefballs, Pipe, & Barges
Tenneco (Deep)	25°58'53"N	80°04'48"W	---	190	10.0	11.9	Oil Rig Legs
Tenneco (Shallow)	25°58'57"N	80°05'06"W	---	105	10.0	11.9	Oil Rig Decks

Source: Pybas, 1991; Broward County website, 2003.



ARTIFICIAL REEF STRUCTURES IN
THE VICINITY OF PORT EVERGLADES HARBOR ODMDS
Port Everglades ODMDS
Palm Beach and Broward Counties, Florida
Broward County Artifical Reef Site Map

GEC
Gulf Engineers & Consultants

Figure: 7
Date: February 2004
Scale: N/A
Source: GEC/Broward County

3.15.1 South Florida Testing Facility

Located on the south side of the Port Everglades inlet in Dania, Florida, the SFTF has housed an active, continuously operating Navy range for over 40 years (Figure 8). The SFTF was placed under the administration of the Naval Surface Warfare Center, Carderock Division in 1994. The SFTF allows the monitoring of surface ship, submarine, and remote vehicle signatures in the nearshore environment. Multiple fixed in-water electromagnetic and acoustic measurement sites at 10, 20, and 200 m are controlled from a secure range house. The range encompasses the Navy's only shallow and deep magnetic research and development ranges, including submerged operations.

The SFTF is currently the centerpiece of the newly formed South Florida Ocean Measurement Center (SFOMC). The SFOMC offers a means to evaluate mine detection, countermeasures and mine response; perform acoustic measurements; and acquire radar cross section and infrared signatures. The SFOMC is the only ship, submarine, and mine-effectiveness test range with simultaneous air, surface, and subsurface tracking capability.

3.15.2 Existing Features and Planned Expansions

The SFOMC is divided into the following ranges: 60-ft area, 600-ft area, and mine fields. Existing structures and planned expansions for each of the ranges are discussed below.

60-Foot Area

Existing features in the 60-ft area include a shallow water acoustic range (SWAR), a shallow water electromagnetic range (SWER), the Port Everglades ADCP, and a forward area combined degaussing and acoustic range (FACDAR- in 30 ft).

Planned expansion in the 60-ft area includes the installation of an AUV docking station (power and data transmission), a modem system with transmitter and 32-channel receive array with 40 kHz window up to 250 kHz, a Cyclesonde Autonomous Profiler to measure currents and buoyancy, a five head ADCP, an ambient noise sonar array, and two environmental arrays (measuring current, temperature, conductivity, and salinity versus depth).

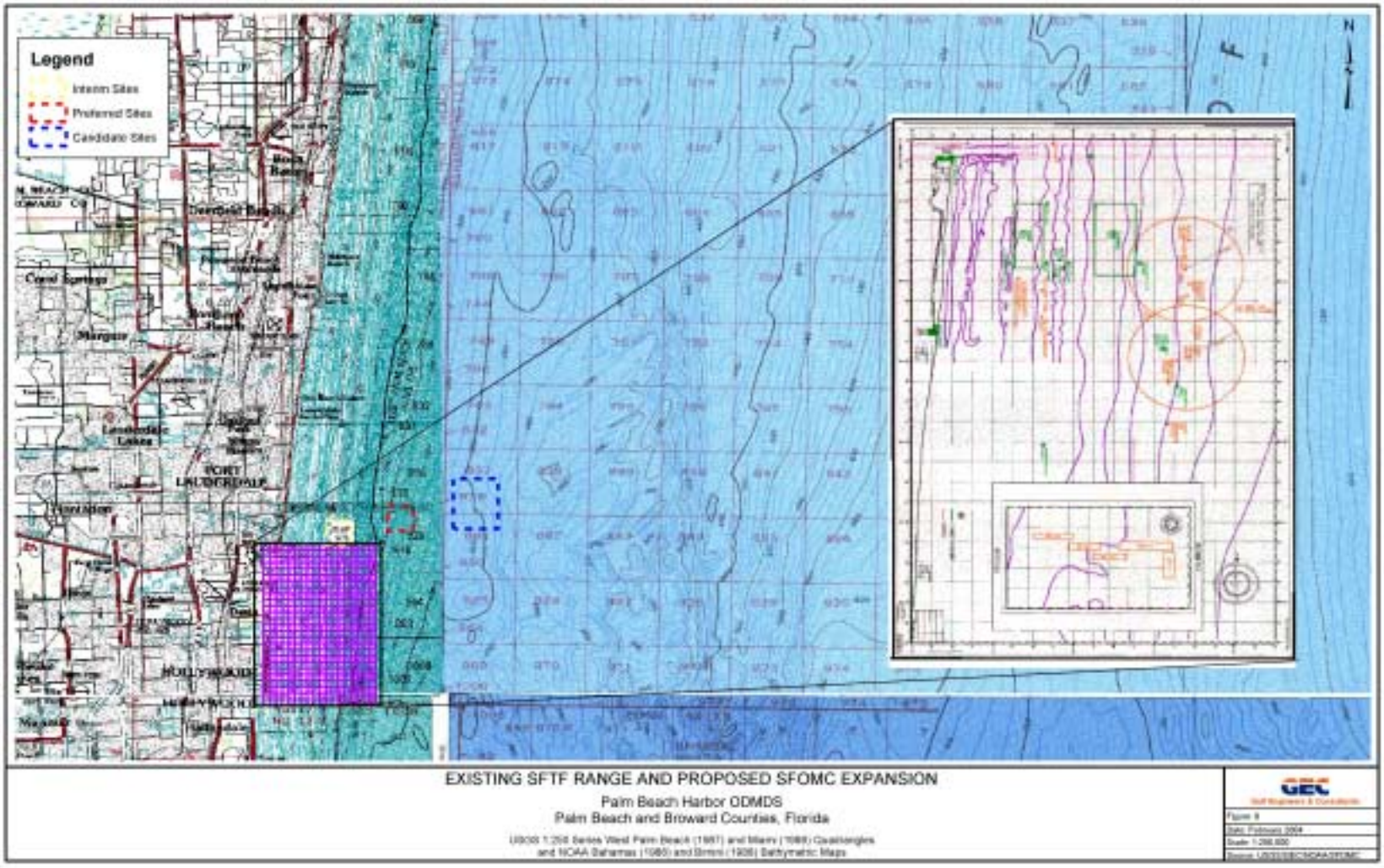
600-Foot Area

Existing features in the 600-ft area include a submarine tracking system, navigation and communication systems, an intermediate depth electromagnetic array (IDEA), and a deep ADCP.

Planned expansion in the 600-ft area calls for the emplacement of three 32-element acoustic arrays (one oriented vertically and two horizontally) and two environmental arrays (measuring current, temperature, conductivity, and salinity versus depth).

Mine Fields

The mine fields range contains a deep mixed submarine mine field. Planned expansion in this area includes the addition of a bottom and buried field and a shallow suspended field.


Legend
Interim Sites
Preferred Sites
Candidate Sites
N
EXISTING SFTF RANGE AND PROPOSED SFOMC EXPANSION
Palm Beach Harbor ODMDS
Palm Beach and Broward Counties, Florida

Other Planned Expansions

In addition to the planned expansion measures discussed above, the SFOMC is planning the addition of a number of other features in the Port Everglades area. Additional expansion plans include the installation of a shore side Ocean Current Surface Radar (OSCAR) apparatus three 32-channel acoustic arrays with thermisters (NRL, UM, WHOI), a 10-channel thermister array (UM), a Miami Sound Machine (UM), an LWAD Assets-Bathymetry, geo-acoustic survey, NRL high-frequency imaging sonar, autonomous undersea vehicles (AUVs) (ONR/FAU) or with following capabilities: low- and high-frequency sidescan sonar, multi-beam passive sonar arrays, CTD, ADCP, sub-bottom sonar, turbidity censor, video camera, acoustic imager, and buried object imager (towed).

3.16 Mineral Resources

The Minerals Management Service (MMS) has not conducted any mineral resource surveys in the waters offshore Palm Beach and Broward counties. There are no known recoverable mineral resources in the vicinity of the proposed Palm Beach Harbor and Port Everglades Harbor ODMDSs. The MMS has not identified any potential sand sources for beach nourishment in the area.

3.17 Other Usage

3.17.1 Subsea Cables

The ocean bottom in the vicinity of the continental shelf may sometimes contain communication cables or gas pipelines. Data for communication cables are not determinable within the project areas according to the Office of Public Affairs (OPA). Charts obtained from AT&T provide the locations of existing telephone cables offshore of Palm Beach and Broward counties as of 30 August 1996. The charts indicate that two telephone cables may intersect the preferred and candidate sites for the Palm Beach Harbor ODMDS. The cables, Florico-1 (N-S) and Florico-1 (S-N), are listed as out of service on the chart. No existing cables that may intersect that proposed sites for Port Everglades Harbor were noted on the chart. The Florida Department of Environmental Protection (FDEP) Southeast Office was contacted regarding fiber optic cables offshore of Pam Beach and Broward counties. FDEP provided the following information regarding permitted fiber optic cables offshore of the counties:

Palm Beach County Landings	Broward County Landings
West Palm Beach (AT&T)	Port Everglades (U.S. Navy)
Delray Beach (Florida Teleport)	Hollywood (AT&T)
Boca Raton (BICS)	
Boca Raton (Tyco/Emergia/Atlantic)	

FDEP further stated that undisclosed cables might potentially exist from the Navy.

Detailed maps of fiber optic cable layouts were not available for the above locations. However, a general state map of offshore fiber optic cables provided by FDEP indicated that the cables extend eastward for all the above locations. Based on this information, although the fiber optic cables at West Palm Beach and Port Everglades may lie in close proximity to the proposed Palm Beach and Port Everglades Harbor sites, respectively, it is unlikely that these cables intersect the proposed sites. No known instances of damage to underwater cables occurring as a result of offshore dredged

material disposal were found. Consequently, it is unlikely that any impacts to underwater cables in the vicinity of the project area will occur as a result of implementation of the proposed project. Information on existing gas pipelines was not determinable. Existing pipelines are considered unlikely to exist in the project areas; however, the proposed Ocean Express and Calypso Pipeline Projects calls for the emplacement of 24-inch natural gas pipelines between Port Everglades and the Bahamas.

3.17.2 AES Ocean Express Pipeline Project

In February 2002, AES Ocean Express LLC submitted an application to lay a 54.3-mile, 24-inch pipeline from a receipt point on the Economic Exclusion Zone between the United States and the Bahamas to delivery points in Broward County, Florida, together with certain ancillary facilities. Approximately 48 miles of this pipeline will be laid in the Atlantic Ocean off Florida's east coast. The remaining 6.3 miles would extend west from a shoreline entry point east of Dania, Florida, and end at proposed interconnections with Florida Gas Transmission Company and Florida Power and Light Company systems. The proposed pipeline would transport up to 842 million standard cubic feet of natural gas into Florida per day. Although specific geospatial coordinates of the AES Ocean Express Pipeline are not readily available, comparison of the pipeline project's map layout with that of the proposed Port Everglades Harbor ODMDS indicates that the proposed pipeline route appears to passes no closer than approximately 4 nmi south of the preferred (4-mile) site.

3.17.3 Tractebel Calypso Pipeline Project

Tractebel Calypso LLC has also proposed construction of a pipeline to transport natural gas from the Bahamas to South Florida. The application for the pipeline was first filed in July 2001. An application for the pipeline was originally filed by Enron to lay the Calypso pipeline, and was assumed by Tractebel in 2002. This 24-inch pipeline would begin at a proposed regasification plant near Freeport, Bahamas and be laid 89.9 miles to Port Everglades in Broward County Florida, where it will connect with the proposed Tractebel Calypso onshore pipeline segment. Approximately 36 miles of this pipeline would extend from the Economic Exclusion Zone to the coast of Florida. The proposed pipeline is 90 miles in total length and will transport up to 832 million standard cubic feet of natural gas per day. Directional drilling will be utilized at the onshore approaches to the pipeline to minimize environmental effects. Although specific geospatial coordinates of the AES Tractebel Calypso Pipeline are not readily available, comparison of the pipeline project's map layout with that of the proposed Port Everglades Harbor ODMDS indicates that the proposed pipeline route is in close proximity to the preferred and candidate sites for the Port Everglades Harbor ODMDS. EPA expressed concern in a letter dated 17 September 2003 regarding a conflict between the proposed pipeline alignment and the proposed Port Everglades Harbor sites. The Federal Energy Commission, in its response to this letter, stated that the proposed Calypso pipeline alignment would avoid both the preferred and the candidate sites for the Port Everglades Harbor ODMDS.

3.17.4 El Paso Seafarer Pipeline Project

Florida Power and Light Group Resources and El Paso Corporation signed an agreement in April 2004 for capacity on the proposed El Paso Seafarer Pipeline System. The proposed pipeline will have a total length of 160 miles and a diameter of 26 inches. The system as planned will transport natural gas for the proposed High Rock liquefied natural gas regasification facility in the Bahamas to south Florida. Landfall will be at Riviera Beach in Palm Beach County, from which the pipeline will extend 42 miles to an existing gas pipeline and a power generation plant. A pipeline capacity of

800,000 dekatherms per day of natural gas is planned. Transportation service is estimated to begin in 2008, when the pipeline and the proposed Bahamas facility are scheduled to be completed. Although specific geospatial coordinates of the El Paso Seafarer Pipeline are not readily available, a comparison of the pipeline project's map layout with that of the proposed Palm Beach Harbor ODMDS indicates that the pipeline appears to pass no closer than 1-2 nmi south of the preferred (4.5-mile) site.

3.18 Candidate Site Surveys

3.18.1 1986 Video, Still Camera, and Sidescan Sonar Survey, Port Everglades Harbor

A video, still-camera, and sidescan sonar survey was conducted in March 1986 CSA for the Port Everglades Harbor 4-mile site. Sidescan sonar (with total coverage of 200 m [984 ft] for each transect) and bathymetry data were collected along five north-south transects and five east-west transects spaced at 0.25 nmi (0.463 km) intervals. Video and still-camera data were collected along the initial survey transect, the nearshore north-south transect near the northern limit of the site.

CSA also conducted a video, still-camera, and sidescan sonar survey in September-October 1986 for the Port Everglades Harbor 4-mile site. Data were collected along two north-south survey transects along the eastern and western sides of the site and extending to the north. Underwater video and still camera coverage was obtained for 7.5 nmi (13.9 km) along the eastern survey transect and 7.3 nmi (13.5 km) along the western survey transect. Still photographs were taken at intervals of less than 164 ft (50 m) along each survey transect. Sidescan sonar transects roughly paralleled the video and still-camera transects and extended for 10.7 nmi (19.8 km) and 10.5 nmi (19.4 km) on the east and west transects, respectively. Sidescan sonar lateral coverage was approximately 492 ft (150 m) on each side, giving a total coverage of 984 ft (300 m) for each transect. Bathymetric data were collected along all transects.

Depths within the March 1986 survey area ranged from 577 ft (176 m) on the western edge of the survey area to 699 ft (213 m) on the eastern edge; no high-relief ledges, rock outcrops, or steep slopes were detected within the survey area. Depths within the September-October survey area ranged from 625 ft to 640 ft (190.5 m to 195 m) along the western transect and from 681 ft to 712 ft (207.5 m to 217 m) along the eastern transect. No high-relief ledges or steep slopes were detected within the survey area.

The tapes from these surveys show that the bottom consisted of fine- to coarse-grained sediment with large rocks or small boulders. The rocks appeared to be isolated boulders rather than outcrops of an underlying structure. There was no evidence of extensive rock outcropping. Evidence of biological activity (i.e., small holes, burrows, depressions, and mounds) and low numbers of epifauna associated with the rocks (i.e., anemones, portunid crabs, scorpionfish, hydrozoans, occasional octocoral fans, and hake) were observed. All other epifauna observed were typical soft-bottom species.

3.18.2 1989 Video Survey, Palm Beach Harbor

A field survey and sampling expedition was conducted in 1988-1989 by CSA for the Palm Beach Harbor 3-mile site, which encompasses the 4.5-mile site. The collected data included bathymetry, underwater video of benthic habitat, water column profiles, water quality samples, bottom sediment chemistry samples, and benthic biotal samples. Ten sampling stations were designated in the vicinity

of the project area, four within the 3-mile site and six outside the site. Three of these sites were designated as water quality sampling sites (one within the 3-mile site, three outside), and seven sites were designated as benthos/sediment sampling sites (three within the 3-mile site, four outside). Biomass determinations and tissue analysis was conducted on the benthic biota retrieved from the sampling stations. Video and bathymetry surveys were conducted along eight north-south transects at intervals of approximately 0.5 nmi (0.93 km).

Depths at the survey site ranged from 354 ft (108 m) northwest of the proposed ODMDS to 607 ft (185 m) in the southeast corner of the proposed site. Water depths increased in an east-southeast direction.

The tapes from this survey show that the bottom substrate consisted of fine-grained sediment with no visible exposed rock or outcrops. The near-bottom water was turbid and visibility was generally less than 3 ft (1 m). There was a significant amount of evidence of biological disturbance (i.e., small holes, burrows, depressions, and mounds) and low numbers of epifauna (i.e., sea pens, anemones, sand dollars, crabs, and unidentified fish).

3.18.3 1998 Sediment/Water Quality Survey, Palm Beach and Port Everglades Harbors

A sediment and water quality survey was by EPA in 1998 for both interim sites and all candidate sites except the Palm Beach Harbor 3-mile site as coverage of this site in previous surveys was deemed adequate. Nine sampling stations were designated for Palm Beach Harbor sites, and 11 sampling stations were designated for Port Everglades Harbor Sites. The data from this survey, in conjunction with that of previous surveys, provided two benthic stations (physical and biotal) within each candidate site and two stations upcurrent and downcurrent of each site. Hydrography, water chemistry, benthos characteristics, granulometry, sediment chemistry, and biotal characteristics were all analyzed at each site using data obtained from the samples retrieved on this survey.

The results of this survey indicated that salinity, dissolved oxygen, and transmissivity data in the water masses over the sampled sites were similar to open ocean waters and deviated little among the various sites. Water quality analyses for trace metals, PCBs, and pesticides yielded very low levels for all parameters, although total petroleum hydrocarbons were higher than expected, particularly in the deepwater sites. The sites contained similar grain size distributions, with the Port Everglades sites exhibiting a slightly coarser distribution. Oil and grease, total petroleum hydrocarbons, pesticides, and PCBs were generally below detection limits in the sediment samples. Copper and lead were the only metals detected in significant amounts in the sediments. Annelids and arthropods were numerically dominant in macroinfaunal samples. All sampled sites exhibited a smilar number of taxa dominated by the same major taxonomic groups.

3.18.4 1998 Sidescan Sonar Survey, Palm Beach and Port Everglades Harbors

EPA conducted a sidescan sonar survey in August 1998 of all five candidate sites and the interim candidate sites. Survey data was collected along north-south transects utilizing a Klein™ 595 system at a speed of three knotts and range setting of 250 m. Only 100 kHz data was collected as cable length prohibited the collection of the 500 kHz frequency. Transect spacing was set at 250-300 m for the candidate sites and at greater down and up current of the sites. A minimum coverage of 100% was achieved in all surveyed areas with 100% overlap within the preferred alternatives. The 250-m transect spacing provided a transverse resolution of 1 m. Transverse resolution is the ability to discern two separate objects that lay near one another in a line parallel to the tow path. It is a

function of vessel speed, range, and beam spread (Fish and Carr, 1990). A minimum of 0.5 nmi was surveyed to the eat and west of each alternative site and 1 nmi north and south. Benthic photography for ground-truthing was unsuccessful due to high currents. Grab sampling from a previous survey was also analyzed for ground-truthing.

Survey Results-Palm Beach Harbor 4.5-Mile Site

The sidescan sonar data indicated a relatively uniform fine sandy bottom throughout the site and areas 2 miles to the north and 2 miles south of the site (see Figure 7 in Appendix E). Grab samples taken earlier in the year showed sediments in the 4.5-mile site to consist of a grey silty fine sand with shell fragments. The mean grain sizes for the area ranged from 0.14 to 0.17 mm with 25-35% silts and clays (EPA, 1999). No areas of hard bottom or potential wrecks were identified through the sidescan record within the site or north or south of the site.

Survey Results-Palm Beach Harbor 9-Mile Site

The sidescan sonar data indicated a relatively uniform fine sandy bottom throughout the site. Grab samples taken from this area showed a grey-green silty fine sand with some shell fragments. The mean grain size was approximately 0.21 mm with 18-23% silts and clays (EPA, 1999). Only a few scattered targets were detected throughout the survey area, none suggesting any significant resources.

Survey Results-Port Everglades Harbor 4-Mile Site

Results show a relatively uniform sandy bottom of medium reflectance with an east/west running low relief ridge through the middle of the candidate site and an east/west running low relief ridge to the northwest of the candidate site. Grab samples taken earlier from the survey area showed a grey, slightly to very silty fine sand with shell fragments. The mean grain size was approximately 0.18 mm with 16% silts and clays (EPA, 1999). The low relief areas are identified by a generally darker acoustic signal with little to no shadows. The bottom appeared consistent with the descriptions provided by the CSA video surveys discussed above. Numerous scattered acoustic targets of varying size were detected throughout the survey area. These were identified by dark acoustical signals with shadows. Most of these were located outside of the candidate site boundaries. Five of the acoustical targets were identified as possible wrecks based on the shape of their reflective return and shadow. All of these targets are outside of the candidate site boundaries and three are within the Navy South Florida Testing Facility Testing Range.

Survey Results-Port Everglades Harbor 7-Mile Site

The southern portion of the survey area (south of 26^{o} 8" latitude) consisted of a relatively uniform low relief hard bottom. Attempts at benthic sampling of the area earlier in the survey resulted encountered hard bottom. Some rocks were retrieved that consisted of fossiliferous limestone, slightly dolomitic with magnesite dendrites. They were identified as being from the Floridian Aquifer of the Suwanee Formation (EPA, 1999). The northern portion of the survey area showed a relatively uniform sandy bottom. Grab samples taken from this area showed a grey, slightly silty, fine sand with shell fragments. The mean grain size was approximately 0.22 mm with 10-18% silts and clays (EPA, 1999). Only a few scattered targets were detected throughout the survey area. These were identified by dark acoustical signals with shadows.

4.0 ENVIRONMENTAL EFFECTS

4.1 Introduction

This section of the EIS establishes the scientific and analytical basis for the summary of effects to environments in the affected area. The environmental consequences of the proposed action (i.e., designation of two ODMDSs, Palm Beach Harbor and Port Everglades Harbor) are discussed in the following sections. The socioeconomic consequences of the proposed action are exclusively beneficial and directly related to the socioeconomic benefits of functional ports in these areas, such as employment, commercial traffic and trade, commodity transport, and leisure cruising.

4.2 No-Action Alternative

Under the no-action alternative, a new ODMDS pursuant to Section 102 of the MPRSA would not be designated at either location. The no-action alternative would result in no additional or future impacts to the biological and physical components of the marine environment. However, ocean disposal of dredged material could occur on a limited basis under Section 103 of the MPRSA (see Section 2.1). The impacts to the biological and physical components of the marine environment associated with a Section 103 site selection and its limited use would be evaluated by the USACE at the time of selection.

4.3 Ocean Disposal Alternatives

4.3.1 Ocean Alternative Sites Not Considered

Although designation of ocean disposal site within 3 nmi of shore was considered, the possibility of unpredictable eddy currents from the Florida Current transporting disposed dredged material to nearshore reefs necessitated the designation of sites located further from the shore. Therefore, the interim sites at both Palm Beach Harbor and Port Everglades Harbor were not considered. In addition, the 3-mile candidate site was dropped from further consideration in favor of the 4.5-mile site as it was determined that a four square mile site was not necessary.

4.3.2 Evaluation Using General and Specific Criteria

The effects of the proposed action were evaluated using the criteria promulgated in 40 CFR Parts 228.5 and 228.6, which gives guidance for the selection of ocean disposal locations and require effective management to prevent unreasonable degradation of the marine environment. Criteria in 40 CFR Part 228.5 are titled “General criteria for the selection of sites,” and those in Part 228.6 are titled “Specific criteria for site selection.” Evaluation of the proposed Palm Beach Harbor and Port Everglades Harbor ODMDSs utilized the literature base and baseline data collected at the sites to assess compliance with both the general and the specific criteria of the regulation. Each of the general and specific criteria is addressed in this section as it relates to the suitability of the selected candidate sites as disposal sites. As presented in Section 2.5, the preferred site near Palm Beach Harbor has an area of approximately one square nmi and is located east-northeast of the Lake Worth Inlet approximately 4.5 nmi offshore. The Palm Beach Harbor 9-mile candidate site has an area of approximately four square nmi and is located approximately 9 nmi offshore east-northeast of the Lake Worth Inlet. The preferred site near Port Everglades Harbor has an area of approximately one square nmi and is located east-northeast of Port Everglades and approximately 4 nmi offshore.

The Port Everglades Harbor 7-mile candidate site has an area of approximately 4 square nmi and is located east-northeast of Port Everglades approximately 7 nmi offshore.

4.3.3 General Criteria (40 CFR 228.5)

1. The dumping of materials into the ocean will be permitted only at sites or in areas selected to minimize the interference of disposal activities with other activities in the marine environment, particularly avoiding areas of existing fisheries or shellfisheries and regions of heavy commercial or recreational navigation [40 CFR 228.5(a)].

The proposed ODMDSs for the Palm Beach Harbor and the Port Everglades Harbor do not support an exclusive commercial or recreational fishery. Fishery and shellfishery resources are not concentrated in, restricted to, or dependent upon the vicinity of the proposed ODMDSs.

The proposed ODMDSs would not be expected to adversely affect recreational boating. Dredging and dredged material disposal are common actions in these areas. The proposed ODMDSs are at a sufficient distance offshore that small recreational boats are not frequently present.

There are also no specially designated shipping lanes near the proposed disposal sites. The candidate ODMDSs are located seaward and slightly north of the entrance channels of Palm Beach Harbor and Port Everglades Harbor, and are areas of heavy commercial shipping traffic. However, it is not anticipated that future, intermittent use of the site would result in a level of activity that would significantly disrupt shipping.

2. Locations and boundaries of disposal sites will be so chosen that temporary perturbations in water quality or other environmental conditions during initial mixing caused by disposal operations anywhere within the site can be expected to be reduced to normal ambient seawater levels or to undetectable contaminant concentrations or effects before reaching any beach, shoreline, marine sanctuary, or known geographically limited fishery or shellfishery [40 CFR 228.5(b)].

Based on dispersion modeling conducted for ODMDS designation for Palm Beach and Port Everglades harbors, any temporary perturbations in water quality resulting from disposal of dredged material would be reduced to ambient or undetectable levels within a short distance of the release point (Section 4.3.5). Prevailing currents at these sites are to the north and parallel the coast. The preferred ODMDSs lie 4.0 nmi (7.4 km) to 4.5 nmi (8.3 km) east of the nearest landfall. The candidate ODMDSs lie 9 nmi (16.7 km) and 7 nmi (13.7 km) east of the nearest landfall in Palm Beach and Broward counties, respectively The Palm Beach Harbor preferred ODMDS lies 1.7 nmi (3.2 km) east of the nearest reef (*Oculina varicosa*); the Palm Beach Harbor candidate ODMDS lies 6.2 nmi (11.5 km) east of this reef. At these locations, the likelihood of impacts to nearshore amenities is small. The proposed disposal sites do not lie near geographically limited fishery or shellfishery resources.

3. If at anytime during or after disposal site evaluation studies, it is determined that existing disposal sites presently approved on an interim basis for ocean dumping do not meet the criteria for site selection set forth in CFR 228.5 through 228.6, the use of such sites will be terminated as soon as alternate disposal sites can be designated [40 CFR 228.5(c)].

The MPRSA site selection process is designed to identify a preferred alternative that minimizes or avoids unacceptable impacts to the physical, biological, and socioeconomic environment. The use of the previously designated interim disposal sites was discontinued as a result of the implementation of the Water Resources Development Act of 1992.

4. The sizes of ocean disposal sites will be limited in order to localize for identification and control any immediate adverse impacts and permit the implementation of effective monitoring and surveillance programs to prevent adverse long-term impacts. The size, configuration, and location of any disposal site will be determined as part of the disposal site evaluation or designation study [40 CFR 228.5 (d)].

A limited area of about one square nmi (3.4 km^2) has been proposed for the preferred ODMDSs at Palm Beach Harbor and Port Everglades Harbor. Larger areas (4 square nmi) are required for the offshore candidate sites at both locations. The dispersion modeling studies for the preferred sites conducted by WES revealed no short-term or long-term adverse impacts (see Appendices K and M). The results indicated that the sediment was generally moving toward the north, not toward the reef. Under the most severe conditions, silt-clay concentrations diminish to approximately one mg/l or less above background at a distance of 1,500 m from the disposal location. For the preferred Port Everglades Harbor and Palm Beach Harbor ODMDSs, the dredged material would be disposed 6,100 m and 5,500 m from reef locations respectively. Due to the greater depths at the offshore candidate sites at both locations, larger disposal sites are required to contain most of the disposed dredged material within the site boundaries. Additionally even during the most severe storms and with mounds 10 times larger than the annual amount that each disposal site is expected to accommodate, the modeling of the mounds at both sites did not show significant erosion.

The location, size, and configuration of preferred sites allow and facilitate long-term capacity, site management, and site monitoring. Bottom contours in the area can be monitored through bathymetric survey methods. Monitoring of the proposed sites is discussed in the SMMPs (Appendix L).

5. EPA will, whenever feasible, designate ocean dumping sites beyond the edge of the continental shelf and other such sites that have been historically [40 CFR 228.5 (e)].

The preferred Palm Beach Harbor and Port Everglades Harbor ODMDSs are located 4.5 nmi and 4 nmi from the coastline, respectively. The continental shelf in the vicinity of the proposed sites has a width of approximately 0.73 miles (0.63 nmi). The sites therefore lay approximately 3.87 nmi (Palm Beach Harbor) and 3.37 nmi (Port Everglades Harbor) beyond the edge of the continental shelf, and are located on the upper Florida-Hatteras slope. The offshore candidate sites also lay beyond the edge of the continental shelf. Historically used sites are also located on the upper continental slope, but their proximity to environmental amenities makes their use questionable.

4.3.4 Specific Criteria (40 CFR 228.6)

1. Geographical position, depth of water, bottom topography, and distance from coast [40 CFR 228.6(a)1].

See Table 18. Bottom topography images are provided in figures 1 and 3.

2. Location in relation to breeding, spawning, nursery, feeding, or passage areas of living resources in adult or juvenile phases [40 CFR 228.6(a)2].

The most active breeding and nursery areas are located in inshore waters, along adjacent beaches, or in nearshore reef areas. While breeding, spawning, and feeding activities may take place near the considered alternative ODMDSs, these activities are not believed to be confined to, or concentrated in, these areas. It is unlikely that localized and intermittent dredged material disposal operations would affect migration, feeding, or nesting of marine mammals and sea turtles. While many marine species may pass through the considered alternative ODMDSs, passage is not geographically restricted to these areas. The probability of significant impact from dredged material disposal is likely inversely related to the motility of these organisms.

3. Location in relation to beaches and other amenity areas [40 CFR 228.6(a)3].

The preferred disposal sites for Palm Beach and Port Everglades harbors are located approximately 4.5 nmi and 4.0 nmi offshore, respectively, as measured to the center of the sites. The offshore candidate disposal sites for Palm Beach and Port Everglades harbors are located approximately 9.0 nmi and 7.0 nmi offshore, respectively. The nearest beaches are located on the shorelines west of the sites. Distances from the western edge of the sites are provided in Table 18. Because of the distance of the proposed sites from the shoreline and the expected localized effects at the disposal sites, it is unlikely that dredged material disposal at any of the considered alternative sites would adversely affect coastal beaches. The locations in relation to amenity areas such as natural and artificial reefs were discussed in sections 3.4 and 3.13.1 and in tables 16 and 17. The locations relative to the considered alternative sites are summarized below:

Site	Distance to Nearest Artificial Reef	Distance to Outer Reef
Palm Beach 4.5-mile (preferred) site	2.3 nmi 4.3 km	2.6 nmi 4.8 km
Palm Beach 9-mile candidate site	5.8 nmi 10.7 km	7.2 nmi 13.3 km
Port Everglades 4-mile (preferred) site	2.3 nmi 4.3 km	3.0 nmi 5.5 km
Port Everglades 7-mile candidate site	5.0 nmi 9.3 km	6.2 nmi 11.5 km

Table 18. Geographic Position, Water Depth, Bottom Topography and Distance from Coast of ODMDSs

Site	Geographic Coordinates	Max/Min Depth	Bottom Topography	Min Distance to Shore (western edge)
Palm Beach 4.5-mile (preferred) site	26°47'30"N 79°57'09"W 26°47'30"N 79°56'02"W 26°46'30"N 79°57'09"W 26°46'30"N 79°56'02"W	509 ft/ 607 ft	Uniform Soft Bottom	4.3 nmi
Palm Beach 9-mile candidate site	26°45'00"N 79°53'00"W 26°45'00"N 79°51'00"W 26°47'00"N 79°53'00"W 26°47'00"N 79°51'00"W	855 ft/ 985 ft	Uniform Soft Bottom	8 nmi
Port Everglades 4-mile (preferred) site	26°07'30"N 80°02'00"W 26°07'30"N 80°01'00"W 26°06'30"N 80°02'00"W 26°06'30"N 80°01'00"W	577 ft/ 712 ft	Soft Bottom; E-W Oriented Low Relief Ridges in Center & NE Corner of Site	3.8 nmi
Port Everglades 7-mile candidate site	26°06'30" N 79°57'30"W 26°06'30" N 79°59'30"W 26°08'30" N 79°59'30"W 26°08'30" N 79°57'30"W	785 ft/ 920 ft	Soft Bottom in N giving way to Hard Bottom in S	6 nmi

Source: EPA 1999, 2000.

In addition to these artificial reef sites, colonies of the deepwater coral *Oculina varicosa* have been observed as scattered, isolated forms 1.7 nmi (3.2 km) west of the proposed Palm Beach Harbor ODMDS (see Figure 6).

WES (1998) conducted modeling studies under a variety of current velocities and directions to estimate the dynamics of the sediment cloud following its release from the disposal vessel. In all Port Everglades applications, results indicate silt-clay concentrations diminish to approximately 1 mg/l or less above background at a distance of 1,500 m west of the disposal location. Sand concentrations diminish to 1 mg/l or less above background at a distance of 2,440 m west of the disposal location. In all Palm Beach Harbor applications, silt-clay concentrations diminish rapidly to 1 mg/l or less above background within 1,500 m of the disposal location. Sand concentrations diminish to 1 mg/l or less above background within 2,400 m of the disposal location.

4. Types and quantities of wastes proposed to be disposed of and proposed methods of release, including methods of packing the dredged materials, if any [40 CFR 228.6(a)4].

The only material to be placed at the proposed ODMDSs will be dredged material that meets EPA Ocean Dumping Criteria in 40 CFR 220-229. The proposed sites are expected to be used for routine maintenance of the respective Harbor Projects. It has been demonstrated that the most cost effective method of dredging is clamshell/barge dredging for Palm Beach

Harbor (Appendix C) and hopper dredging for Port Everglades Harbor (Appendix D). The disposal of dredge material to the proposed sites will be conducted using a near instantaneous dumping type barge or scow.

Dredged material must meet EPA Ocean Dumping Criteria in 40 CFR 220-229 and will be tested following procedures outlined in the 1991 EPA/USACE Dredged Material Testing Manual (Green Book) and the 1993 EPA Region 4/USACE South Atlantic Division Regional Implementation Manual (RIM) prior to ocean disposal. Dredged material from the Palm Beach and Port Evergades harbors have been characterized in the following reports: Final Report for Port Everglades and Palm Beach Harbor Florida, 1998 Evaluation of Dredged Material for Ocean Disposal (PPB Inc.); Geotechnical Testing Services of Intracoastal Waterway for Channel Widening Project, Port Everglades (Ardaman and Assoc., 1997); and Soil Borings and Grab Sample Study on Atlantic Intracoastal Waterway, Port Everglades (Geoverse Inc., 1998).

Material from Palm Beach Harbor is predominantly sand with small amounts of silts. Samples collected from the harbor in 1997 contained 6% silts by weight, with the remainder consisting of sand.

Material from Port Everglades Harbor is more variable than that of Palm Beach Harbor. Samples collected from the harbor in 1997 contained 38% fines by weight for samples collected from the bay, and 5% fines by weight from samples collected from the inlet (the remainder in each case consisted of sand).

Palm Beach Harbor. Dredged material volumes for Palm Beach Harbor will vary from dredging event to dredging event depending on the amount of shoaling. Shoaling rates for the turning basin are projected to average 10,300 cy per year (see Appendix C). Total disposal volumes (turning basin and entrance channel) for the years in which the turning basin is dredged and hence ocean disposal is needed are expected to average in the range of 75,000-100,000 cy with volumes as large as 200,000 cy (Murphy, 2004). Disposal volumes of 75,000-100,000 cy every three years equates to annual averages of 25,000-35,000 cubic yards. Up to 1,000,000 cy of suitable material may be placed at the ODMDS in 2007 as a result of proposed construction dredging. Additional volumes that may be placed at the Palm Beach Harbor ODMDS include 9,000 cy from the North Turning Basin Extension (cited in the August 1984 Feasibility Report). Should ocean disposal be deemed appropriate for this material, and should the capacity of the designated sites be deemed adequate, then this material may be placed at the sites.

Port Everglades Harbor. Annual shoaling rates at Port Everglades Harbor have been estimated at 16,500 cy per year for the turning basin (Appendix D) and 15,600 cy for the entrance channel (Olsen & Assoc., 2003) for a total of approximately 30,000 cy per year. Dredging frequency has ranged from 6 to 20 years with project volumes in the range of 26,000-144,000 cy (Brodehl, 2003). The infrequent dredging has been due to the lack of available disposal options and with an available ocean disposal site, the frequency is expected to increase to every 3-5 years (Brodehl, 2004). Some or all of the maintenance material may be placed on the beach or utilized for other beneficial use when possible. Additional volumes that may be placed at the Port Everglades Harbor ODMDS include 8,079,400 cy between 2006 and 2024 from proposed construction activities at Port Everglades Harbor (see Section 1.2.4). Should ocean disposal be deemed appropriate for this material, and should the capacity of the designated sites be deemed adequate, then this material may be placed at the site.

5. Feasibility of surveillance and monitoring [40 CFR 228.6(a)5].

Monitoring of the preferred sites is discussed in the Site Management and Monitoring Plans (SMMPs) provided in Appendix L. Surveillance and monitoring of the preferred and candidate sites are feasible. However, due to the greater depths and greater distance offshore of the offshore candidate sites, monitoring would be more expensive for these sites. The depths at the offshore candidate sites are beyond EPA's current in-house sidescan sonar capability. Additionally, collecting grab samples from the bottom and water samples at these depths and high currents is more difficult than at the preferred sites.

6. Dispersal, horizontal transport, and vertical mixing characteristics of the area, including prevailing current direction and velocity, if any [40 CFR 228.6(a)6].

Previous Dredged Material Fate Studies in Close Proximity of the Project Alternative Sites. In response to a request by the Jacksonville District, WES performed technical studies of the Gulf Stream meanders, frontal eddies, and prevailing tides and currents off the east coast of Florida with respect to the potential for reef siltation by disposed dredged material originating from the Miami ODMDS. In these studies, both the short-term disposal and long-term erosion simulations of sediment transport as a function of local velocity fields indicated little possibility of affecting reefs as a direct result of use of the proposed sites (CERC, 1989; CERC, 1995).

In addition, the National Oceanic and Atmospheric Administration (NOAA) Atlantic Oceanographic and Meteorological Laboratory in Miami, Florida conducted a field study of the disposal plumes from the Miami Harbor project. The study concluded that the dredged material, except for a low concentration residual remaining within the water column, reached bottom within the designated site boundaries. For the discharges monitored, the resulting plumes were observed to be transported in a north to northeast direction (NOAA, 1991).

Dredged Material Fate Studies for Port Everglades/Palm Beach ODMDSs. An evaluation of the Port Everglades Harbor and Palm Beach Harbor ODMDSs was performed at the request of the USACE, Jacksonville District (see Appendix K). The study utilized three years of velocity data from an ADCP located offshore Port Everglades, Florida. The directional distribution of velocities reflected in the data indicates that the most prevalent currents are headed to the north and these currents also have the greatest average velocity. Maximum surface currents did not exceed 530 cm/sec with average surface currents on the order of 70 to 100 cm/sec. Currents are discussed further in Section 3.7. Additional work was requested by the USACE, Jacksonville District, to clarify, justify and further examine the study results (WES, 2001). The following discussion and results are taken from the original and supplementary studies conducted WES/CERC. Copies of the studies are also attached in appendices M and K.

Short-Term Modeling Results. STFATE was used to estimate the dynamics of the sediment cloud following its release from the dredge. The model computes the time-history of a single disposal operation from the time the dredged material is released from the barge until it reaches equilibrium. STFATE was used to model worst case and typical current profiles.

Port Everglades Harbor. In all Port Everglades Harbor applications sediment was disposed 6,100 m from the grid origin (reef location). Two sediment compositions were simulated, with 60% and 70% solids by weight and 38% and 5% fines, respectively. Additionally, eight velocity profiles were simulated ranging from 50% to 99% exceedence velocities in both the north and west direction. Results indicate silt-clay concentrations diminish to approximately 1 mg/l or less at a distance of 1,500 m west of the disposal location. Sand concentrations diminish to 1 mg/l or less at a distance of 2,440 m west of the disposal location. Under the most severe conditions (North 99 percentile velocity: 70% solids), the maximum total sediment concentration within 4,000 m from the reef location was approximately 3 mg/l at a depth of 137 m. A major portion of the dredged material is sand with a concentration of 2.7 mg/l, while the silt-clay concentration value was 0.5 mg/l.

The typical (median) velocity profile modeled was derived from analysis of the 0-5° from north angle band described in Cialone and Lillycrop (1998). A majority of the currents measured were in this angle band. Simulating sediment transport under these conditions describes the phenomena under typical conditions. The typical velocity profile indicated that the sediment was moving toward the northeast and not toward the reef. Concentrations for the typical velocity profile were never observed west of the disposal location, which was 6100 m from the reef. The results show that sediment is moving toward the north and approximately parallel to the shore away from the reef for the typical velocity profile. After 100 minutes, the maximum total concentration in the water column for the 70% solids case was 2 mg/l. Consequently, it can be concluded that under typical conditions no potential exists for sediment movement from the Port Everglades Harbor ODMDS onto the reef.

Palm Beach Harbor. In all Palm Beach Harbor applications sediment was disposed 5,500 m from the grid origin (reef location). Two sediment compositions were simulated, with 80% and 85% solids by weight and 6% fines. In addition, eight velocity profiles were simulated ranging from 50% to 99% exceedence velocities in both the north and west direction. Silt-clay concentrations diminish rapidly to 1 mg/l or less within 1,500 m west of the disposal location. Sand concentrations diminish to 1 mg/l or less within 2,400 m west of the disposal location. Under the most severe conditions (North 99 percentile velocity: 85% solids), the maximum total sediment concentration within 3,800 m from reef location was approximately 19 mg/l at a depth of 55 m. A major portion of the dredged material is sand with a concentration of 17.4 mg/l, while the silt-clay concentration value was 1.5 mg/l. The sand in the dredged material settles rapidly and it is expected that the concentration will decrease with closer distance to the reef.

The typical (median) velocity profile modeled was derived from analysis of the 0-5° from north angle band described in Cialone and Lillycrop (1998). A majority of the currents measured were in this angle band. Simulating sediment transport under these conditions describes the phenomena under typical conditions. The typical velocity profile indicated that the sediment was moving toward the north and approximately parallel to the shore away from the reef. After 105 minutes, the maximum total concentration in the water column for the 85% solids case was 2 mg/l.

It can therefore be concluded that under typical conditions no potential exists for sediment movement from the ODMDS at Palm Beach Harbor onto the reef.

Long Term Modeling Results. A screening level erosion model was used to estimate the long-term response of the dredged material mounds at the Port Everglades Harbor and Palm Beach Harbor ODMDSs to local environmental forcing functions. The screening level erosion modeling was completed using the three largest historical storms selected from the National Hurricane Center's HURDAT database. An additional case of a severe extratropical storm was also simulated for the Port Everglades Harbor site. The model was used to estimate the peak sediment flux and total sediment loss caused by the three severe tropical storms. A 305 m × 305 m × 0.41 m square mound configuration was assumed for a 50,000 cy mound. This volume represents the annual amount that each disposal site is expected to accommodate. The total sediment losses for each storm, in which the peak flux was assumed to occur for four hours across one side of the 305 m × 305 m disposal site, are 3.5 m^3 at the Port Everglades Harbor site (0.09% of 50,000 cy mound) and 3 m^3 at the Palm Beach Harbor site (0.08% of 50,000 cy mound).

The USACE also suggested applying the screening level erosion model for a larger mound of 500,000 cy (10 times the volume) to simulate the long-term fate of the disposal mound for both sites. The assumed dimension of the proposed mound was 965 m × 965 m × 0.41 m. The input data to the screening level model (wave height, wave period, water depth, sediment size, and velocity) were those used in the previous application. The total sediment loss for each storm was estimated when the peak flux was assumed to occur for four hours across one side of the 965 m × 965 m disposal site. The maximum computed total sediment loss is 11 m^3 at the Port Everglades Harbor site and 10 m^3 at the Palm Beach Harbor site; both are less than 0.003% of the disposed mound volume of 500,000 cy. The results of the study indicate that even during the most severe storms and with mounds 10 times larger than the annual amount that each disposal site is expected to accommodate, the mounds at the Port Everglades Harbor and Palm Beach Harbor sites will not be significantly eroded.

7. Existence and effects of current and previous discharges and dumping in the area (including cumulative effects) [40 CFR 228.6(a)7].

There are two formerly designated interim-designated ODMDSs near Palm Beach Harbor. Use of these sites was discontinued by the implementation of the Water Resources Development Act of 1992. The disposal of dredged material from Palm Beach Harbor was conducted annually between 1950-1953, 1955-59, 1961-63, 1968, 1979-81, and 1983. During this time, 5,230,828 cy (3,999,491 m^3) of material have been disposed. The characteristics of the dredged material are poorly graded sand with traces of shell fragments (Barry Vittor and Associates, Inc., 1985).

The existing EPA interim-designated ODMDS at Port Everglades Harbor is located approximately 2.5 nmi (4.6 km) west-southwest of the preferred site. It was first used for dredged material disposal in 1952. Required maintenance dredging of Port Everglades Harbor has been relatively infrequent and occurred in 1952, 1960, 1978, and twice in 1982. During this time, 219,810 cy (168,067 m^3) of material were disposed at the interim site. The characteristics of the dredged material are organic silt with some clay (Barry Vittor and Associates, Inc., 1985). No records of ocean disposal prior to 1952 are available for this area. A 1984 survey conducted by EPA indicated that some damage to nearby inshore, hard bottom areas may have occurred because of the movement of fine material associated with

the disposal of dredged material at the site. In light of the survey findings, disposal at the Port Everglades Harbor interim site was discontinued.

8. Interference with shipping, fishing, recreation, mineral extraction, desalination, fish and shellfish culture, areas of special scientific importance, and other legitimate uses of the ocean [40 CFR 228.6(a)8].

Commercial Shipping/Recreational Boating. The preferred Palm Beach Harbor ODMDS is located just north and approximately 4.5 nmi (8.3 km) east of the entrance channel to the Port of Palm Beach and the Lake Worth inlet, an area of heavy commercial shipping traffic. Most traffic passes to the south of the alternative disposal sites. Therefore, the infrequent use of any of the alternative sites would not significantly disrupt either commercial shipping or recreational boating.

The preferred Port Everglades Harbor ODMDS is located just north and approximately 4.0 nmi (7.4 km) east of the entrance channel to the Port Everglades Harbor, an area of heavy commercial shipping traffic. Most traffic passes to the south of the alternative disposal sites. Therefore, the infrequent use of any of the alternative sites would not significantly disrupt either commercial shipping or recreational boating.

Fishing. Commercial and recreational fishing activity is concentrated in inshore and nearshore waters or at offshore natural and artificial reefs. Proximity of the considered alternative sites to the offshore natural and artificial reefs was discussed under Specific Criteria #3. All considered alternative sites are located at least 2.3 nmi (4.3 km) from the natural or artificial reefs. All considered alternative sites are located within reported habitat (175-300 m water depth) for the Golden Tilefish (Parker and Mays, 1998). EPA does not believe the Palm Beach Harbor preferred ODMDS provides the necessary malleable substrate from which the tilefish can construct shelter and that any impact to tilefish habitat at the Port Everglades Harbor preferred ODMDS will be minor (see Appendix I). Therefore, disposal activities are not expected to interfere with fishing activities.

Recreation. Coastal waters of Broward and Palm Beach counties are used for swimming, skiing, sailing, boating, surfing, skin diving, and SCUBA diving, but few of these activities occur in, and none is restricted to, the preferred ODMDSs.

Mineral Extraction. No mineral extraction occurs in the immediate project area. According to the MMS, no data are available regarding sand resources in the project areas. The MMS has not identified any sources of beach quality material in the vicinity of the proposed sites.

Other Activities. No desalination or mariculture activities occur in the immediate area. Data for communication cables is not determinable within the project areas according to the Office of Public Affairs (OPA). FDEP further stated that undisclosed cables might potentially exist from the Navy. Placement of a natural gas pipeline is proposed between Port Everglades and Freeport, Grand Bahama Island. EPA is coordinating with other federal agencies in order to minimize any potential interferences with the proposed pipeline.

Scientific Resources. Located on the south side of the Port Everglades inlet in Dania, Florida, the South Florida Ocean Measurement Center (SFOMC, formerly the South Florida Testing Facility) has housed an active, continuously operating Navy range for over forty

years. The SFOMC was placed under the administration of the Naval Surface Warfare Center, Carderock Division in 1994. The SFOMC allows the monitoring of surface ship, submarine, and remote vehicle signatures in the nearshore environment. Multiple fixed in-water electromagnetic and acoustic measurement sites at 10, 20, and 200 m are controlled from a secure range house. The range encompasses the Navy's only shallow and deep magnetic research and development ranges, including submerged operations. The Port Everglades Harbor 4-mile (preferred) ODMDS is located approximately 1.5 miles from the northern boundary of the SFOMC.

9. The existing water quality and ecology of the site as determined by available data or by trend assessment or baseline surveys [40 CFR 228.6(a)9].

Baseline surveys conducted for the Palm Beach Harbor and the Port Everglades Harbor ODMDSs show the water quality and other environmental characteristics of the preferred and candidate ODMDSs to be typical of the Atlantic Ocean (Appendix H). Salinity, dissolved oxygen, and transmissivity data indicated water masses over the sites were similar to open ocean waters and deviated little between sites. Macroinfaunal samples were dominated in numbers by annelids and arthropods. All areas surveyed were similar in that they had a similar number of taxa dominated by the same major taxonomic groups. The southern portion of the Port Everglades Harbor 7-mile candidate site was dominated by low relief limestone hard bottom. This hard bottom area may be considered a unique ecological community.

10. Potential for the development or recruitment of nuisance species in the disposal site [40 CFR 228.6(a)10].

The disposal of dredged material should not attract or promote the development of nuisance species. No pre-disposal nuisance organisms were identified in surveys conducted in the vicinities of the proposed ODMDSs or in previously utilized disposal sites in the surrounding area.

Based on information on the community structure of the preferred sites, no adverse changes in benthic species composition are expected. The communities currently present in the sites are characteristic of sand bottom substrates. The material proposed for the disposal includes fine-grained sand. The similarity of dredged materials to the sediments of the disposal sites and surrounding areas should make the development or recruitment of undesirable species unlikely.

11. Existence at or in close proximity to the site of any significant natural or cultural features of historical importance [40 CFR 228.6(a)11].

No natural or cultural features of historical importance are known to occur at, or in proximity to, the preferred or candidate sites with the exception of the low relief limestone hard bottom identified in the southern portion of the Port Everglades Harbor 7-mile candidate site. No other significant features were noted in video or sidescan surveys of the alternative sites.

4.3.5 Summary of Specific Criteria Applications

Tables 19 and 20 summarize the application of the specific criteria to the sites.

4.3.6 Unavoidable Adverse Environmental Effects and Mitigation Measures

Unavoidable adverse impacts from dredged material disposal at any of the alternative sites include the following:

- Formation of temporary, localized water column changes associated with suspended sediment plumes;
- Burial and smothering of non-motile infauna and/or epifauna;
- Possible alterations in sediment texture, grain size and/or chemical composition; and
- Changes in bathymetry (mounding of material).

Plumes of suspended sediment associated with sinking dredged materials would result in increases in turbidity levels, suspended particulate concentrations, and decreased light transmittance. These effects are limited to disposal operations, are localized, short-term effects dissipated by natural dispersion, mixing, and eventual sinking of particles as discussed in Section 4.3.4. Use of the sites is expected to be infrequent.

Deposition of dredged materials will bury and smother localized populations of benthic organisms, reducing abundance and diversity of the benthic communities in the immediate area of dumping. The magnitude of this impact will depend on the extent of the affected area, volume of dredged material disposed, and specific tolerances of affected species to periodic burial. The recovery of impacted areas will reflect the ability of buried organisms to burrow through the sediment layer and the ability of adjacent populations to recolonize the area. Differences in grain size characteristics between the dredged materials and the existing site sediments could exacerbate impacts to the benthic fauna. Alterations in the bottom sediment texture could affect the survival of existing species or recruitment of new species. Benthic assemblages requiring hard substrate or structure will be less tolerant of burial and less able to recolonize than those assemblages associated with sand or sand-silt substrates.

With regard to water column effects and benthic impacts, mitigating measures include required periodic evaluations of dredged materials proposed for ocean disposal using applicable guidance. The periodic bioassay and bioaccumulation testing of dredged materials will ensure that dredged materials remain non-toxic to marine organisms. Mitigation includes selection of preferred disposal sites that avoid hard substrate or structure. In addition, disposal operations will be managed (see SMMPs in Appendix L) to limit the areal extent of burial. Site management and monitoring activities including routine bathymetry and site use documentation are mitigation measures for physical effects such as mounding, area covered, and frequency of impact for a specific area.

4.4 Socioeconomic Impacts

No significant socioeconomic impacts are anticipated because of actions associated with the proposed projects. Cost estimates for Port Everglades Harbor dredging (Appendix D) indicate that the 7-mile candidate site would increase project costs by 4-18% (depending on dredging method) over the 4-mile (preferred) site. For Palm Beach Harbor, cost estimates for dredging

Table 19. Summary of the Specific Criteria as Applied to the Preferred and Candidate Ocean Dredged Material Disposal Sites for Palm Beach Harbor

Criteria as Listed in 40 CFR 228.6(a)		Offshore Candidate Site (9-Mile Site)	Preferred Site (4.5-mile Site)
1.	Geographical position, depth of water, bottom topography and distance from coast.	See Figure 1. Approximately 9 nmi offshore Lake Worth Inlet on the upper continental slope. Depths: 855 to 985 feet (260 to 300 meters). Declivity of 65 ft (20 m) per nautical mile (nmi) [1.85 kilometers (km)]. Uniform fine sandy bottom.	See Figure 1. Approximately 4.5 nm offshore Lake Worth Inlet on the upper continental slope. Depths: 509 to 607 feet (155 to 185 meters). Declivity of at least 98 ft (30 m) per nautical mile (nmi) [1.85 kilometers (km)]. Uniform fine sandy bottom.
2.	Location in relation to breeding, spawning, nursery, feeding, or passage areas of living resources in adult or juvenile phases.	None concentrated in or restricted to the proposed disposal sites. Most breeding, spawning, nursery, and feeding activities take place in coastal waters or at reef areas located shoreward (7.2 nmi) of the site. Passage through the site is not geographically restricted.	None concentrated in or restricted to the proposed disposal sites. Most breeding, spawning, nursery, and feeding activities take place in coastal waters or at reef areas located shoreward (4.8 nmi) of the site. Passage through the site is not geographically restricted.
3.	Location in relation to beaches and other amenity areas.	The site is located 8 nmi (14.8 km) from coastal beaches. The natural reef zones lay at least 7.2 nmi (13.3 km) inshore of the proposed sites. Artificial reef sites are located at least 5.8 nmi (10.7 km) west of the proposed sites. Isolated patches of *Oculina* lay approximately 7.4 nmi (13.7 km) west of the site.	The site is located 4.3 nmi (8.0 km) from coastal beaches. The natural reef zones lay at least 2.6 nmi (4.8 km) inshore of the proposed sites. Artificial reef sites are located at least 2.6 nmi (4.8 km) west of the proposed sites. Isolated patches of *Oculina* lay approximately 1.7 nmi (3.2 km) west of the site.
4.	Types and quantities of waste proposed to be disposed of, and proposed methods of release, including methods of packing the waste if any.	The only material to be disposed in the ODMDS will be dredged material that complies with EPA Ocean Dumping Regulations (40 CFR 220-229).	The only material to be disposed in the ODMDS will be dredged material that complies with EPA Ocean Dumping Regulations (40 CFR 220-229).
5.	Feasibility of surveillance and monitoring.	Feasible. However, depths, currents and distance from shore increase cost of monitoring.	Feasible. Draft Site Management and Monitoring Plan is included in this EIS as Appendix L.
6.	Dispersal, horizontal transport, and vertical mixing characteristics of the area, including prevailing current direction and velocity, if any.	Prevailing currents parallel the coast and are generally oriented along a north-south axis. Northerly flow predominates. According to the latest ADCP data from 1995 to 1997, mean surface currents range from 10 to 100 cm/sec depending on direction with maximum velocities up to 530 cm/sec. Current speeds are lower and current reversals more common in near-bottom waters. Mean velocities of 20 cm/sec and	Prevailing currents parallel the coast and are generally oriented along a north-south axis. Northerly flow predominates. According to the latest ADCP data from 1995 to 1997, mean surface currents range from 10 to 100 cm/sec depending on direction with maximum velocities up to 530 cm/sec. Current speeds are lower and current reversals more common in near-bottom waters. Mean velocities of 20 cm/sec and

Table 19. Summary of the Specific Criteria as Applied to the Preferred and Candidate Ocean Dredged Material Disposal Sites for Palm Beach Harbor

Criteria as Listed in 40 CFR 228.6(a)		Offshore Candidate Site (9-Mile Site)	Preferred Site (4.5-mile Site)
		maximum velocities of 130 cm/sec have been measured for near-bottom waters in the area. Dredged material dispersion studies conducted by the USACE for both short and long-term fate of material disposed at Palm Beach Harbor and Port Everglades Harbor ODMDSs indicate little possibility of disposed material affecting near-shore reefs in the areas of the disposal sites.	maximum velocities of 130 cm/sec have been measured for near-bottom waters in the area. Dredged material dispersion studies conducted by the USACE for both short and long-term fate of material disposed at Palm Beach Harbor and Port Everglades Harbor ODMDSs indicate little possibility of disposed material affecting near-shore reefs in the areas of the disposal sites.
7.	Existence and effects of current and previous discharges and dumping in the area (including cumulative effects).	No current or prior dumping or discharges in the area.	No current or prior dumping or discharges in the area.
8.	Interference with shipping, fishing, recreation, mineral extraction, fish and shellfish culture, areas of special scientific importance, and other legitimate uses of the ocean.	No significant interference is anticipated.	No significant interference is anticipated. Closest fishing areas are located $\geq$2.0 nmi (3.7 km) inshore of the site.
9.	The existing water quality and ecology of the site as determined by available data or by trend assessment or baseline surveys.	Water quality at the sites is typical of the Atlantic Ocean. The site supports a benthic and epibenthic fauna characteristic of upper continental slope habitat.	Water quality at the sites is typical of the Atlantic Ocean. The location of the Florida Current determines whether the site waters are predominantly coastal or oceanic. The site supports a benthic and epibenthic fauna characteristic of upper continental slope habitat.
10.	Potential for the development of nuisance species in the disposal site.	Disposal should not recruit or promote the development of nuisance species.	Disposal should not recruit or promote the development of nuisance species.
11.	Existence at or in close proximity to the site of any significant natural or cultural features of historical importance.	No known features.	No known features.

Table 20. Summary of the Specific Criteria as Applied to the Preferred and Candidate Ocean Dredged Material Disposal Sites for Port Everglades Harbor

Criteria as Listed in 40 CFR 228.6(a)		Offshore Candidate Site (7-Mile Site)	Preferred Site (4-Mile Site)
1.	Geographical position, depth of water, bottom topography and distance from coast.	See Figure 2. Approximately 7 nmi offshore Port Everglades, FL on the upper continental slope. Depths: 785 to 920 feet (240 to 280 meters). Declivity of at least 68 ft (20 m) per nautical mile (nmi) [1.85 kilometers (km)]. Northern half of site dominated by uniform sandy bottom. Low relief hard bottom in southern half of site.	See Figure 2. Approximately 4 nmi offshore Port Everglades, FL on the upper continental slope. Depths: 640 to 705 feet (195 to 215 meters) Declivity of at least 135 ft (40 m) per nautical mile (nmi) [1.85 kilometers (km)]. Uniform fine sandy bottom.
2.	Location in relation to breeding, spawning, nursery, feeding, or passage areas of living resources in adult or juvenile phases.	None concentrated in or restricted to the proposed disposal sites. Most breeding, spawning, nursery, and feeding activities take place in coastal waters or at reef areas located shoreward (6.2 nmi) of the site. Passage through the site is not geographically restricted.	None concentrated in or restricted to the proposed disposal sites. Most breeding, spawning, nursery, and feeding activities take place in coastal waters or at reef areas located shoreward (3 nmi) of the site. Passage through the site is not geographically restricted.
3.	Location in relation to beaches and other amenity areas.	The site is located 6 nmi (11.1 km) from coastal beaches. The natural reef zones lay at least 6.2 nmi (11.4 km) inshore of the proposed sites. Artificial reef sites are located at least 5 nmi (9.3 km) west of the proposed sites.	The site is located 3.8 nmi (7.1 km) from coastal beaches. The natural reef zones lay at least 3 nmi (5.6 km) inshore of the proposed sites. Artificial reef sites are located at least 2.3 nmi (4.3 km) west of the proposed sites.
4.	Types and quantities of waste proposed to be disposed of, and proposed methods of release, including methods of packing the waste if any.	The only material to be disposed in the ODMDS will be dredged material that complies with EPA Ocean Dumping Regulations (40 CFR 220-229).	The only material to be disposed in the ODMDS will be dredged material that complies with EPA Ocean Dumping Regulations (40 CFR 220-229).
5.	Feasibility of surveillance and monitoring.	Feasible. However, depths, currents and distance from shore increase cost of disposal.	Feasible. Draft Site Management and Monitoring Plan is included in this EIS as Appendix L.
6.	Dispersal, horizontal transport, and vertical mixing characteristics of the area, including prevailing current direction and velocity, if any.	Prevailing currents parallel the coast and are generally oriented along a north-south axis. Northerly flow predominates. According to the latest ADCP data from 1995 to 1997, mean surface currents range from 10 to 100 cm/sec depending on direction with maximum velocities up to 530 cm/sec. Current speeds are lower and current reversals more common in near-bottom waters. Mean velocities of 20 cm/sec and maximum velocities of 130 cm/sec have been	Prevailing currents parallel the coast and are generally oriented along a north-south axis. Northerly flow predominates. According to the latest ADCP data from 1995 to 1997, mean surface currents range from 10 to 100 cm/sec depending on direction with maximum velocities up to 530 cm/sec. Current speeds are lower and current reversals more common in near-bottom waters. Mean velocities of 20 cm/sec and maximum velocities of 130 cm/sec have been

Table 20. Summary of the Specific Criteria as Applied to the Preferred and Candidate Ocean Dredged Material Disposal Sites for Port Everglades Harbor

Criteria as Listed in 40 CFR 228.6(a)		Offshore Candidate Site (7-Mile Site)	Preferred Site (4-Mile Site)
		measured for near-bottom waters in the area. Dredged material dispersion studies conducted by the USACE for both short and long-term fate of material disposed at Palm Beach Harbor and Port Everglades Harbor ODMDSs indicate little possibility of disposed material affecting near-shore reefs in the areas of the disposal sites.	measured for near-bottom waters in the area. Dredged material dispersion studies conducted by the USACE for both short and long-term fate of material disposed at Palm Beach Harbor and Port Everglades Harbor ODMDSs indicate little possibility of disposed material affecting near-shore reefs in the areas of the disposal sites.
7.	Existence and effects of current and previous discharges and dumping in the area (including cumulative effects).	No current or prior dumping or discharges in the area.	No current or prior dumping or discharges in the area.
8.	Interference with shipping, fishing, recreation, mineral extraction, fish and shellfish culture, areas of special scientific importance, and other legitimate uses of the ocean.	No significant interference is anticipated.	No significant interference is anticipated. Closest fishing areas are located $\geq$2.0 nmi (3.7 km) inshore of the site.
9.	The existing water quality and ecology of the site as determined by available data or by trend assessment or baseline surveys.	Water quality at the sites is typical of the Atlantic Ocean. The site supports a benthic and epibenthic fauna characteristic of upper continental slope habitat. The southern portion of the site is dominated by low relief limestone hard bottom. This hard bottom area may be considered a unique ecological community.	Water quality at the sites is typical of the Atlantic Ocean. The location of the Florida Current determines whether the site waters are predominantly coastal or oceanic. The site supports a benthic and epibenthic fauna characteristic of upper continental slope habitat.
10.	Potential for the development of nuisance species in the disposal site.	Disposal should not recruit or promote the development of nuisance species.	Disposal should not recruit or promote the development of nuisance species.
11.	Existence at or in close proximity to the site of any significant natural or cultural features of historical importance.	The southern portion of the site is dominated by low relief limestone hard bottom. This hard bottom area may be considered a unique ecological community.	No known features.

(Appendix C) indicate that the 9-mile candidate site would increase project costs by 6-18% (depending on dredging method) over the 4.5-mile (preferred) site.

4.5 Cumulative Impacts

Cumulative impacts are defined in 40 CFR 1508.7 as "impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions." NEPA guidance requires that such connected, similar impacts be examined.

4.5.1 Past Projects

EPA Interim-Designated ODMDSs

Dredged material disposal has occurred at the EPA interim-designated ODMDSs discussed in Section 2.4. Use of the two interim sites for Palm Beach Harbor was discontinued as a result of the implementation of the WRDA of 1992. The interim site for Port Everglades Harbor was discontinued after a 1984 EPA survey indicated that some damage to nearby inshore, hard bottom areas may have occurred due to the movement of fine material associated with disposed dredged material.

4.5.2 Current Projects

Maintenance of Palm Beach and Port Everglades Harbors Federal Navigation Projects

These projects will continue to require periodic dredging to maintain adequate depths for access and safe navigation. Ocean dredged material disposal will likely be required for these projects. The need for ocean disposal is based primarily on the lack of economically, logistically, and environmentally feasible alternatives for the disposal of the projected quantities of dredged material deemed unsuitable for beach nourishment or other beneficial uses.

Intracoastal Waterway Federal Navigation Project

The Intracoastal Waterway (ICWW) provides deep draft access to coastal Florida in the vicinity of the study area. The ICWW is confined from the open ocean by the outer rim of barrier islands in Palm Beach and Broward counties and is located a substantial distance from the continental shelf-slope break. Ocean disposal of dredged material is unlikely to result from this project.

Beach Re-Nourishment Projects

Federal beach re-nourishment projects exist for both Palm Beach and Broward counties. Both projects allow for the restoration of beaches to a general width of 100 ft with a berm elevation of 10 ft above mean low water, and periodic nourishment thereafter. Dredged material from Palm Beach and Port Everglades harbors that is beach quality may be used for these projects. Beach re-nourishment projects are nearshore activities and would not likely result in impacts to offshore environments such as those in which the project areas are located.

Wastewater Outfalls

Current projects that may serve as potential sources of pollution in the area include wastewater outfalls. Offshore sewage outfalls have been used to discharge untreated or partially treated domestic wastewater in southeastern Florida for over 60 years. Under current regulations, untreated effluent is no longer discharged, and the discharged effluent has undergone secondary treatment and chlorination. Two wastewater ocean outfalls discharge into ocean waters near Palm Beach Harbor and two wastewater ocean outfalls discharge into ocean waters near Port Everglades Harbor. Amplifying information on these facilities is provided in tables 21 and 22.

Table 21. Wastewater Ocean Outfalls in the Vicinity of Palm Beach Harbor

Facility Description	Address (City)	Distance to 4.5-Mile (Preferred) Site (mi)
Delray Beach WTP	Unknown (Delray Beach)	26.8
Boca Raton WTP	1501 W Glades Rd (Boca Raton)	31.3

Source: EPA, 1998.

Table 22. Wastewater Ocean Outfalls in the Vicinity of Port Everglades Harbor

Facility Description	Address (City)	Distance to 4-Mile (Preferred) Site (mi)
Broward County North District WTP	2401 N Powerline Rd (Pompano Beach)	12.4
Hollywood WTP	3441 Hollywood Blvd (Hollywood)	11.1

Source: EPA, 1998.

Recent studies on the impact of wastewater outfalls on marine habitat indicate that nutrient loading would be the likely source of any impacts to the habitat (EPA, 1998). However, significant adverse impacts to marine environments have not been documented in association with offshore wastewater outfalls, owing to dilution and mixing under the influence of prevailing currents. Additionally, any impacts would be ongoing, and would likely have been incorporated into existing water quality parameters.

4.5.3 Reasonably Foreseeable Future Projects

Potential reasonably foreseeable future projects in the vicinity of the project areas may include subsea placement of fiber optic cables, USACE harbor maintenance dredging projects, new or proposed USACE harbor deepening projects, and USACE beach re-nourishment projects. Future projects in the vicinity of the project area could involve channel modifications that are currently unknown.

Subsea Cable Placement

No projects for future subsea placement of fiber optic cables are known to exist at this time for offshore Palm Beach or Broward counties. Charts obtained from AT&T provide the locations of existing telephone cables offshore of Palm Beach and Broward counties as of 30 August 1996. The charts indicate that two telephone cables may intersect the preferred and candidate sites for the Palm Beach Harbor ODMDS. The cables are listed as out of service on the chart. No existing cables that

may intersect that proposed sites for Port Everglades Harbor were noted on the chart. The FDEP Southeast Office was contacted regarding fiber optic cables offshore of Pam Beach and Broward counties. FDEP reported that fiber optic cable landings occur at West Palm Beach, Delray Beach, and Boca Raton in Palm Beach County; and Port Everglades and Hollywood in Broward County. FDEP further stated that undisclosed cables might potentially exist from the Navy. The fiber optic cables at West Palm Beach and Port Everglades may lie in close proximity to the proposed Palm Beach Harbor and Port Everglades Harbor sites, respectively; however, based on the available evidence, it is unlikely that these cables intersect the proposed sites. No known instances of damage to underwater cables occurring as a result of offshore dredged material disposal were found. Consequently, it is unlikely that any impacts to underwater cables in the vicinity of the project area will occur as a result of implementation of the proposed project.

AES Ocean Express Pipeline Project

AES Ocean Express LLC has submitted an application to lay a 54.3-mile, 24-inch pipeline from a receipt point on the Economic Exclusion Zone between the United States and the Bahamas to delivery points in Broward County, Florida, together with certain ancillary facilities. Approximately 48 miles of this pipeline will be laid in the Atlantic Ocean off Florida's east coast. The remaining 6.3 miles would extend west from a shoreline entry point east of Dania, Florida, and end at proposed interconnections with Florida Gas Transmission Company and Florida Power and Light Company systems. The proposed pipeline would transport up to 842 million standard cubic feet of natural gas into Florida per day. According to the project FEIS, construction of the AES Ocean Express Pipeline would impact approximately 2.9 acres (0.01 km^2) of hardbottom habitat. Disruption of offshore live bottom habitats is expected to be minimal because of the use of horizontal directional drilling during construction. Local temporary increases in turbidity would also likely result from project implementation. Any temporary impacts to offshore essential fish habitat and commercial fisheries resulting from project implementation would be temporary and expected to recover shortly after construction activities were completed.

Although specific geospatial coordinates of the AES Ocean Express Pipeline are not readily available, comparison of the pipeline project's map layout with that of the proposed Port Everglades Harbor ODMDS indicates that the proposed pipeline route appears to pass no closer than approximately 4 nmi south of the preferred (4-mile) site.

Tracetebel Calypso Pipeline Project

Tractebel Calypso LLC has also proposed construction of a pipeline to transport natural gas from the Bahamas to South Florida. This 24-inch pipeline would begin at a proposed regasification plant near Freeport, Bahamas and be laid 89.9 miles to Port Everglades in Broward County Florida, where it will connect with the proposed Tractebel Calypso onshore pipeline segment. Approximately 36 miles of this pipeline would extend from the Economic Exclusion Zone to the coast of Florida. The proposed pipeline is 90 miles in total length and will transport up to 832 million standard cubic feet of natural gas per day. Directional drilling will be utilized at the onshore approaches to the pipeline to minimize environmental effects. According to the project FEIS, construction of the Tractebel Calypso Pipeline would impact approximately 16.2 acres of marine habitat. Approximately 7.2 acres (0.03 km^2) of this habitat occurs at a depth of less than 200 ft (61 m). Of these 7.2 acres, approximately 4.7 acres (0.02 km^2) are natural or artificial hardbottoms. Avoidance of deepwater hardbottom and live bottom habitat has been incorporated into the proposed pipeline route. Local temporary increases in turbidity would also likely result from project implementation.

Disruption of offshore live bottom habitats is expected to be minimal because of the use of horizontal directional drilling in sensitive habitat areas during construction.

Although specific geospatial coordinates of the Tractebel Calypso Pipeline are not readily available, comparison of the pipeline project's map layout with that of the proposed Port Everglades Harbor ODMDS indicates that the proposed pipeline route is in close proximity to the preferred and candidate sites for the Port Everglades Harbor ODMDS. EPA expressed concern in a letter dated 17 September 2003 regarding a conflict between the proposed pipeline alignment and the proposed Port Everglades Harbor sites. The Federal Energy Commission, in its response to this letter, stated that the proposed Calypso pipeline alignment would avoid both the preferred and the candidate sites for the Port Everglades Harbor ODMDS.

El Paso Seafarer Pipeline Project

Florida Power and Light Group Resources and El Paso Corporation signed an agreement in April 2004 for capacity on the proposed El Paso Seafarer Pipeline System. The proposed pipeline will have a total length of 160-miles and a diameter of 26 inches. The system as planned will transport natural for the proposed High Rock liquefied natural gas regasification facility in the Bahamas to south Florida. Landfall will be at Riviera Beach in Palm Beach County, from which the pipeline will extend 42 miles to an existing gas pipeline and a power generation plant. A pipeline capacity of 800,000 dekatherms per day of natural gas is planned. Transportation service is estimated to begin in 2008, when the pipeline and the proposed Bahamas facility are scheduled to be completed. No project FEIS has been completed for the El Paso Seafarer Pipeline; consequently, impacts resulting from pipeline construction have not been quantified.

Although specific geospatial coordinates of the El Paso Seafarer Pipeline are not readily available, a comparison of the pipeline project's map layout with that of the proposed Palm Beach Harbor ODMDS indicates that the pipeline appears to pass no closer than 1-2 nmi south of the preferred (4.5-mile) site.

Palm Beach Harbor Construction

A feasibility study has been proposed for construction dredging at Palm Beach Harbor (currently proposed to take place in 2007). This feasibility study will augment a recently completed reconnaissance study which stated that deepening of the existing Federal project was justified. Construction activities at the harbor may result in the dredging of up to 1,000,000 cy of material. Additionally, construction of the harbor's North Turning Basin Extension (cited in the August 1984 Feasibility Report), may result in the dredging of 9,000 cy of material. Ocean dredged material disposal would likely be required for this project. Impacts resulting from the proposed construction dredging at Palm Beach Harbor include temporary increase in turbidity in the vicinity of dredging operations.

Port Everglades Harbor Deepening Project

A feasibility study is currently underway for improving the Federal navigation project at Port Everglades Harbor. The project, if approved, would consist of widening and deepening all the port's major channels and basins to accommodate future development. The proposed entrance channel would extend approximately 2,200 ft seaward from its current position. Three different stages of

deepening are currently proposed to occur between 2006 and 2012. An estimated volume of 7,379,400 cy of dredged material are expected to be generated by these deepening activities. Maintenance dredging of the project is currently proposed for 2024; an estimated 700,000 cy are expected to be removed during maintenance dredging. Ocean dredged material disposal would likely be required for this project. Impacts resulting from the proposed improvements at Port Everglades Harbor include temporary increase in turbidity in the vicinity of dredging operations.

4.5.4 Conclusion

Disposal of dredged material at the proposed ODMDS locations would result in temporary increases in turbidity in the vicinity of the proposed sites. Temporary increases in turbidity are also anticipated for several of the projects described above; however, it is unlikely that actions associated with the above projects would occur concurrently with disposal of dredged material at the proposed sites. Additionally, increases in turbidity from either dredged material disposal or actions associated with the above projects would be temporary in nature.

Impacts to offshore habitat from wastewater outfalls would most likely be caused by nutrient loading (EPA, 1998). Significant nutrient loading resulting from disposal of dredged material at the proposed ODMDS locations is not anticipated.

Both the AES Ocean Express and Tractebel Calypso Pipeline projects involve impacts to hardbottom habitats. At least 10.1 acres (0.04 km^2) of hardbottom habitat would be impacted by construction of these pipelines. No hardbottom natural reefs have been observed within the proposed ODMDS locations for either Palm Beach or Port Everglades harbors; however, the southern portion of the 7-mile site at Port Everglades Harbor, an area of approximately 420 acres (1.7 km^2) consists of relatively low relief hardbottom (see Appendix E). Consequently, as much as 430.1 acres (1.74 km^2) of ocean hardbottom habitat would be impacted by the combined effects of these actions if the 7-mile site were selected. No hardbottoms were detected at the preferred sites for either Palm Beach Harbor or Port Everglades Harbor; therefore designation of the ODMDSs at the preferred sites would not result in cumulative impacts to ocean hardbottoms in conjunction with other projects.

Significant adverse cumulative impacts are not anticipated from the designation of ODMDS locations for Palm Beach and Port Everglades harbors, in conjunction with past, present, or reasonably foreseeable future actions in the offshore waters off Palm Beach and Broward counties. Future projects in the area would be subject to the requirements of and would be evaluated in accordance with NEPA.

4.6 Relationship Between Local Short-Term Uses of the Environment and Maintenance and Enhancement of Long-Term Productivity

Use of the proposed ODMDSs in the manner described should have no effect on long-term productivity. Based on modeling for the Miami ODMDS, the disposal of dredged materials at the proposed ODMDSs would not result in significant long-term water quality degradation. Water quality impacts of concern with regard to dredged material disposal include those associated with increased turbidity, decreased DO levels, and the release of sediment-bound contaminants such as heavy metals, nutrients, and hydrocarbons, including pesticides and PCBs. Generally, contaminants bound in sediments are not released under conditions normally occurring at open water disposal sites (Burks and Engler, 1978; Saucier *et al*., 1978). Most potential contaminants remain sorbed on sediments, or are readily scavenged from the water column by particulate matter and metal oxides,

and precipitated. In addition, only material meeting ocean disposal criteria will be disposed at the site.

Increased turbidity resulting from dredged material disposal is generally short-term and transient (Windom, 1976). Elevated turbidity levels occur during dredged material disposal, but decrease rapidly as suspended sediments settle or disperse. Some increases in turbidity could occur at the pycnocline.

Temporary decreases in DO may occur during disposal. Given the depth of the well-mixed portion of the water column at the proposed ODMDS, significant offsite impacts are not expected and any onsite impacts should be of short duration.

Nutrients bound in sediments would be released to the water column during disposal. Soluble phosphorous would be temporarily released but would be rapidly scavenged from the water column (Burks and Engler, 1978). Soluble nitrogen compounds, particularly ammonia, would also be released during disposal.

The potential for water quality impacts resulting from the release of trace metals is minor. Most heavy metals are poorly soluble and are readily sorbed by suspended matter and precipitated (Windom, 1976; Burks and Engler, 1978). Hydrocarbons, such as pesticides and PCBs, are generally poorly water-soluble. These substances generally remain sorbed on sediments and are not released during disposal (Windom, 1976; Burks and Engler, 1978).

The disposal of uncontaminated sediments in compliance with EPA's Ocean Dumping Regulations and Criteria (40 CFR 220-229) would not be expected to result in sediment quality degradation. Periodic bioassay testing (toxicity/bioaccumulation) of proposed dredged material is required to ensure compliance.

Impacts of dredged material disposal on organisms in the water column are difficult to assess but are generally considered minimal and temporary (Pequegnat *et al.*, 1981). Most motile organisms (nekton) can avoid disposal operations and localized areas of poor water quality. Nonmotile (planktonic) organisms such as phytoplankton, zooplankton, and ichthyoplankton entrained within the disposal plume would be directly affected. The impacts of disposal on these organisms are difficult to assess in light of the high natural variability of planktonic communities. Significant long-term impacts are not anticipated.

Sedentary and slow-moving benthic and epibenthic biota could be impacted both directly and indirectly by dredged material disposal. Direct impacts would result from the smothering of bottom-dwelling organisms under varying depths of dredged material. These impacts would result in the loss of some of the disposal site biota and the resultant alteration of benthic community structure. The high reproductive potential of most benthic infaunal species is expected to re-establish pre-disposal conditions rapidly.

Direct impacts would occur at the specific sites of disposal. Recolonization from both the vertical migration of resident infaunal species and the recruitment of species from nearby areas would occur rapidly after completion of disposal operations.

Indirect impacts to biota could include the disruption of localized population dynamics of individual species. Indirect impacts would occur in and near the disposal sites.

4.7 Irreversible or Irretrievable Commitment of Resources

An irreversible commitment of resources is one in which the ability to use and/or enjoy the resource is lost forever. Non-renewable fossil energy (petroleum) used for fuel during project activities would be an irreversible loss.

With all being equal concerning construction, equipment and personnel, fuel consumption would only differ with distance and time to each candidate site. This would hold true for comparing dredging operations that included either beach nourishment or ocean disposal. Estimates for Port Everglades Harbor dredging indicate that the 7-mile candidate site would increase fuel consumption by 28% or 130 gallons per load over the 4-mile (preferred) site. This equates to approximately 9,100 gallons of fuel for a 50,000 cy project. For Palm Beach Harbor, estimates for dredging indicate that the 9-mile candidate site would increase fuel consumption by 40% or 192 gallons per load over the 4.5-mile (preferred) site. This equates to approximately 14,881 gallons of fuel for a 50,000 cy project (Fletcher, 2003).

An irretrievable commitment of resources is one in which, due to decisions to manage the resource for another purpose, opportunities to use or enjoy the resource as they presently exist are lost for a period of time. Other than creating a potential for altering the structure of benthic communities by possibly changing the characteristics of the substrate, no irretrievable loss of resources is expected.

4.8 Relationship of the Proposed Action to Other Federal Projects

Palm Beach Harbor is located in Palm Beach County along the ICWW at the Lake Worth Inlet. Palm Beach Harbor is located approximately 4.5 nmi from the harbor's preferred site for ODMDS designation. The Federal Project at Palm Beach Harbor would utilize the proposed ODMDS for dredged material disposal. Total disposal volumes (turning basin and entrance channel) for the years in which the turning basin is dredged and hence ocean disposal is needed are expected to average in the range of 75,000-100,000 cy with volumes as large as 200,000 cubic yards (Murphy, 2004). Up to 1,000,000 cy of suitable material may be placed at the ODMDS in 2007 as a result of proposed construction dredging. Additional volumes that may be placed at the Palm Beach Harbor ODMDS include 9,000 cy from the North Turning Basin Extension (cited in the August 1984 Feasibility Report).

Port Everglades Harbor is located in Port Everglades County along the ICWW immediately south of Forth Lauderdale. Port Everglades Harbor is located approximately 4 nmi from the harbor's preferred site for ODMDS designation. The Federal Project at Port Everglades Harbor would utilize the proposed ODMDS for dredged material disposal. Annual shoaling rates at Port Everglades Harbor have been estimated at 16,500 cy per year for the turning basin (Appendix D) and 15,600 cy for the entrance channel (Olsen & Assoc., 2003) for a total of approximately 30,000 cubic yards per year. Additional volumes that may be placed at the Port Everglades Harbor ODMDS include 8,079,400 cy between 2006 and 2024 from proposed construction activities at Port Everglades Harbor (see Section 1.2.4).

The ICWW provides deep draft access to coastal Florida in the vicinity of the study area. The ICWW intersects Palm Beach and Port Everglades harbors and is equidistant to the preferred ODMDS locations at these points relative to the harbors. The ICWW is confined from the open ocean by the outer rim of barrier islands in Palm Beach and Broward counties and is located a

substantial distance from the continental shelf-slope break. No material from the ICWW is expected to be disposed at either of the proposed ODMDS locations.

The proposed Port Everglades Harbor ODMDS is located approximately 1.5 miles north of the northern boundary of the Navy's SFTF. The SFTF is currently the centerpiece of the newly formed SFOMC. The SFOMC offers a means to evaluate mine detection, countermeasures, and mine response; perform acoustic measurements; and acquire radar cross section and infrared signatures. The SFOMC is the only ship, submarine, and mine-effectiveness test range with simultaneous air, surface, and subsurface tracking capability. Some of the SFOMC's underwater detection and monitoring apparatus on the northern portion of the range may be adversely impacted by activities associated with the implementation of the proposed Port Everglades Harbor site. Passive monitoring equipment would likely experience the largest impacts.

Mr. William Baxley, Environmental Liaison for the SFOMC, was contacted regarding impacts to the SFOMC resulting from disposal of dredged material at the proposed ODMDS locations. Mr. Baxley agreed to provide a brief text description of potential impacts to the facility. At the time of the current submittal, this information remains outstanding.

4.9 Essential Fish Habitat

The Fishery Management Amendments of the South Atlantic Fishery Management Council identify a number of categories of EFH and HAPC. Due to the offshore location of the proposed dredged material disposal sites, many of the areas listed as EFH and HAPC, were eliminated from consideration for this project. Estuarine areas such as estuarine emergent wetlands, intertidal flats, and estuarine scrub/shrub mangroves, are not present in the project area and therefore, are not discussed. Impacts on EFH that are relevant to the proposed dredge material disposal sites are discussed in the EFH assessment (Appendix I).

With the No-Action Alternative, EFH would not be affected.

4.10 Threatened and Endangered Species

Biological assessments of the impacts of the proposed site designation on currently listed threatened and endangered species have been prepared and coordinated with NMFS pursuant to Section 7 of the Endangered Species Act 1973, as amended. The Biological Assessment for the Palm Beach Harbor ODMDS is included as Appendix F and the Biological Assessment for the Port Everglades Harbor ODMDS is included as Appendix G.

Site designation of the Palm Beach Harbor ODMDS and Port Everglades Harbor ODMDS would not adversely affect or threatened the continued existence of any threatened or endangered species.

With the No-Action Alternative, threatened or endangered species would not be affected.

4.11 Hardbottoms

Several distribution surveys for hermatypic and ahermatypic corals have been conducted in the vicinity of the proposed ODMDSs from 1973-1987. No hermatypic corals were found in the vicinity of the project site, but ahermatypic corals were observed as scattered, isolated forms in the vicinity of the proposed ODMDS for Palm Beach Harbor.

The proposed project will not have any effect on wormrock reefs because no known colonies exist within the proposed ODMDS project sites.

Under the No-Action Alternative, hardbottoms would not be affected.

4.12 Fish and Wildlife Resources

Breeding, spawning, and feeding activities may occur near the proposed project areas; however, these activities are not believed to be confined to, or concentrated in, the proposed sites. The probability of significant impact from dredged material disposal to species found within the proposed sites is likely related to the motility of the species.

Both natural and artificial reef sites are found near the proposed ODMDSs. Natural hardbottom reefs occur primarily at depths of 20-100 ft (6-30 m). The seaward extent of the natural reef zone near the Palm Beach Harbor ODMDS is approximately 2.6 nmi (4.8 km) west of the western boundary of the proposed site. The seaward extent of the natural reef zone in the vicinity of the Port Everglades Harbor ODMDS is approximately 3.0 nmi (5.6 km) west of the western boundary of the proposed site. Colonies of the deepwater coral *Oculina varicosa* have been observed as scattered, isolated forms 1.7 nmi (3.2 km) west of the proposed Palm Beach Harbor ODMDS. Artificial reefs occur at a variety of depths, ranging from 10-440 ft (3-134 m). The seaward extent of documented artificial reef structures near the Palm Beach Harbor ODMDS is approximately 2.0 nmi (3.7 km) west of the western boundary of the site. The seaward extent of documented artificial reef structures near the Port Everglades Harbor ODMDS is approximately 2.0 nmi (3.7 km) west of the western boundary of the site. Natural and artificial reefs are not expected to be adversely affected by the proposed project.

4.13 Physical Oceanography

No significant impacts to tides or currents in the project areas are expected to occur.

4.14 Water Quality

The disposal of dredged material is not expected to significantly degrade water quality within disposal sites. The disposal will locally and temporarily increase water column turbidity and concentrations of dissolved and particulate constituents. Dissolved oxygen concentrations may decrease in the dump plume. Plumes of suspended sediments would result in increases in turbidity levels, suspended particulate concentrations, and decreased light transmittance. These effects are also localized, short-term effects dissipated by natural dispersion, mixing, and eventual sinking of particles. Based on dispersion modeling conducted for the Palm Beach/Port Everglades Harbor ODMDSs, any temporary perturbations in water quality resulting from disposal of dredged material would be reduced to ambient or undetectable levels within a short distance of the release point (see Section 4.3.3).

Only dredged material evaluated and found acceptable in accordance with the joint EPA/USACE guidance (EPA/USACE, 1991 and EPA/USACE, 1993) can be disposed in the ocean. The testing evaluates the potential for unacceptable effects such as toxicity or bioaccumulation. These required tests reduce the possibilities of unacceptable water column and benthic effects caused by dredged material contaminants. Palm Beach Harbor and Port Everglades Harbor sediment characteristics reveal that the dredged material is acceptable for ocean disposal.

The No-Action Alternative is expected to have no impact on water quality of both ocean disposal sites.

4.15 Air Quality

The short-term impacts from increased barge or scow traffic associated with the project would not significantly impact air quality of the project sites. No air quality permits would be required for this project. Both Broward and Palm Beach counties are designated as attainment areas for Federal air quality standards under the Clean Air Act. The offshore candidate sites for both Palm Beach Harbor and Port Everglades Harbor would result in higher overall air emissions than the preferred sites. Shown below are typical per load barge tug emissions based on emission factors reported by the Port of San Diego (2003) and an average barge speed of 4.3 knotts.

	Emissions (Pounds/Load)			
Site	**CO**	**NOx**	**SOx**	**PM_{10}**
Palm Beach 4.5-mile (preferred) site	5.0	33	4.7	1.9
Palm Beach 9-mile candidate site	10.0	69.1	9.8	4.0
Port Everglades 4-mile (preferred) site	4.5	30.7	4.4	1.8
Port Everglades 7-mile candidate site	7.8	53.7	7.7	3.1

CO=Carbon monoxide; Nox=Nitrogen oxides; Sox=Sulfur oxides; PM10=Inhalable particles

The No-Action Alternative is expected to have no impact on air quality.

4.16 Noise

The noise at any of the alternative ocean disposal sites would increase during disposal of dredged material. The duration of the noise increase would be greater for the offshore candidate sites. Surface noise for a tugboat is expected to be 82 dB at 50 ft (Port of Oakland and the USACE San Francisco District, 1998). Noise from the tugboats hauling barges or from hopper dredges to and from the ocean disposal sites would be too far from shore to have any meaningful noise impact on noise-sensitive land uses.

Subsurface noise would increase during disposal and monitoring activities in the vicinity of the proposed disposal sites. According to the National Research Council (NRC) (2003), vessel traffic is a major contributor to noise in the world's oceans especially at low frequencies between 5 and 500

kHz. Low-frequency ship noise sources include propeller noise, propulsion machinery and major auxiliaries such as diesel generators. Source spectral density levels for the types of vessels visiting the proposed sites would likely range from more than 165 dB re 1 μPa^2/Hz at 1 meter around 25 Hz for larger vessels down to 140 dB re 1 μPa^2/Hz or less for smaller craft. During monitoring activities, the use of sonar systems for bathymetry measurements or sidescan imagery would also result in subsurface noise (NRC, 2003).

This elevated noise level will be temporary and would not be expected to result in any significant adverse impacts to wildlife or aquatic organisms in the areas. Existing data are insufficient to predict accurately any but the grossest acoustic impacts on marine mammals. Marine mammals as a group have functional hearing ranges of 10 Hz to 200 kHz. Behavioral responses to noise range from subtle changes in surfacing and breathing patterns, to cessation of vocalizations, to active avoidance or escape from the region of the highest sound levels. For fish and elasmobranchs (sharks and rays), the functional hearing range is from well below 50 Hz to upward of 500-1,000 Hz. The hearing range for sea turtles has been measured in the 250-750 Hz range, with the most sensitive threshold recorded a the lowest frequency tested, 250 Hz (NRC, 2003).

The No-Action Alternative would have no effect on the noise environment of the area.

4.17 Aesthetic Resources

No significant impacts on aesthetic resources would result from the proposed actions.

4.18 Recreation

The coastal waters of Broward and Palm Beach counties are used for a variety of recreational activities including swimming, skiing, sailing, boating, surfing, skin diving, and SCUBA diving. Few of these activities occur in, and none is restricted to, the proposed ODMDSs. No significant impacts to recreation are anticipated.

4.19 Public Safety

There should be no adverse impacts on public safety from the proposed actions.

4.20 Energy Requirements and Conservation

The energy requirements for this activity would be confined to fuel for the construction and transportation equipment. With all being equal concerning construction, equipment and personnel, fuel consumption would only differ with distance and time to each candidate site. This would hold true for comparing dredging operations that included either beach nourishment or ocean disposal. Fuel consumption was discussed in Section 4.7.

4.21 Natural or Depletable Resources

In this case, the depletable resources would be the fuel for the construction and transportation equipment and human energy required for the project. The No-Action Alternative would eliminate these requirements, but would allow a continuation of and possible increase in navigational safety and economic problems.

With all being equal concerning construction, equipment and personnel, fuel consumption would only differ with distance and time to each candidate site. This would hold true for comparing dredging operations that included either beach nourishment or ocean disposal. Fuel consumption was discussed in Section 4.7.

4.22 Scientific Resources

No scientific resources would be affected by the proposed actions.

4.23 Native Americans

Native Americans would not be adversely impacted by project activities.

4.24 Reuse and Conservation Potential

No adverse impacts are expected from the proposed project activities. The project does not lend itself to recycling or use of recycled or recyclable materials.

4.25 Urban Quality

No adverse impacts are expected. The project would benefit the local shipping industry and the economy.

4.26 Solid Waste

No solid waste is expected to be generated by project activities. Each site meets all evaluation criteria for use as an ODMDS.

4.27 Drinking Water

Drinking water would not be impacted by the project.

4.28 Indirect Effects

The proposed action may facilitate area dredging projects by providing a disposal option and thereby increase the associated environmental impacts of dredging (water quality degradation, wetland losses, pollution from increased shipping, etc.). The proposed action would benefit the shipping industry and economy. Furthermore, the indirect effect on the Federal standard could make beneficial use projects cost prohibitive by creating a lower cost option.

4.29 Compatibility with Federal, State, and Local Objectives

The proposed action is expected to be consistent with Federal, State and local plans and objectives.

4.30 Conflicts and Controversy

The areas of controversy are the proximity of the ODMDSs to nearshore reefs and the potential impacts of fine-grained material to these reefs. Other issues include: the scope, frequency, and costs of monitoring effects of disposal at the ODMDSs.

4.31 Uncertain, Unique or Unknown Risks

No such risks are known or anticipated at this time. However, in the unlikely event of unacceptable impacts, corrective measures would be taken as required by permit, law, or otherwise as determined to be appropriate.

4.32 Precedent and Principle for Future Actions

The proposed actions would create two new ODMDSs in the Atlantic Ocean to be used initially for the disposal of maintenance dredged material from the existing Palm Beach Harbor and Port Everglades Harbor Federal Navigation Projects, respectively.

4.33 Environmental Commitments

The USACE and contractors commit to avoiding, minimizing or mitigating for adverse effects during disposal activities by including appropriate measures in the contract specifications. Contract specifications implementing the requirements of the SMMPs are provided as an attachment to the SMMPs in Appendix L. For non-Federal users, an attachment to the SMMPs provides standard permit conditions for the sites. In addition, EPA and the USACE commit to environmental monitoring of the proposed ODMDSs dependent upon available funding (see Appendix L).

4.34 Compliance with Environmental Regulations

4.34.1 National Environmental Policy Act of 1969

Environmental information on this federal project has been compiled and the present Environmental Impact Statement is being prepared. The project complies with the National Environmental Policy Act.

4.34.2 Endangered Species Act of 1973

In 1986, NMFS concurred with the original BAs presented by the USACE regarding the impacts of the proposed project to populations of threatened and/or endangered species. Due to the length of time that has passed since this concurrence, however, updated BAs for the proposed sites for Palm Beach and Port Everglades harbors were submitted to NMFS (see appendices F and G). In a letter received 24 May 2004, NMFS indicated that adverse impacts were unlikely to occur to the shortnose sturgeon, smalltooth sawfish, or any of the whale and turtle species listed above as a result of project activities (see Appendix B).

4.34.3 Fish and Wildlife Coordination Act of 1958

No coordination has been attempted with the USFWS. Because only marine waters would be affected, no species under the jurisdiction of the USFWS would be affected.

4.34.4 Clean Water Act of 1972

The project would comply with this Act. A Section 404(b) evaluation is not applicable to this project and was not prepared.

4.34.5 Clean Air Act of 1972

The short-term impacts from transportation and construction equipment associated with the project would not significantly impact air quality. No air quality permits would be required for this project. Because both Broward and Palm Beach counties are designated as attainment areas for Federal air quality standards under the Clean Air Act, a conformity determination is not required.

4.34.6 Coastal Zone Management Act of 1972

A Federal consistency determination in accordance with 15 CFR 930 Subpart C is included in this report as Appendix N.

4.34.7 Farmland Protection Policy Act of 1981

No prime or unique farmland would be impacted by this project. This act is not applicable.

4.34.8 Wild and Scenic River Act of 1968

No designated Wild and Scenic river reaches would be affected by project related activities. This act is not applicable.

4.34.9 Marine Mammal Protection Act of 1972

Incorporation of the safe guards used to protect threatened and endangered species during project activities would protect any marine mammals in the area, therefore, this project is in compliance with the Act.

4.34.10 Estuary Protection Act of 1968

No designated estuary would be affected by project activities. This act is not applicable.

4.34.11 Fishery Conservation and Management Act of 1976

The project has been coordinated with NMFS and is in compliance with the Act.

4.34.12 Submerged Lands Act of 1953

The project would not occur on submerged lands of the State of Florida. This project is in full compliance with this Act.

4.34.13 Coastal Barrier Resources Act and Coastal Barrier Improvement Act of 1990

No coordination has been made with the USFWS.

4.34.14 Rivers and Harbors Act of 1899

The proposed work would not obstruct navigable waters of the United States. The proposed action has been subject to evaluations normally conducted for activities subject to the Act. The project is in full compliance.

4.34.15 Anadromous Fish Conservation Act

Anadromous fish species would not be affected. The project has been coordinated with NMFS.

4.34.16 Migratory Bird Treaty Act and Migratory Bird Conservation Act

No migratory birds would be affected by project activities. The project is in compliance with these acts.

4.34.17 Marine Protection, Research and Sanctuaries Act

The MPRSA regulates the transportation and subsequent dumping of materials, including dredged material, into ocean waters. Section 102 of the MPRSA requires EPA to designate ODMDSs where needed. The proposed ODMDSs are being designated pursuant to Section 102 of the MPRSA. The five general (40 CFR 228.5) and 11 specific (40 CFR 228.6) criteria for the selection of sites have been applied and satisfied (see sections 4.3.3 and 4.3.4).

4.34.18 Magnuson-Stevens Fishery Conservation and Management Act

The project activities would not have an adverse effect on the fish off the coasts of the United States, the highly migratory species of the high seas, the species which dwell on or in the continental shelf appertaining to the United States, and the anadromous species which spawn in United States rivers or estuaries or their habitats.

4.34.19 E.O.11990, Protection of Wetlands

No wetlands would be affected by project activities. This project is in compliance with the goals of this Executive Order.

4.34.20 E.O. 11988, Flood Plain Management

This project does not occur in any floodplain, therefore, this Executive Order does not apply to project activities.

4.34.21 E.O. 12898, Environmental Justice

The proposed activity would not exclude persons from participating in, deny persons the benefits of, or subject persons to discrimination because of their race, color, or natural origin, nor would the proposed action adversely impact “subsistence consumption of fish and wildlife.” The proposed project complies with this Executive Order.

4.34.22 E. O. 13089, Coral Reef Protection

Executive Order 13089 (E.O. 13089) on Coral Reef Protection, signed by the President on June 11, 1998, recognizes the significant ecological, social, and economic values provided by the Nation's coral reefs and the critical need to ensure that Federal agencies are implementing their authorities to protect these valuable ecosystems. E.O. 13089 directs Federal agencies, including EPA and the USACE whose actions may affect U.S. coral reef ecosystems, to take the following steps:

1. Identify their actions that may affect U.S. coral reef ecosystems;
2. Utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and
3. To the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the conditions of such ecosystems.

It is the policy of EPA and the USACE to apply their authorities under the MPRSA to avoid adverse impacts on coral reefs. Protection of coral reefs have been carefully addressed through the application the site designation criteria which require consideration of the potential site's location in relation to breeding, spawning, nursery, feeding, and passage areas of living marine resources and amenity areas (40 C.F.R. 228.6[a][2] and [3]), interference with recreation and areas of special scientific importance (40 C.F. R. 228.6[a][8]), and existence of any significant natural or cultural features at or in close proximity to the site (40 C.F.R. 228.6[a][11]) (see Section 4.3.4). Based on application of these criteria, the proposed disposal sites should not have adverse affects on coral reefs.

5.0 PUBLIC INVOLVEMENT

5.1 Introduction

EPA, the USACE, and the local sponsors involved the public through outreach programs. A proactive approach was taken to inform the public, resource agencies, industry, local government, and other interested parties about the project and to identify any concerns.

5.2 Notice of Intent

A Notice of Intent for the designation of ODMDSs offshore Palm Beach and Port Everglades harbors was published by the EPA Region 4 Office on June 27, 1997 in the Federal Register (Volume 62, Number 124). Mr. Christopher McArthur is listed as the Point of Contact. A copy of the Notice of Intent is included in Appendix A.

5.3 Scoping Letter

A scoping letter dated April 17, 1995, regarding designation of the Port Everglades Harbor ODMDS, was sent to Federal, State, and local governmental offices and agencies and other concerned entities. A second scoping letter dated September 26, 1997, regarding designation of the Palm Beach Harbor ODMDS, was sent to Federal, State, and local governmental offices and agencies, and other concerned entities. Fourteen letters were received in response to these letters from surrounding businesses and state agencies. A copy of the original scoping letters and response letters are appended to this document (see Appendix A).

5.4 Distribution of Draft and Final FEIS

This draft EIS is being distributed to the following agencies, groups, and individuals for review and comment.

Advisory Council on Historic Preservation
Council on Environmental Quality
Economic Development Commission
Environmental Government Affairs
Federal Maritime Commission
General Services Administration
National Science Foundation
U.S. Department of Commerce
- National Oceanic and Atmospheric Administration
- Atlantic Oceanographic and Meteorological Laboratory
- National Marine Fisheries Service, St. Petersburg Office
- National Marine Fisheries Service, Miami Office
- National Ocean Survey
- Office of Ocean and Coastal Resource Management
- U.S. Coral Reef Task Force

U.S. Department of Defense
- Pentagon
- Department of the Air Force
- Department of the Army Corps of Engineers
- Department of the Navy
- Naval Surface Warfare Center, South Florida Testing Facility

U.S. Department of Energy
U.S. Department of Housing and Urban Development
U.S. Department of Interior
- Fish and Wildlife Service
- Geological Survey
- Minerals and Management Service
- National Park Service (Southeast Regional Office, Archaeology)

U.S. Department of Transportation
- Coast Guard Seventh District, Miami, Florida
- Maritime Administration

U.S. House of Representatives
- Appropriate to areas of Palm Beach Harbor and Port Everglades Harbor

U.S. Senate
- Honorable Bob Graham
- Honorable Bill Nelson

State

Florida Department of Agriculture
Florida Department of Community Affairs
Florida Department of Environmental Protection
Florida Department of Transportation
Florida Division of Historical Resources

Florida Game and Fresh Water Fish Commission
Florida House of Representatives
Appropriate to areas of Palm Beach Harbor and Port Everglades Harbor
Florida Marine Fisheries Commission
Florida OTED
Florida Senate
Appropriate to areas of Palm Beach Harbor and Port Everglades Harbor
Office of the Governor-Florida
Governor of Florida Honorable John Ellis Bush
State of Florida A-95 Clearing House

Local

Palm Beach County
Chairman of County Commissioners
Mayor of the City of Palm Beach
Palm Beach Port Authority

Broward County
Chairman of County Commissioners
Mayor of the City of Fort Lauderdale
Port Everglades Port Authority

Organizations and Public

Atlantic States Marine Fisheries Commission
Coast Alliance
Ocean Conservancy-Southeast Atlantic and Gulf of Mexico Office
Coastal Fuels Marketing, Inc.
Crowley American Transport, Inc.
Cry of the Water (Attn: Dan Clark)
Eller & Company, Inc.
Florida Atlantic University
Florida Audubon Society
Florida Institute of Technology
Florida League of anglers
Florida Sport Fishing Association
Florida Wildlife Federation
Mr. George R. Frost, P.E.
Harbor Branch Oceanographic Institute
International Women's Fishing Association
MAR, Inc.
Michael Swerdlow Companies, Inc.
National Wildlife Federation
National Resources Defense Council
Nova University
Organized Fisherman of Florida
Port Everglades Association, Inc.
Port Everglades Pilots' Association

Rinker Materials Corporation
Rosenstiel School of Marine and Atmospheric Science – University of Miami
(Attn: Tom Lee)
Sierra Club
South Atlantic Fishery Management Council
South Florida Regional Planning Council
S.N. Ship Management, Inc.
Treasure Coast Regional Planning Council
Mr. Gerald M. Ward, P.E.

5.5 Points of Contact

Christopher J. McArthur, P.E.
Environmental Engineer
U.S. Environmental Protection Agency Region 4
Coastal Section
61 Forsyth Street, SW
Atlanta, GA 30303

William J. Lang
Environmental Planning Lead
U.S. Army Corps of Engineers
Jacksonville District
701 San Marco Blvd.
Jacksonville, Florida 32207

6.0 LIST OF PREPARERS

Name	Discipline	Affiliation	Education	Role
Christopher McArthur	Environmental Engineering/Coastal Dynamics	EPA Region 4, Coastal Section	B.S. Civil Engineering, Oregon State University; M.S. Environmental Engineering Science, California Institute of Technology	FEIS Review/ Coordination and Site Characterization Surveys
Gary Collins	Oceanography/Benthic Ecology	EPA Region 4, Coastal Section	B.S. Biology, College of Charleston; M.S. Bioenvironmental Oceanography, Florida Institute of Technology	Site Characterization Surveys
Cade E. Carter, Jr., P.E.	Civil/Environmental Engineering	GEC	B.S. Civil Engineering, Louisiana State University (LSU)	Project Supervisor, FEIS Review/ Coordination
Michael S. Loden, Ph.D.	Biology	GEC	B.S. Biological Sciences, Auburn University; M.S. Zoology, Auburn University; Ph.D. Zoology, LSU	FEIS Review/ Coordination
Patrick S. MacDanel	Biology	GEC	B.S. Wildlife Management/Biology, University of Southwestern Louisiana	Introduction, Impacts Analysis, NEPA Compliance

Name	Discipline	Affiliation	Education	Role
Donald W. Glenn III, Ph.D.	Environmental Engineering/Biology	GEC	B.S. Marine Biology, Auburn University; B.S. Environmental Engineering, LSU; M.S. Forestry, Wildlife and Fisheries, LSU; Ph.D. Civil and Environmental Engineering, LSU	Hardgrounds, Fish and Wildlife Resources, Environmental Effects
Senda Ozkan, Ph.D., P.E.	Environmental Engineering/Water Quality	GEC	B.S. Civil Engineering, Middle East Technical University; M.S. Civil and Environmental Engineering LSU; Ph.D. Civil and Environmental Engineering, LSU	Physical Oceanography, Water Quality, Sediment Quality, Environmental Effects
Joseph C. Wyble	Geology/Sedimentology	GEC	B.S. in Geology, LSU; M.S. Geology, LSU	General Environmental Setting, Geological Characteristics, Navigation, Military Usage, Mineral Resources, Other Uses, Environmental Effects
Rachel A. Keane	Biology/Limnology	GEC	B.S. Limnology, University of Central Florida	Essential Fish Habitat, Threatened or Endangered Species, Environmental Effects
William Lang	Biology	USACE Jacksonville		EIS Facilitator
Rea Boothby	Ecology	USACE Jacksonville		EIS Facilitator
Kenneth Dugger	Biology	USACE Jacksonville		NEPA Compliance
Renee Thomas, M.S.	Biology	Lotspeich and Associates, Inc.		Project Supervisor (1997 DEIS)
Clay A. Adams, M.S.	Ecology	Golder Associates, Inc.	M.S.	Project Manager and Advisor (1997 DEIS)
James R. Newman, Ph.D.	Ecology	Golder Associates, Inc.	B.S.	Technical Reviewer (1997 DEIS)
Rosemary Graham Mora, M.S.	Environmental Science	Golder Associates, Inc.	M.S.	Primary Author (1997 DEIS)
Don J. Silverberg, M.S.	Biology	Lotspeich and Associates, Inc.	M.S.	Technical Reviewer (1997 DEIS)
Ann Hague	Document Format	Lotspeich and Associates, Inc.		Document Format Reviewer (1997 DEIS)
Leslie Burges	Document Editing	Golder Associates, Inc.		Document Production (1997 DEIS)

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8.0 ABBREVIATIONS

ADCP	Acoustic Doppler Current Profiler
AUV	autonomous undersea vehicle
BA	Biological Assessment
CAA	Clean Air Act
cc	cubic centimeter
CERC	Columbia Environmental Research Center
CFR	Code of Federal Regulations
CSA	Continental Shelf Associates, Inc.
dB	decibel
DEIS	Draft Environmental Impact Statement
DO	dissolved oxygen
DOI	Department of the Interior
EFH	Essential Fish Habitat
EO	Executive Order
EPA	U.S. Environmental Protection Agency
FACDAR	forward area combined degaussing and acoustic range
FDEP	Florida Department of Environmental Protection
FEIS	Final Environmental Impact Statement
FFWCC	Florida Fish and Wildlife Conservation Commission
FMC	Fishery Management Council
FMP	Fishery Management Plan
ft	foot
g	gram
GEC	Gulf Engineers and Consultants, Inc.
HAPC	Habitat Areas of Particular Concern
HURDAT	Hurricane Database
Hz	Hertz

ICWW	Intracoastal Waterway
IDEA	interim depth electromagnetic array
km	kilometer
l	liter
m	meter
m^2	square meter
Ma	million years ago
mg	milligram
mm	millimeter
MMS	Minerals Management Service
MPRSA	Marine Protection, Research, and Sanctuaries Act
NAAQS	National Ambient Air Quality Standard
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
nmi	nautical mile
NOAA	National Oceanic and Atmospheric Administration
NRC	National Research Council
NTU	nephelometric turbidity unit
ODMDS	Ocean Dredged Material Disposal Site
OPA	Office of Public Affairs
OSCAR	Ocean Current Surface Radar
Pa	Pascale
PCB	polychlorinated biphenyl
PCS	Permit Compliance System
PL	Public Law
ppb	parts per pillion
PPB	PPB Environmental Labs, LLC
RIM	Regional Implemental Manual
SAFMC	South Atlantic Fishery Management Council
SFOMC	South Florida Ocean Management Center
SFTF	South Florida Testing Facility
SMMP	Site Management and Monitoring Plans
sp.	species
STFATE	short-term fate

SWAR	shallow water acoustic range
SWER	shallow water electromagnetic range
TPH	total petroleum hydrocarbon
USACE	U.S. Army Corps of Engineers
USC	U.S. Congress
USFWS	U.S. Fish and Wildlife Service
WES	Waterways Experiment Station
WRDA	Water Resource Development Act
µg	microgram

9.0 GLOSSARY

Adverse Impact - A detrimental effect relative to desired or baseline conditions.

Affected Environment - Existing biological, physical, social and economic conditions of an area subject to change, both directly and indirectly, as a result of a proposed human action.

Air Quality - A measure of the health-related and visual characteristics of the air, often derived from quantitative measurements of the concentrations of contaminating or injurious substances.

Aquatic - Consisting of, relating to or being in water; living or growing in, on or near the water; or taking place in or on the water.

Authorization - An act by the U.S. Congress that authorizes use of public funds to carry out a prescribed action.

Bathymetry - A detailed, precise description of an underwater place or region; or the graphic representation of the surface features of an underwater place or region on a map, indicating its relative position and elevations.

Benthic - The bottom of rivers, lakes or oceans, and the organisms that live on the bottom of water bodies.

Biodiversity - The number and variety of organisms found within a specified geographic region; or the variability among living organisms on the earth, including the variability within and between species and within and between ecosystems.

Biological Assessment (BA) - A biological evaluation conducted for major Federal construction projects requiring an Environmental Impact Statement. BAs are developed to assess probable impacts of USFWS projects to Federally listed species.

Carbonate - sedimentary rock composed primarily of calcium carbonate, usually formed by chemical precipitation

Critical Habitat - A description, which may be contained in a Biological Assessment, of the specific areas with physical or biological features essential to the conservation of a listed species and which may require special management considerations or protection; these areas have been legally designated via Federal Register notices.

Cumulative impacts - Impacts on the environment resulting from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions.

Density - The mass per unit volume of a substance under specified conditions of pressure and temperature.

Discharge - The rate of water movement as volume per unit time, usually expressed as cubic feet per second.

Dissolved Oxygen (DO) - The concentration of oxygen dissolved in water, sometimes expressed as percent saturation, where saturation is the maximum amount of oxygen that theoretically can be dissolved in water at a given altitude and temperature.

Dredged material- Material excavated from waters of the United States or ocean waters.

Ecology - The science of the relationships between organisms and their environments, also called bionomics; or the relationship between organisms and their environment.

Ecosystem - An ecological community together with its environment, functioning as a unit.

Endangered Species - Any species or subspecies of amphibian, bird, fish, mammal, reptile or plant that is in serious danger of becoming extinct throughout all or a significant portion of its range.

Environmental Impact Statement - A detailed written statement that documents the proposed action, alternatives to the proposed action, the characteristics of the environment that is potentially affected by the proposed action, and the environmental consequences of implementing each alternative.

Feasibility Study - The phase of a project whose purpose is to describe and evaluate alternative plans and fully describe a recommended project.

Federally Endangered Species - An Endangered Species which is officially designated by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service and published in the Federal Register.

Habitat - The area or environment where an organism or ecological community normally lives or occurs.

Hardgrounds - synsedimentarily lithified carbonate seafloors.

Infauna - Animals that live within the sediment of the ocean bottom.

Invertebrate - An animal that does not have a backbone; examples include crayfish, insects and mollusks.

Juvenile - A young organism older than one year but not having reached reproductive age.

Larva - an embryo that differs markedly in appearance from adult members of its species and becomes self-sustaining before assuming the physical characteristics of its adult form.

Latitude - The angular distance north or south of the earth's equator, measured in degrees along a meridian.

Limnology - The scientific study of the physical characteristics and biology of lakes, streams and ponds.

Local sponsor - The entity that is partnering with the Federal Government to complete a specific project or program.

Longitude - The angular distance on the earth's surface, measured east or west from the prime meridian at Greenwich, England, to the meridian passing through a position, expressed in degrees (or hours), minutes and seconds.

Mitigation - To make less severe; to alleviate, diminish or lessen.

Model - A way of looking at reality, usually for the purpose of abstracting and simplifying it to make it understandable in a particular context; this may be a plan to describe how a project will be completed, or a tool to mathematically represent a process which could be based upon empirical or mathematical functions.

Monitoring - The capture, analysis and reporting of project performance, usually as compared to plan.

Nutrients - Elements essential as raw materials for the growth of an organism.

Objective - A goal expressed in specific, directly measurable terms.

Ocean disposal - placement of dredged material in oceans via pipeline or surface release from hopper dredgers or barges.

Ocean Dredged Material Disposal Site (ODMDS) - a site in the ocean designated by EPA for the reception of dredged material.

PCB - Polychlorinated biphenyls, a group of organic compounds used in the manufacture of plastics. PCBs are highly toxic to aquatic life, are biologically accumulative, and persist in the environment for long periods of time.

Project - A sequence of tasks with a beginning and an end that uses time and resources to produce specific results.

Project area - An area subject to change, both directly and indirectly, as a result of a proposed human action, or project.

Public Involvement - The process of obtaining citizen input into each stage of the development of planning documents, and which is required as a major input into any environmental impact statement.

Quality Assurance - The process of evaluating overall project performance on a regular basis to provide confidence that the project will satisfy the relevant quality standards.

Record of Decision - A concise, public legal document which identifies publicly and officially discloses the responsible official's decision on the alternative selected for implementation; prepared following completion of an Environmental Impact Statement.

Reef - A resistant ridge of calcium carbonate formed on the seafloor by corals and coralline algae.

Scope - The sum of the products and services, in fact the magnitude of the effort, required to complete a project.

Scoping - The process of defining the extent and content of a study, primarily with respect to the issues, geographic area and alternatives to be considered.

Sediment - The layer of soil, sand, and/or rock fragments at the bottom of waterbodies.

Threatened Species - Legal status afforded to plant or animal species that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range, as determined by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service.

Tide - The periodic variation in the surface level of the oceans and of bays, gulfs, inlets and estuaries caused by gravitational attraction of the moon and sun.

Turbidity - An optical measure of the amount of material suspended in the water column. Increases in turbidity decrease the amount of light that penetrates the water column.

Water Quality - A measure of the health-related and visual characteristics of the water, often derived from quantitative measurements of the concentrations of contaminating or injurious substances.

Water Resources Development Act (WRDA) - Legislation that provides for the conservation and development of water and related resources and authorizes the Secretary of the Army to construct various projects for improvements to rivers and harbors of the United States, and for other purposes deemed appropriate by the U.S. Congress and the President of the United States.

10.0 CONVERSION FACTORS

Unit	Conversion Unit	Conversion Factor
acres	ft^2	43560
acres	m^2	4046.9
atmospheres (atm)	feet of water	33.94
atmospheres	in of Hg	29.92
atmospheres	mm of Hg	760
atmospheres	psi	14.7
bar	atm	.98692
bar	dyne cm^{-2}	10^6
bar	psi (lb in^{-2})	14.5038
bar	mm Hg	750.06
bar	MPa	10^{-1}
barrel (bbl)	ft^3	5.6146
barrel	m^3	.15898
barrel	gal (US)	42
barrel	liter	158.9
centimeter (cm)	inch	0.39370
cm	m	10^{-2}
fathom (fath)	ft	6
feet (ft)	in	12
feet	m	0.3048
furlong	yd	220
gallon (US) (gal)	in^3	231
gallon	liter	3.78541
gallon (Imp.) (gal)	in^3	277.419
gallon	liter	4.54608
gram (g)	pound	0.0022046
gram	kg	10^{-3}
hectare	acre	2.47105
hectare	cm^2	10^8
inch (in)	cm	2.54
inch (in)	mm	25.4
kilogram (kg)	g	10^3
kilogram	pound	2.20462
kilometer (km)	m	10^3
kilometer	ft	3280.84

Unit	Conversion Unit	Conversion Factor
kilometer	mile	0.621371
knot	mph	1.150779
liter	cm^3	10^3
liter	gal (US)	0.26417
liter	in^3	61.0237
meter	angstrom	1×10^{10}
meter	ft	3.28084
micron	cm	10^{-4}
mile	ft	5280
mile	km	1.60934
mile	nautical mile	0.8689741
nautical mile	mile	1.150782
ounce	lb	0.0625
Pascal	atmospheres	$9.86923 * 10^{-6}$
Pascal	psi	$1.45 * 10^{-4}$
Pascal	torr	$7.501 * 10^{-3}$
pint	gallon	0.125
pound (lbm)	kg	0.453592
pound (lbf)	newton	4.4475
quart	gallon	0.25
ton (long)	lb	2240
ton (Metric)	lb	2205
ton (Metric)	kg	1000
ton (short or net)	lb	2000
ton (short or net)	kg	907.185
ton (short or net)	ton (Metric)	.907
yard	in	36
yard	m	0.9144
year (cal)	days	365.242198781
year (cal)	s	3.15576×10^7