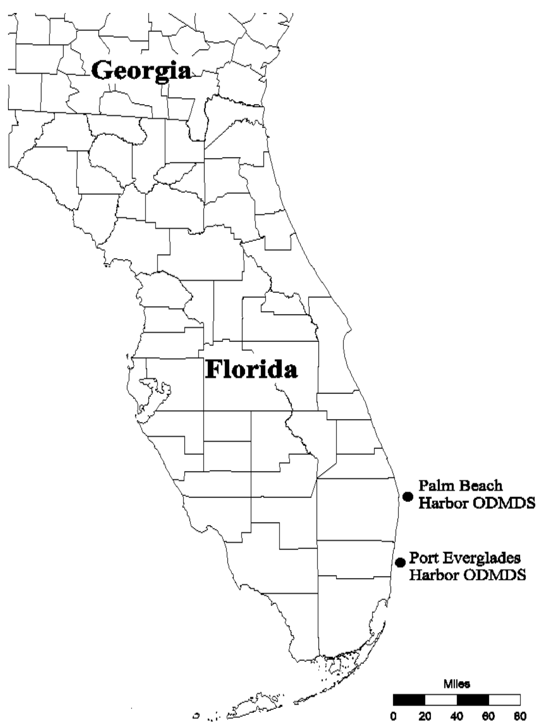
904/9-04-003

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

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In cooperation with:

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Jacksonville District
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With the assistance of:

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Federal Programs Division
Environmental Services
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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

U.S. Environmental Protection Agency
Region 4
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Comments must be received no later than:

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

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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

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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.

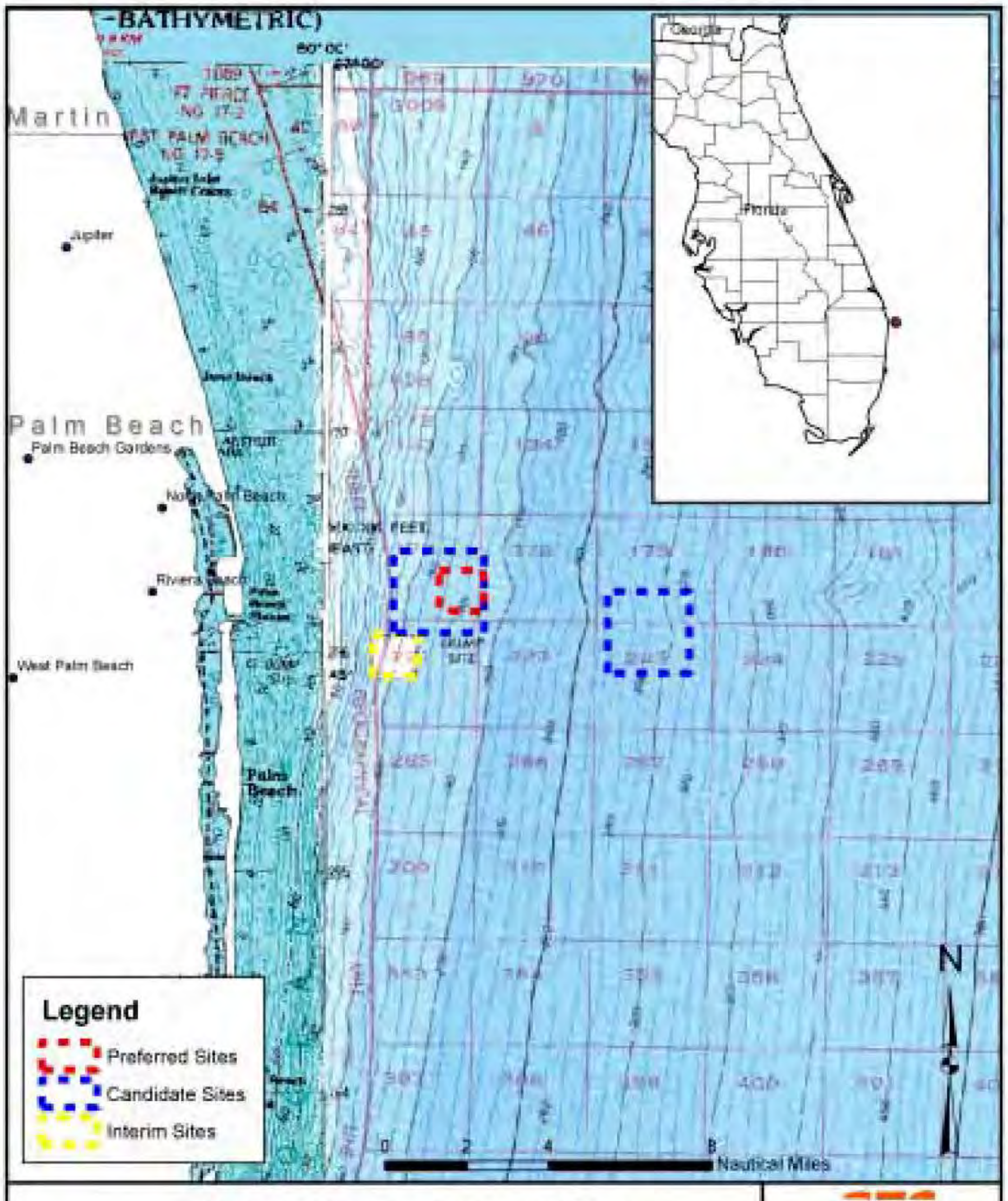
Sandy sediment derived from the maintenance of coastal navigation channels is deemed suitable for beach placement with up to 10% fine material passing the #230 sieve, provided that it meets the above criteria and appropriate water quality standards. Such material containing 10-20% fine material passing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

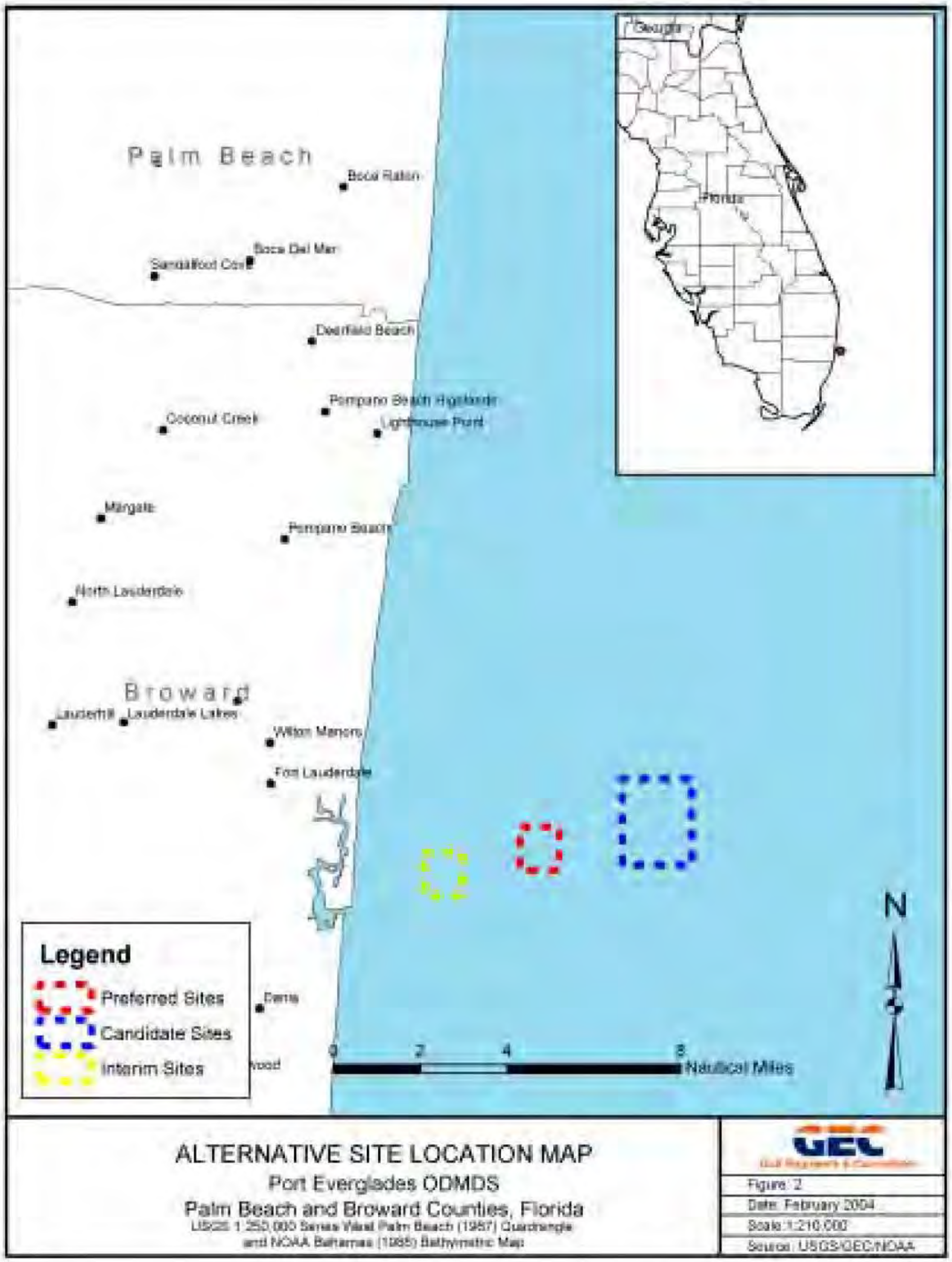
Port Everglades Harbor Alternatives	Distance from shore to western edge of site
Interim Site	1.6 nautical miles
4-Mile Site (Preferred)	3.8 nautical miles
7-Mile Candidate Site	6 nautical miles

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.


Palm Beach
Boca Raton
Boca Del Mar
Deerfield Beach
Coconut Creek
Margate
Pompano Beach
North Lauderdale
Broward
Lauderhill
Lauderdale Lakes
Wilton Manors
Fort Lauderdale
Dania
Legend
Preferred Sites
Candidate Sites
Interim Sites
0
2
4
8
Nautical Miles
N
ALTERNATIVE SITE LOCATION MAP
Port Everglades ODMDS
Palm Beach and Broward Counties, Florida
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

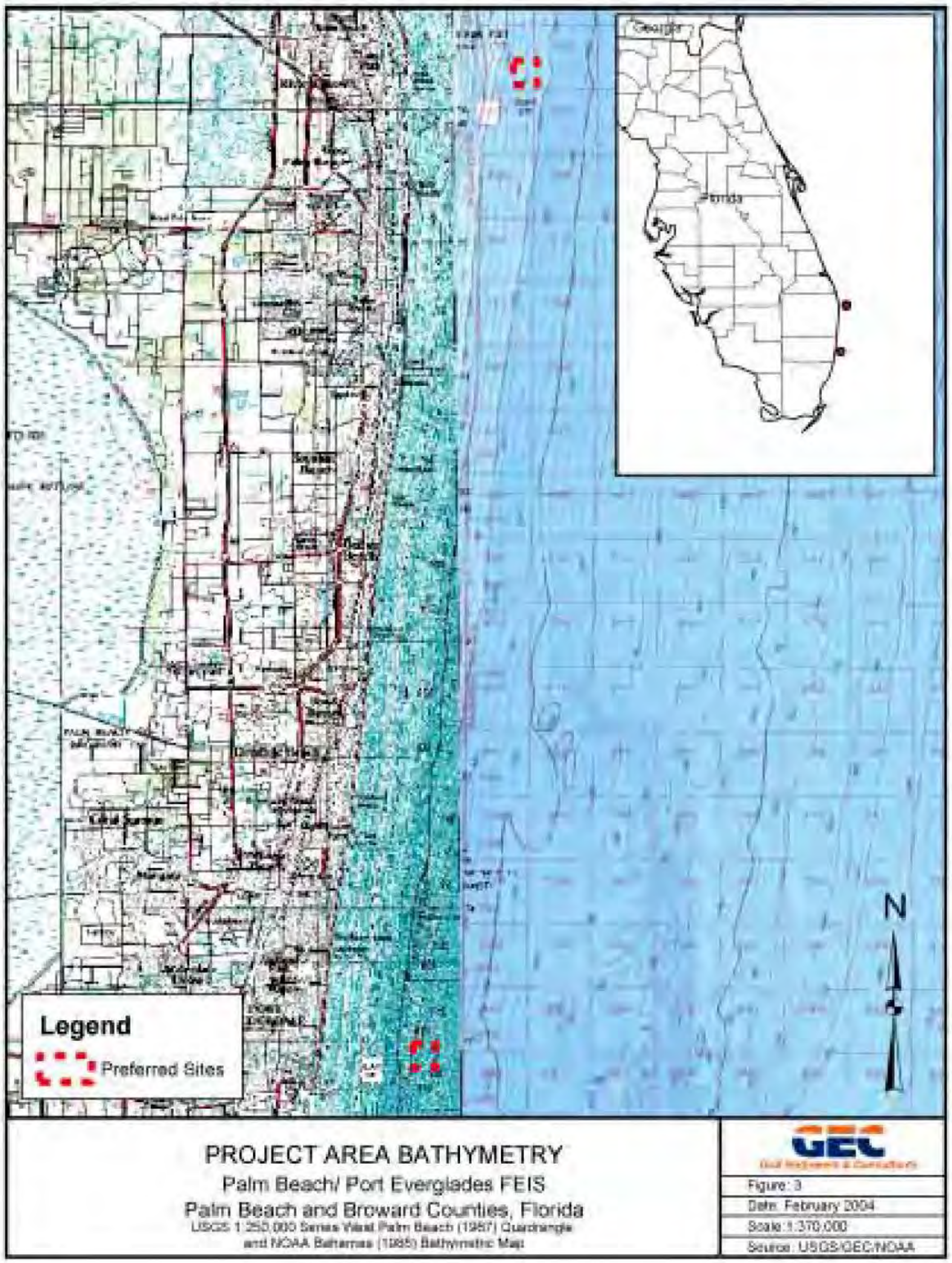
The 9-mile site is also situated on the Florida-Hatteras Slope. Depths at this site range from 855 ft (260 m) to 985 ft (300 m). Bathymetric data for this site can be found in Figure 1.

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.



Legend
Preferred Sites
N
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 (1985) Bathymetric Map
GEC
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).

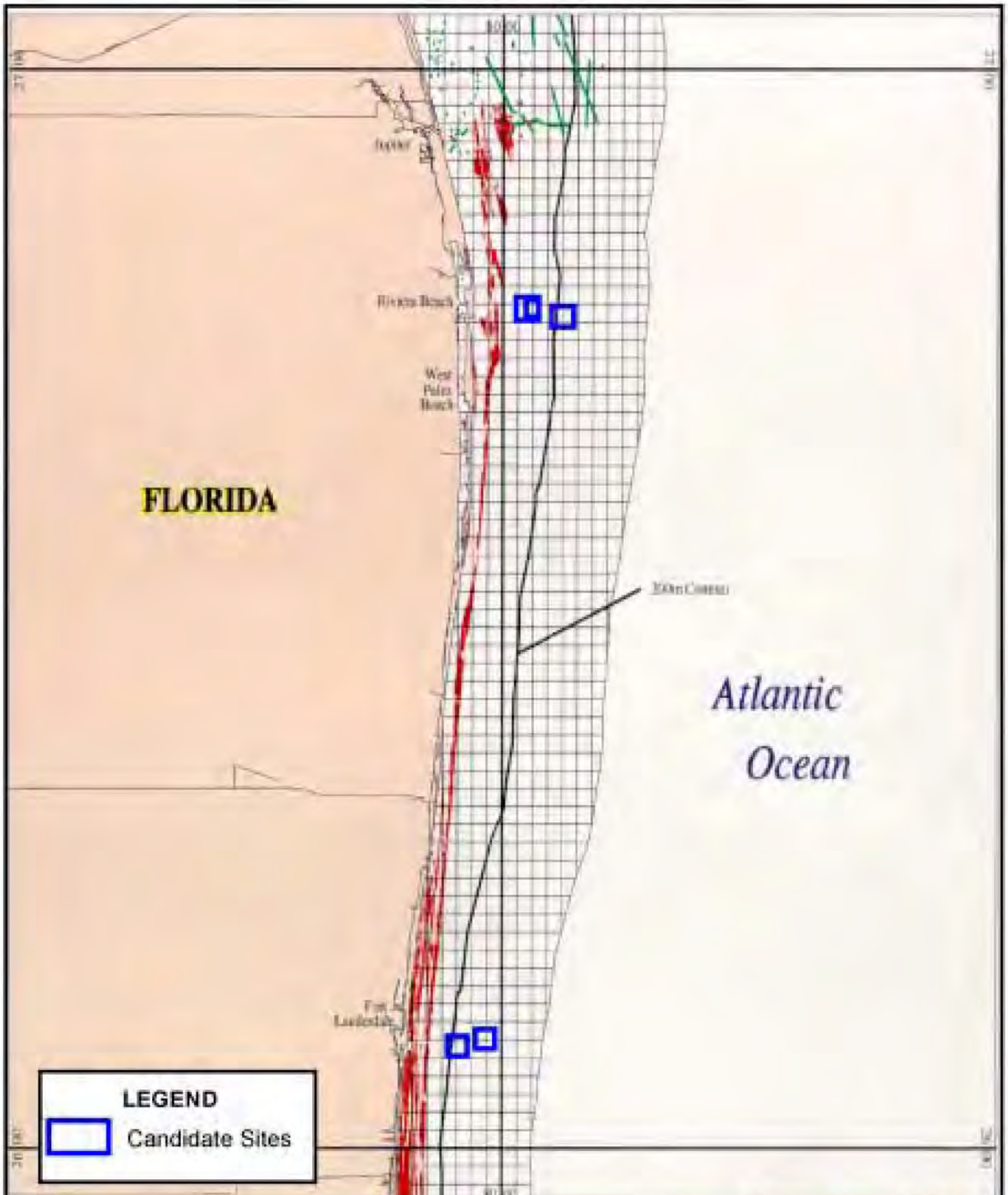
The composition of hardground biological assemblages along Florida’s east coast has been detailed by Goldberg (1970; 1973), Marszalek and Taylor (1977), Raymond and Antonius (1977), Marszalek (1978), Continental Shelf Associates, Inc. (1984; 1985; 1987; 1993), Wheaton (1987), and Blair and Flynn (1989). 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)

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



PROJECT AREA HARDBOTTOM HABITAT

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

SAFMC Sea Map (1997)

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 inverte-brates 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.

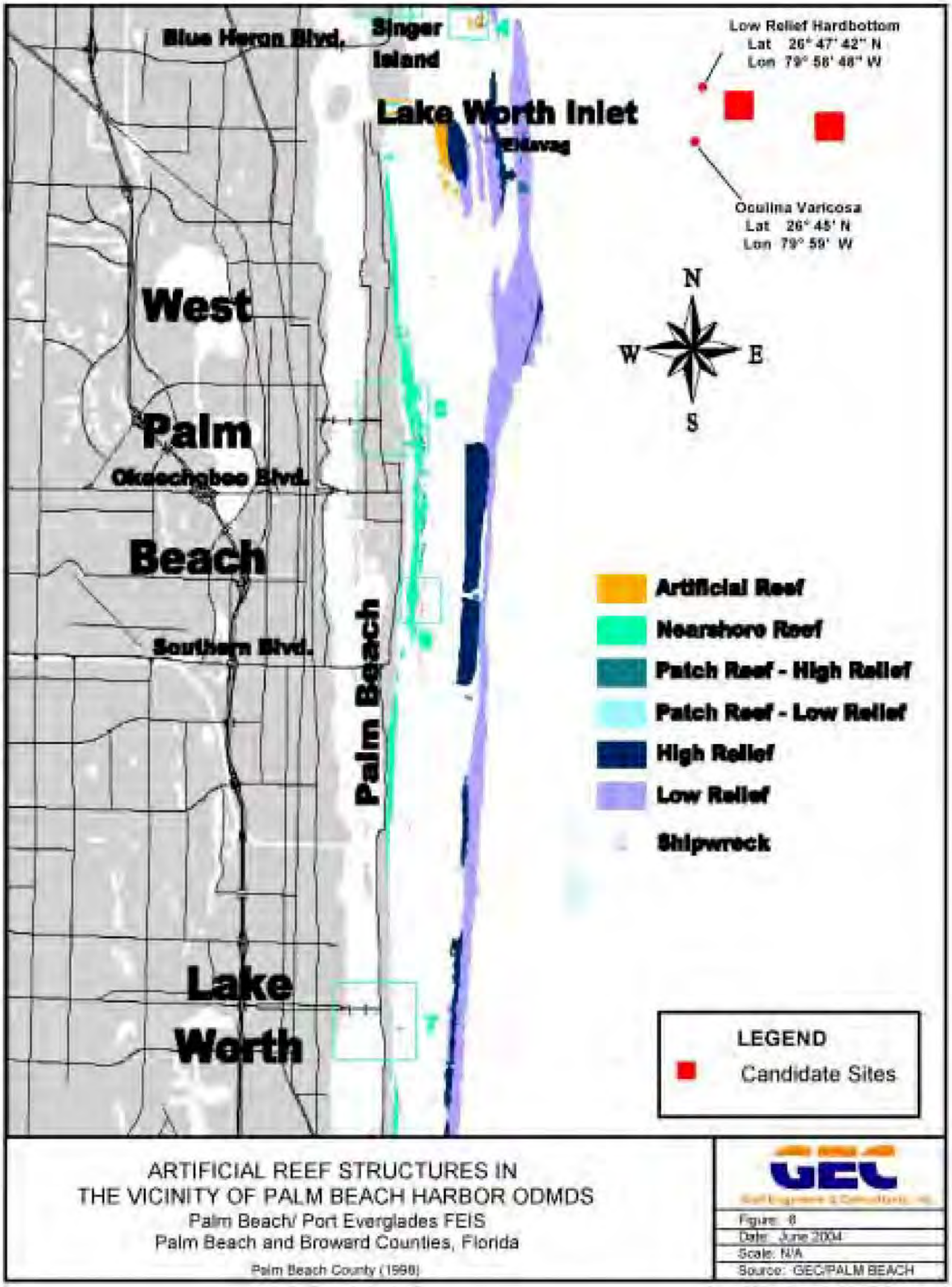

Blue Heron Blvd.
Singer Island
Lake Worth Inlet
Low Relief Hardbottom
Lat 26° 47' 42" N
Lon 79° 58' 48" W
Oculina Varicosa
Lat 26° 48' N
Lon 79° 59' W
N
W
E
S
West Palm Beach
Okeechobee Blvd.
Southern Blvd.
Palm Beach
Lake Worth
Artificial Reef
Nearshore Reef
Patch Reef - High Relief
Patch Reef - Low 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
Figure: 8
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	---		4.2	6.9	Vessels
Bud Krohn	26°08’51”N	80°05’00”W	---		4.2	6.9	Freighter
Trio Bravo	26°08’51”N	80°05’00”W	---		4.2	6.9	Tug
FL League of Anglers	26°08’51”N	80°05’00”W	95 ---440		4.2	6.9	Minesweeper
Rebel	26°08’51”N	80°05’00”W	---145		4.2	6.9	Freighter
Jim Atria	26°08’51”N	80°05’00”W	---388		4.2	6.9	Freighter
Robert Edmister	26°08’51”N	80°05’00”W	---		4.2	6.9	Cutter
River Bend	26°08’51”N	80°05’00”W	---110		4.2	6.9	Vessels
Bill Boyd Reef	26°08’51”N	80°05’00”W	---110		4.2	6.9	Freighter
Hog Heaven	26°08’51”N	80°05’00”W	---70		4.2	6.9	Barges, lighthouse
Jay Scutti	26°08’51”N	80°05’00”W	---98		4.2	6.9	Schooner
Qualmann Barge	26°08’51”N	80°05’00”W	---265		4.2	6.9	Barge
Osborne	26°08’51”N	80°05’00”W	---64		4.2	6.9	Barge
Grouper Grotto	26°08’51”N	80°05’00”W	---67		4.2	6.9	Tanks, pipes, concrete
Powell Barge, DB 24	26°08’51”N	80°05’00”W	145 --- 73		4.2	6.9	Barge, concrete
Mariott Reef	26°08’51”N	80°05’00”W	---150		4.2	6.9	Airplane
Mercedes	26°08’51”N	80°05’00”W	---314		4.2	6.9	Freighter
Tracor/Navy Drydock	26°06’48”N	80°04’10”W	--- 71		2.8	6.0	Vessels, drydock
Powell Barges	26°06’48”N	80°04’10”W	---97		2.8	6.0	Barges
TE AMO	26°06’48”N	80°04’10”W	---210		2.8	6.0	Vessel
Erojacks	26°06’43”N	80°05’43”W	---		4.4	7.5	Concrete erojacks
Berry Patch	26°18’07”N	80°03’45”W	---270		13.0	13.4	Vessels (4)
Deerfield Pier	---	---	---215	67	---	---	Unknown
Hydro Atlantic	26°19’30”N	80°03’02”W	---14		14.7	14.5	Dredge

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

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190
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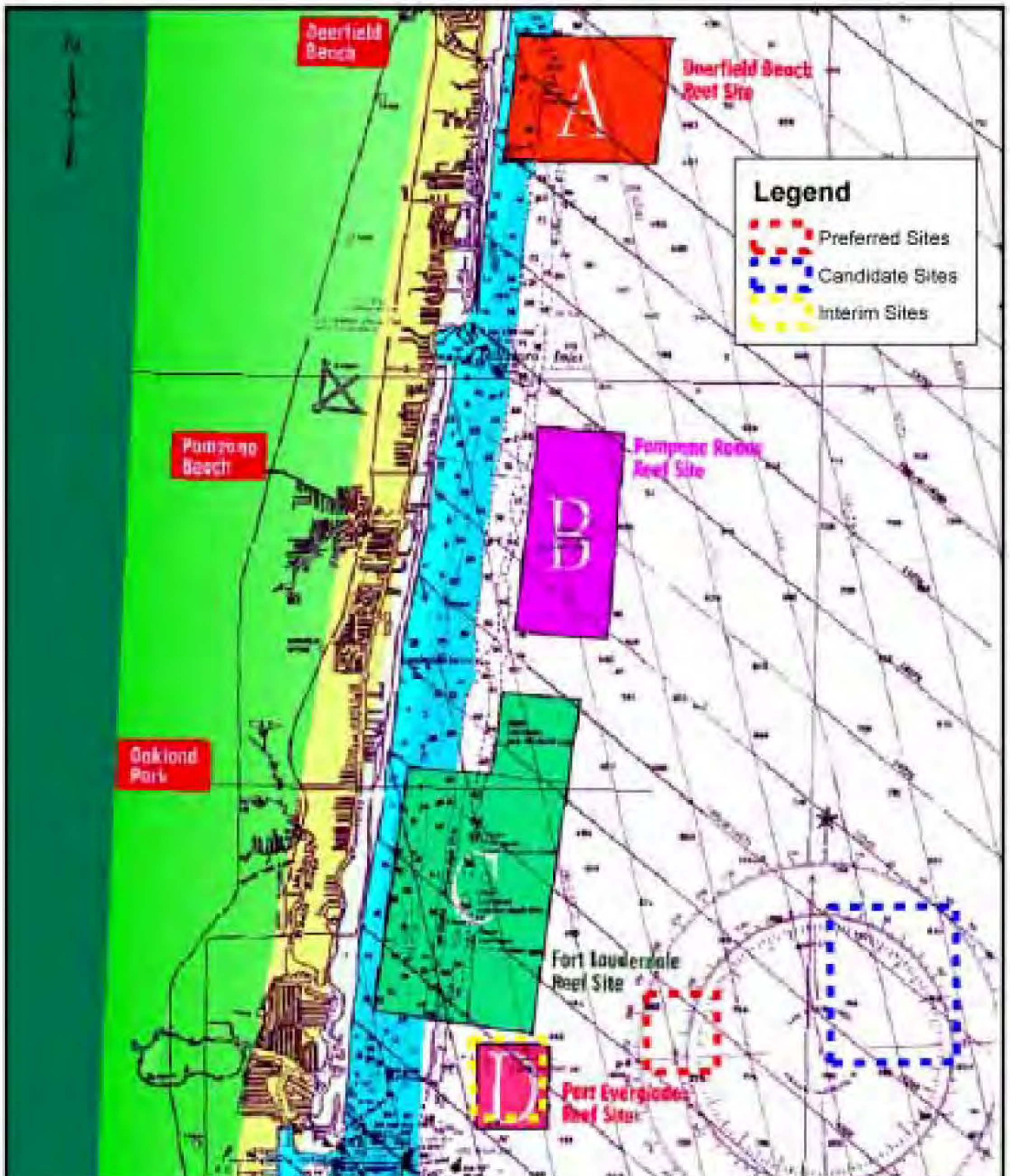
Table 17 (cont'd). Artificial Reef Locations in the Vicinity of the Proposed Port Everglades Harbor ODMDS

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	---		8.2	8.9	Vessel
Tote Machines	---	---	14271.6 x 62096.4	200	---	---	Debris
Bruce Mueller	26°10'07"N	80°04'42"W	---122		4.8	7.1	Vessel
Chevron 1"	26°07'24"N	80°04'33"W	---		4.8	6.3	Vessel
Chevron 3"	26°08'06"N	80°04'06"W	---		3.0	5.8	Vessel
Chris Coffman Reefball	26°07'30"N	80°04'24"W	---45 73		3.1	6.0	Reefballs (11)
Corky M.	26°10'05"N	80°04'43"W	---190		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 65	170	---	---	Vessel
Harbor Town	---	---	14265.2 x 22 62106.3	70	---	---	Vessel
Bulk Trader	26°08'36"N	80°03'50"W	---		7.8	8.4	Vessel
Eben-Ezer 2	26°00'24"N	80°05'35"W	---		8.0	10.25	Vessel
Merci Jesus	26°09'38"N	80°04'45"W	---		4.6	6.9	Vessel
Moonshot	---	---	---313	70	---	---	Vessel
Paul Sherman	---	---	14264.8 x 63 62106.6 72	70	---	---	Vessel
Peter B. McAllister	26°10'09"N	80°04'43"W	---		5.5	7.1	Vessel
Reef Balls (Deep)	26°07'48"N	80°04'25"W	---		3.2	6.2	Prefab Concrete
Reef Balls (Shallow)	26°07'31"N	80°04'25"W	---		3.1	6.1	Prefab Concrete
Reuben Reef	---	---	14262.6 x 69 62109.0 144	70	---	---	Vessels
Spaghetti Barge	---	---	14263.7 x 23 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	---		4.3	6.8	Vessel
NSWC	26°10'30"N	80°03'13"W	---		4.4	6.0	Cable Spools
AFDL-8	---	---	14261.2 x 62107.4 65	220	---	---	Drydock
Chris Craft Molds	---	---	14261.4 x 150 62107.2	70	---	---	Molds
FAD	---	---	14262.0 x 62107.2	110	---	---	Midwater Kites
Joe's Nightmare	26°06'48"N	80°04'13"W	---		2.8	5.9	Barge
Marriot	---	---	14261.4 x 62109.8	71	---	---	Airplane
Monomy	---	---	14263.2 x 17 62107.5	60	---	---	Vessel
NSWC Sea Con Reef	26°00'36"N	80°05'37"W	---		8.5	11.1	Acoustic Arrays (2) & Concrete
Port Everglades Reef	26°06'45"N	80°04'02"W	---		2.6	5.7	Concrete Piers
Capt. DeDe	26°00'34"N	80°05'36"W	--- 74		8.6	11.0	Vessel
Cruz del Sur	25°58'10"N	80°04'38"W	--- 150		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 --- 230		8.6	11.0	Vessel
Emmi Boggs	26°00'36"N	80°05'37"W	---		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	75 ---	190	10.0	11.9	Oil Rig Legs
Tenneco (Shallow)	25°58'57"N	80°05'06"W	---75	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

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.

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 26°47'30"N 26°46'30"N 26°46'30"N	79°57'09"W 79°56'02"W 79°57'09"W 79°56'02"W	509 ft/ 607 ft	Uniform Soft Bottom	4.3 nmi
Palm Beach 9-mile candidate site	26°45'00"N 26°45'00"N 26°47'00"N 26°47'00"N	79°53'00"W 79°51'00"W 79°53'00"W 79°51'00"W	855 ft/ 985 ft	Uniform Soft Bottom	8 nmi
Port Everglades 4-mile (preferred) site	26°07'30"N 26°07'30"N 26°06'30"N 26°06'30"N	80°02'00"W 80°01'00"W 80°02'00"W 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 26°06'30" N 26°08'30" N 26°08'30" N	79°57'30"W 79°59'30"W 79°59'30"W 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 $\mu Pa^2/Hz$ at 1 meter around 25 Hz for larger vessels down to 140 dB re 1 $\mu Pa^2/Hz$ 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
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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
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Treasure Coast Regional Planning Council
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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

Appendix A

SCOPING AND RESPONSE LETTERS

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

April 17, 1995

REPLY TO
ATTENTION OF

Planning Division
Environmental Branch

APR 20 1995

TO WHOM IT MAY CONCERN:

The U.S. Army Corps of Engineers (Corps), Jacksonville District, has requested that the Environmental Protection Agency (EPA) designate an Offshore Dredged Material Disposal Site (ODMDS) offshore Port Everglades, Florida, for the disposal of dredged material from the Port Everglades area when ocean disposal is the preferred disposal alternative. An Environmental Impact Statement is required to provide the necessary information to evaluate alternatives and designate the preferred ODMDS.

The entrance channel and turning basin of Port Everglades must receive periodic maintenance dredging to ensure safe navigation. The dredged material has been disposed of at the existing interim ODMDS for Port Everglades in the past. Designation of a Port Everglades ODMDS is being evaluated to determine the most feasible and environmentally acceptable ocean disposal site for anticipated future dredging.

The area that will be investigated lies between 3 and 10 miles offshore of Port Everglades in the Atlantic Ocean. The alternative to selecting a site is no action, being defined as not designating an ocean disposal site.

The Corps welcomes your views, comments, and information about resources, study objectives, and important features within the described study area, as well as any suggested improvements. Letters of comment or inquiry should be addressed to the letterhead address to the attention of Planning Division, Environmental Coordination Section, and received by this office within 30 days of the date of this letter.

Sincerely,

FR A. J. Salem
Chief, Planning Division

DEPARTMENT OF THE NAVY
NAVAL SURFACE WARFARE CENTER
CARDEROCK DIVISION

SOUTH FLORIDA TESTING FACILITY
8010 NORTH OCEAN DRIVE
DANIA, FL 33004

IN REPLY REFER TO:

5000
Ser 7110/159
30 Jun 95

From: Officer in Charge, Naval Surface Warfare Center, Carderock Division Detachment, South Florida Testing Facility
To: Planning Division, Environmental Coordination Section, Department of the Army, Jacksonville District Corps of Engineers, P.O. Box 4970, Jacksonville, FL 32232-0019

Subj: OFF-SHORE DREDGED MATERIAL DISPOSAL SITE

Ref: (a) Chief, Planning Division, Jacksonville District Corps of Engineers ltr of 17 Apr 95

1. This is in response to reference (a) regarding your request to the U.S. Environmental Protection Agency (EPA) to designate an Offshore Dredged Material Disposal Site offshore Port Everglades, Florida, for the disposal of dredged material from the Port Everglades area. As the referenced letter states, the entrance channel and turning basin of Port Everglades must receive periodic maintenance dredging to ensure safe navigation.

2. The Naval Surface Warfare Center, Carderock Division Detachment, South Florida Testing Facility strongly supports your request to the EPA and the designation of an Offshore Dredged Material Disposal Site offshore Port Everglades. Due to the nature of the South Florida Testing Facility's operations, however, some careful attention to the location of the site is requested.

3. The South Florida Testing Facility (SFTF) conducts surface and subsurface trials of Navy vessels, and has an extensive underwater cable range off the coast south of Port Everglades. It is requested that all considerations involving the actual disposal site include the exclusion of the SFTF test range bounded by the following coordinates:

North-west corner:	80° 06' 30" West, 26° 06' 30" North
North-east corner:	79° 40' 00" West, 26° 06' 30" North
South-east corner:	79° 40' 00" West, 26° 00' 00" North
South-west corner:	80° 07' 00" West, 26° 00' 00" North

Exclusion of this area shall insure that any disposal activities will not interfere with range operations. Additional information regarding our test range is contained in Title 33 Code of Federal Regulations, Navigation and Navigable Waters, designated as restricted area 334.580.

Subj: OFF-SHORE DREDGED MATERIAL DISPOSAL SITE

4. If you have any questions, please contact William Baxley, Environmental Site Manager, at (305) 926-4015.

M C Ruddeforth

M.C. RUDDEFORTH

STATE OF FLORIDA
DEPARTMENT OF COMMUNITY AFFAIRS

2740 CENTERVIEW DRIVE • TALLAHASSEE, FLORIDA 32399-2100

LAWTON CHILES
Governor

LINDA LOOMIS SHELLEY
Secretary

June 6, 1995

Mr. A. J. Salem
U. S. Army Corps of Engineers
Jacksonville District
Post Office Box 4970
Jacksonville, Florida 32232-0019

RE: Beach Erosion Control Projects - Port Everglades - Offshore Dredged Material Disposal Site, Broward County, Florida
SAI: FL9504190258C

Dear Mr. Salem:

The Florida State Clearinghouse is awaiting additional comments from our reviewing agencies on the above referenced project. We are therefore requesting an additional fifteen (15) days for completion of the consistency review in accordance with 15 CFR 930.41(b).

We will make every effort to conclude the review and forward the consistency determination to you on or before June 15, 1995.

Very truly yours,

Mary Anne Price

for Linda Loomis Shelley
Secretary

LLS/rk

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

December 3, 1998

4WM-WCWQ

Mr. Don Fore
Jacksonville District Corps of Engineers
Attn: CESAJ-DP-I
P.O. Box 4970
Jacksonville, FL 32232-0019

Dear Mr. Fore:

I have completed my review of the draft final report entitled, "Dispersion Characteristics for Palm Beach and Port Everglades Ocean Dredged Material Disposal Sites (ODMDS)" completed by the Waterways Experiment Station. Overall, the effort appears sound, comprehensive and useful for the designation EIS. My comments on the STFATE simulations and long-term fate analysis are attached. However, prior to any additional analysis per my comments, it may be prudent to await comments from the State of Florida. If there are any questions regarding my comments, please contact me at (404) 562-9391.

Sincerely,

Christopher J. McArthur, PE
Environmental Engineer
Wetlands, Coastal & Water Quality Branch

Enclosure

cc: Mr. Rea Boothby, CESAJ-PD-ER
Mr. Glenn Schuster, CESAJ-PD-EE
Ms. Lynn Griffin, State of Florida DEP
Ms. Mary Cialone, CEWES-CR-P

EPA REGION 4 COMMENTS
DISPERSION CHARACTERISTICS FOR PALM BEACH AND PORT EVERGLADES OCEAN DREDGED MATERIAL DISPOSAL SITES (ODMDS)

STFATE Results:

1. In our previous comments prior to modeling initiation, we requested that a "typical" current profile (V_{50} for angle band 1) be modeled to provide a description of the disposal event under typical conditions at the ODMDS. This was not done and should be conducted.

2. In our previous comments prior to modeling initiation, we raised concerns regarding the validity of the Navy ADCP data set for use at Palm Beach located 40 miles to the north. This issue has still not been addressed. Additional sources of current data should be consulted to determine the validity of this data set at Palm Beach.

3. Model coefficients were selected based on recommended default values and values more appropriate for the study. However, the report does not discuss which coefficients were modified from the default values and what was the basis of the modification besides personal communication. The rationale for selected coefficient values should be stated. Additionally, acoustic plume measurements conducted by NOAA at the Miami ODMDS could assist in the development of more accurate entrainment coefficients. This should be examined.

4. The STFATE results should include figures showing total suspended solids concentrations. Additionally, the scales should be adjusted to show the entire plume decay. In some cases the plots end with sediment concentrations as high as 20mg/l.

Long Term Fate Analysis:

5. Long term modeling and screening assumed a disposal project volume of 50,000 cubic yards. It is unclear that this is a suitable project volume. It is stated that 50,000 cubic yards is an annual disposal amount. Disposal mounds are created not by annual averages, but by project volumes. It is expected that these ODMDSs will not be used on an annual basis. The 1994 Port Everglades Disposal Area Study showed harbor shoals of 162,500 cubic yards and 68,500 cubic yards. The Palm Beach Disposal Area Study showed harbor shoals of 16,000 and 60,000 cubic yards. Additional discussions with Tim Murphy and Don Fore of the Jacksonville District indicate that ocean disposal project sizes of 30,000 to 50,000 cubic yards are reasonable, but that projects on the order of 600,000 to 700,000 cubic yards are possible for use of the ODMDS. The sites should be re-evaluated using a more conservative project volume in addition to the typical project size.

STATE OF FLORIDA
DEPARTMENT OF COMMUNITY AFFAIRS

2740 CENTERVIEW DRIVE • TALLAHASSEE, FLORIDA 32399-2100

LAWTON CHILES
Governor

LINDA LOOMIS SHELLEY
Secretary

June 16, 1995

Mr. A. J. Salem
Chief of Planning
Department of the Army
Corps of Engineers
Jacksonville District
Post Office Box 4970
Jacksonville, Florida 32232-0019

RE: Scoping Letter for Offshore Dredged Materials Disposal Site - Port Everglades - Broward County, Florida
SAI: FL9504190258C

Dear Mr. Salem:

The Florida State Clearinghouse, pursuant to Presidential Executive Order 12372, Governor's Executive Order 93-194, the Coastal Zone Management Act, 16 U.S.C. §§ 1451-1464, as amended, and the National Environmental Policy Act, 42 U.S.C. §§ 4321, 4331-4335, 4341-4347, as amended, has coordinated a review of the above-referenced project.

The Department of Environmental Protection (DEP) recommends that the environmental impact statement for the above-referenced project include an analysis of disposal options, including the reuse of beach quality materials, and the results of a detailed survey to identify suitable disposal sites. The DEP also indicates that significant marine resources including hard bottom, soft bottom and reef communities, and areas utilized by marine mammals and turtles, may occur within the project area. Therefore, the Corps of Engineers is encouraged to coordinate closely with the DEP during all stages of the site investigations and project planning. Please refer to the enclosed DEP comments for further discussion of these recommendations and concerns.

Based on the information contained in the scoping document and the enclosed comments provided by our reviewing agencies, the state has determined that, at this stage, the above-referenced project is consistent with the Florida Coastal Management Program (FCMP). All subsequent environmental documents prepared for this project must be reviewed to determine the project's continued consistency with the FCMP. The state's continued concurrence with the project will be based, in part, on the adequate resolution of issues identified during this and subsequent reviews. All future documents prepared for this project must be submitted to the Florida State Clearinghouse for interagency review.

Very truly yours,

Mary Anne Price

for Linda Loomis Shelley
Secretary

LLS/rk

Enclosures

cc: George Percy, Department of State
Lynn Griffin, Department of Environmental Protection

Department of Environmental Protection

Lawton Chiles
Governor

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

Virginia B. Wetherell
Secretary

June 16, 1995

Suzanne Traub-Metlay
Executive Office of the Governor
Office of Planning and Budgeting
Room 1603, The Capitol
Tallahassee, Florida 32399-0001

Dear Ms. Traub-Metlay:

Re: Scoping Request, U.S. Army Corps of Engineers
Ocean Dredged Material Disposal Site Designation
Port Everglades, Florida
SAI FL9504190258

The Corps of Engineers is planning to prepare an environmental impact statement (EIS) to determine an appropriate location for a new ocean dredged material disposal site (ODMDS) offshore of Port Everglades. The primary use of the site will be to dispose of sediments dredged from the port's entrance channel and turning basin. In addressing the purpose and need to designate a site off of Port Everglades, the EIS should clearly acknowledge that the site is not intended for the disposal of beach quality material. There should also be an exhaustive analysis of alternative upland sites and reuse options which could avoid the need to dispose of usable material in the ocean environment.

In 1990, the department objected to any further use of the interim-designated disposal site located near Port Everglades, due, in part, to documented impacts to hard bottom communities. It appears that the Corps and EPA are intending to relocate the permanent disposal site to deeper waters 3-10 miles offshore. However, this area, and downcurrent areas further inshore, may also include significant marine resources, such as hard bottom, reef communities; artificial reefs and other fish havens; areas frequented by marine mammals and turtles; and possibly significant soft bottom communities. The ideal location for a site would be removed from such areas so that disposal operations do not result in direct or indirect impacts to bottom habitats and other important biological resources.

Although the scoping notice indicates that a broad area will be investigated, old correspondence regarding this site designation refers to surveys which were probably conducted around the mid-1980s and focused on two locations 3 and 7 nmi offshore. While geophysical information gathered in old surveys may be useful for comparative purposes, biological information presented in the EIS needs to be up-to-date. Rather than selecting specific locations to investigate, we recommend conducting a wide area search of the study area shown in the notice, using bathymetry, side scan sonar, and photography, to identify potential disposal site locations based primarily on gross physiographic characteristics. Promising candidate sites can then be investigated in greater detail for evaluation in the EIS.

Surveys of candidate sites should include detailed bathymetry and, depending on water depths and current conditions, may warrant sediment sampling, biological sampling, and more detailed video and still photography. Surveys should cover the site and the area within .5 nmi surrounding the site. If video surveys are conducted, survey transects should be set at 150-200m line spacings to allow the type, areal extent, and density of bottom resources to be mapped. Sufficient biological sampling should be performed to ground truth photographic information and characterize benthic communities. Maps depicting bathymetry, distribution of representative benthic communities, and sediment types should be presented in the draft EIS.

Dredged material transport is an issue of concern, particularly where sensitive marine communities are located in close proximity to the disposal site. It is expected that the same eddy currents present at the Miami ODMDS would be present in the area off of Port Everglades. If this is the case, transport of fine sediments may be an issue at this site also, depending on what resources are found to be present and the site location. We recommend that EPA and the Corps continue the consultation with NOAA-AOML and UM-RSMAS ongoing at the Miami site on matters pertaining to current conditions, hydrographic modeling, and sediment transport at Port Everglades.

We request that the department be consulted at all stages of this site investigation. We would like to assist in developing the survey protocols and review survey data, particularly site photography, before it is presented in the draft EIS. We recommend that EPA establish the site management and monitoring team for this site at this time so that a working group is involved in the site search and alternatives analysis from inception. The team can also participate in developing the dredged material disposal plan and site management and monitoring plan which should be included in the draft EIS.

At other sites, the department has been given the opportunity to review a preliminary copy of the draft EIS and provide informal, early coordination comments. This consultation has been invaluable in resolving issues before the draft EIS was officially published. We request that such consultation take place for this site as well.

The draft EIS should include a federal consistency determination which evaluates the consistency of the proposed designation with the department's statutory authorities in the Florida Coastal Management Program, particularly Chapters 373 and 370, Florida Statutes. This analysis should focus on the issues raised above.

We appreciate the opportunity to review this scoping notice. If you have any questions concerning these comments, please contact me at 487-2231.

Cordially,

Lynn Griffin

Lynn Griffin
Environmental Manager
Office of Intergovernmental
Programs

/l
cc: George Henderson

FLORIDA DEPARTMENT OF STATE
Sandra B. Mortham
Secretary of State
DIVISION OF HISTORICAL RESOURCES
R.A. Gray Building
500 South Bronough Street
Tallahassee, Florida 32399-0250

Director's Office
(904 488-1480

Telecopier Number (FAX)
(904) 488-3353

RECEIVED
MAY 14 1995
Florida Coastal
Management Program

May 11, 1995

Ms. Suzanne Traub-Metlay
State Clearinghouse
Executive Office of the Governor
Room 1603, The Capitol
Tallahassee, Florida 32399-0001

In Reply Refer To:
Frank J. Keel
Historic Sites Specialist
(904) 487-2333
Project File No. 951538

RE: Cultural Resource Assessment Request
SAI# FL9504190258C
Proposed Offshore Dredged Material Disposal Area
Port Everglades, Broward County, Florida

Dear Ms. Traub-Metlay:

In accordance with the provisions of Florida's Coastal Zone Management Act and Chapter 267, *Florida Statutes*, as well as the procedures contained in 36 C.F.R., Part 800 ("Protection of Historic Properties"), we have reviewed the referenced project(s) for possible impact to historic properties listed, or eligible for listing, in the *National Register of Historic Places*, or otherwise of historical or architectural value.

A review of the Florida Site File indicates that no significant archaeological or historical sites are recorded for or likely to be present within the project area. Furthermore, because of the project location and/or nature it is unlikely that any such sites will be affected. Therefore, it is the opinion of this office that the proposed project will have no effect on historic properties listed, or eligible for listing, in the *National Register of Historic Places*, or otherwise of historical or architectural value. The project is also consistent with the historic preservation laws of Florida's Coastal Management Program.

Ms. Traub-Metlay
May 11, 1995
Page 2

If you have any questions concerning our comments, please do not hesitate to contact us. Your interest in protecting Florida's historic properties is appreciated.

Sincerely,

Laura A. Kammerer

for George W. Percy, Director
Division of Historical Resources
and
State Historic Preservation Officer

GWP/Kfk
xc: Jasmin Raffington, FCMP-DCA

FLORIDA DEPARTMENT OF TRANSPORTATION

LAWTON CHILES
GOVERNOR

605 Suwannee Street, Tallahassee, Florida 32399-0450

BEN G. WATTS
SECRETARY

M E M O R A N D U M

RECEIVED
MAY 9 1995
Florida Coastal Management Program

Date: May 8, 1995

To: **State Clearinghouse**

From: **Robert G. Hebert, Jr.**
Manager-Ports/Intermodal
Florida Department of Transportation
SC 278-5704 FAX SC 277-3403

Copies: FDOT ICAR Coordinator w/att., FDOT District 4 Public Transportation Manager, Florida Coastal Management Director (DCA), File

Subject: **ICAR Federal Consistency Project Review Process**
Port Everglades Dredging
SAI#'s FL9504190258C

In accordance with departmental procedure 525-010-205-c, and State Clearinghouse requirements for review and comment on potential federal projects that may affect state programs and objectives, please be advised that the above-referenced proposed study or project:

___ Does influence and impose a potential impact on existing state programs or objectives under Rail Office jurisdiction to the extent noted in the following comments:

X Does not influence or impose a potential impact on existing state programs or objectives under Rail Office jurisdiction at this time, and no comments or recommendations are required.

Should further information or explanation be required, please feel free to contact the Rail Office at (904) 488-5704.

RGH/
Attachment

INTERGOVERNMENTAL COORDINATION AND REVIEW ROUTING SHEET

DATE: 05/05/95

TO: Norm Feder, D1; Aage Schroder, D2; Marvin Stukey, D3; Joe Yesbeck, D4; Jim Kimbler, D5; Servando Parapar, D6; David Twiddy, D7; Leroy Irwin, MS37; Rob Hebert, MS25; Ashbaker, MS46.

SAI#: FL9504190258C

Application Transmitted: Port Everglades Dredging

Date Response Due to the Clearinghouse: 05/10/95

Please review and comment regarding the attached application in accordance with Department Procedure 525-010-205. A letter of response to the Director of the Clearinghouse and this routing sheet should be completed and returned as directed in the procedure.

The following criteria, as appropriate to the project, should be used to evaluate the application and develop your comments:

- Florida Transportation Plan
- Adopted Work Program
- Transportation Improvement Plan (TIP)
- Right of Way Preservation and Advanced Acquisition
- Transit Development Program
- MPO Comprehensive Transportation Plan and 20 year Transportation Plan
- Florida Rail System Plan
- Florida Aviation System Plan
- Local Airport Master Plan
- Florida Seaport Mission Plan
- Environment Commitments
- Unified Planning Work Program
- Level of Service
- Access Management

If comments are warranted based on other criteria, they should be included.

Work Program Item Number: ____________________ (if applicable).

Ronnice Freeman
Central Office ICAR Coordinator, MS28

Type: GENERAL AVIATION RAIL SEAPORTS ENVIRONMENT TRANSIT

DATE:	04/25/95
COMMENT DUE DATE:	05/10/95
CLEARANCE DUE DATE:	06/02/95
SAI#:	FL9504190258C

COUNTY: Broward

STATE AGENCIES	LOCAL/OTHER	OPB POLICY UNITS
Community Affairs Environmental Protection Game and Fresh Water Fish Comm Health and Rehabilitative Services State Transportation	South Florida Water Manag. District	Environmental Policy/C & ED

The attached document requires a Coastal Zone Management Act/Florida Coastal Management Program consistency evalutation and is categorized as one of the following:

___ Federal Assistance to State or Local Government (15 CFR 930, Subpart F). Agencies are required to evaluate the consistency of the activity.

_X_ Direct Federal Activity (15 CFR 930, Subpart C). Federal Agencies are required to furnish a consistency determination for the State's concurrence or objection.

___ Outer Continental Shelf Exploration, Development or Production Activities (15 CFR 930, Subpart E). Operators are required to provide a consistency certification for state concurrence/objection.

___ Federal Licensing or Permitting Activity (15 CFR 930, Subpart D). Such projects will only be evaluated for consistency when there is not an analogous state license or permit.

RECEIVED
MAY - 5 1995
CENTRAL OFFICE FDOT
ICAR COORDINATOR

FOR CONSISTENCY PROJECTS, SEE REVERSE SIDE FOR INSTRUCTIONS.

To: **State Clearinghouse**
Executive Office of the Governor -OPB
Room 1603, The Capitol
Tallahassee, FL 32399-0001
(904) 488-8114 (SC 278-8114)

Florida Coastal Management Program
Department of Community Affairs
Suite 305, Rhyne Building
2740 Centerview Drive
Tallahassee, FL 32399-2100
(904) 922-5438 (SC 292-5438)

EO. 12372/NEPA

- [x] No Comment
- [ ] Comments Attached
- [ ] Not Applicable

Federal Consistency

- [x] No Comment/Consistent
- [ ] Consistent/Comments Attached
- [ ] Inconsistent/Comments Attached
- [ ] Not Applicable

From:

Division/Bureau: FDOT Rail Office

Reviewer: [signature] Manager - Ports/Intermodal

Date: 5/8/95

,TY: Broward

DATE: 04/25/95
COMMENT DUE DATE: 05/10/95
CLEARANCE DUE DATE: 06/02/95
SAI#: FL9504190258C

STATE AGENCIES	LOCAL/OTHER	OPB POLICY UNITS
Community Affairs Environmental Protection Game and Fresh Water Fish Comm Health and Rehabilitative Services State Transportation	South Florida Water Manag. District	Environmental Policy/C & ED RECEIVED MAY 14 1995 Florida Coastal Management Program

'he attached document requires a Coastal Zone Management Act/Florida :oastal Management Program consistency evalutation and is categorized .s one of the following:

__ Federal Assistance to State or Local Government (15 CFR 930, Subpart F). Agencies are required to evaluate the consistency of the activity.

_X_ Direct Federal Activity (15 CFR 930, Subpart C). Federal Agencies are required to furnish a consistency determination for the State's concurrence or objection.

__ Outer Continental Shelf Exploration, Development or Production Activities (15 CFR 930, Subpart E). Operators are required to provide a consistency certification for state concurrence/objection.

__ Federal Licensing or Permitting Activity (15 CFR 930, Subpart D). Such projects will only be evaluated for consistency when there is not an analogous state license or permit.

FOR CONSISTENCY PROJECTS, SEE REVERSE SIDE FOR INSTRUCTIONS.

To: **State Clearinghouse**
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Federal Consistency

- [ ] No Comment/Consistent
- [ ] Consistent/Comments Attached
- [ ] Inconsistent/Comments Attached
- [ ] Not Applicable

From:
Division/Bureau: Comprehensive Planning
Reviewer: Frank Duke
Date: May 11, 1995

PORT EVERGLADES
Hollywood/Ft. Lauderdale/Dania

Port Everglades
Department of Broward County
1850 Eller Drive
Fort Lauderdale, FL. U.S.A. 33316-4201
(305) 523-3404 · Fax ~~525-1910~~ 468-3506

May 11, 1995

Mr. Erik Hvide, President
Port Everglades Association, Inc.
c/o Hvide Marine
P.O. Box 13038
Fort Lauderdale, FL 33316

Re: Assistance of Port Everglades Association, Inc.
Attached Public Notice from the U.S Army Corps of Engineers (COE)

Dear Mr. ~~Hvide:~~ Erik

We are requesting that the Port Everglades Association respond to the referenced COE Public Notice with positive comments regarding this study. In addition, it will be to our advantage if the individual members of the Association also responded to this request for comments, as the COE likes to see volume as well as quality in these matters.

As you are aware, one of the most important aspects of running a port is to maintain safe navigational channels and to increase our harbor and channel depths when needed as the result of new construction dredging projects. Currently, the Port has very limited areas to place dredge soil material within the confines of the our property. By having an approved Offshore Dredge Material Disposal Site (ODMDS), the Port can be assured that the channels will be maintained to depths necessary to ensure safe passage of all vessels transiting and utilizing our facility. The study process currently underway, is a rather lengthy one (2.5 to 3 years), and it would be helpful to the Port to show the COE support for this project from the Port users.

If you feel that there is a need for me to explain the study further to you or your members, please do not hesitate to call me. Congratulations on your new undertaking.

Sincerely,

Allan

Allan D. Sosnow
Environmental Projects Manager

✓ ADS:rfc

cc: Maurice F. Canady, Jr.

Enclosure

File: ODMDS

1850 Eller Drive ☐ Port Everglades, Florida 33316 ☐ (305) 463-2801 ☐ Fax (305) 467-5418

PORT EVERGLADES ASSOCIATION, INC.

May 23, 1995

Department of the Army
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Attention: Planning Division, Environmental Coordination Section

Dear Sir:

Reference is made to the April 17, 1995, letter from A.J. Salem, Chief, Planning Division, Jacksonville District Corps of Engineers, regarding your request to the U.S. Environmental Protection Agency (EPA) concerning the designation of an Offshore Dredged Material Disposal Site offshore Port Everglades, Florida, for the disposal of dredged material from the Port Everglades area.

As you know, the entrance channel and turning basin of Port Everglades must receive periodic maintenance dredging to ensure safe navigation.

Port Everglades is a major U.S. seaport, the second largest cruise port in the world, and the major petroleum port for South Florida. Nearly 4,500 ships transit the Port's entrance channel each year. Clearly, safety of navigation at Port Everglades is of the highest importance, and maintenance dredging is an essential aspect of the port's continuing operations.

The Port Everglades Association, a not-for-profit group of South Florida businesses organized to promote the growth and development of the Port, strongly supports your request to the EPA and the designation of an Offshore Dredged Material Disposal Site offshore Port Everglades.

Please feel free to contact me should you have questions about this matter.

Sincerely,

J. Erik Hvide
President

PD-ER
(Boothby)

Coastal
The Energy People

PAUL D. STANTON
SENIOR VICE PRESIDENT
COASTAL FUELS MARKETING, INC.

June 7, 1995

Department of the Army
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Attention: Planning Division, Environmental Coordination Section

Dear Sir:

We are writing in response to the April 17, 1995, letter from A.J. Salem, Chief, Planning Division, Jacksonville District Corps of Engineers, regarding your request to the U.S. Environmental Protection Agency (EPA) to designate an Offshore Dredged Material Disposal Site offshore Port Everglades, Florida, for the disposal of dredged material from the Port Everglades area.

Coastal Fuels Marketing, Inc. strongly supports your request to the EPA and the designation of an Offshore Dredged Material Disposal Site offshore Port Everglades.

We are a long term operator of a large facility within Port Everglades and, through our affiliate companies, supply petroleum products into the Port using our own vessels as well as chartered shipping. Accordingly, we are keenly interested in activities that will help maintain and improve the entrance channel and turning basin of Port Everglades.

Coastal has been and will always be very active in bettering the Port. Please feel free to contact me should you have any questions regarding this matter.

Sincerely,

Paul D. Stanton

Paul D. Stanton

PDS/kc

Coastal Fuels Marketing, Inc.
A SUBSIDIARY OF THE COASTAL CORPORATION
P O BOX 025500 • MIAMI FL 33102-5500 • 305/551-5200

MICHAEL SWERDLOW
COMPANIES, INC.

June 7, 1995

Department of the Army
Jacksonville District Corps of Engineers
Post Office Box 4970
Jacksonville, FL 32232-0019

Attention: Planning Division, Environmental Coordination Section

Dear Sir:

Reference is made to the April 17, 1995 letter from A. J. Salem, Chief, Planning Division, Jacksonville District Corps of Engineers, regarding your request to the U.S. Environmental Protection Agency (EPA) to designate an Offshore Dredged Material Disposal Site offshore Port Everglades, Florida, for the disposal of dredged material from the Port Everglades area. As the referenced letter states, the entrance channel and turning basin of Port Everglades must receive periodic maintenance dredging to ensure safe navigation.

Port Everglades is a major U.S. seaport, the second largest cruise port in the world, and the major petroleum port for South Florida. More than four thousand ships transit the Port's entrance channel each year. Clearly, safety of navigation at Port Everglades is of the highest importance, and maintenance dredging is an essential aspect of the port's continuing operations.

The Michael Swerdlow Companies, Inc. strongly supports your request to the EPA and the designation of an Offshore Dredged Material Disposal Site offshore at Port Everglades.

Please feel free to contact me should you have any questions about this matter.

Sincerely,

MICHAEL SWERDLOW COMPANIES, INC.

Bernard T. Budd

Bernard T. Budd
Vice Chairman

xc: Eric Hvide

Venture Corporate Center • 200 South Park Road, Suite 200 • Hollywood, Florida 33021 • Telephone (305) 981-1000 • Fax (305) 961-6377

Rinker

Rinker Materials Corporation
1200 N.W. 137th Avenue
Miami, FL 33182

P.O. Box 650679
Miami, FL 33265-0679

Facsimile (305) 223-5403
Telephone (305) 221-7645

June 2, 1995

Department of the Army
Jacksonville District Corps of Engineers P.O.. Box 4970
Jacksonville, Florida 32232-0019

Attention: Planning Division, Environmental Coordination Section

Dear Sir:

Reference is made to the April 17, 1995, letter from A.J. Salem, Chief, Planning Division, Jacksonville District Corps of Engineers, regarding your request to the U.S. Environmental Protection Agency (EPA) to designate an Offshore Dredged Material Disposal Site offshore Port Everglades, Florida, for the disposal of dredged material from the Port Everglades area. As the referenced letter states, the entrance channel and turning basin of Port Everglades must receive periodic maintenance dredging to ensure safe navigation.

Port Everglades is a major U.S. seaport, the second largest cruise port in the world, and the major petroleum port for South Florida. More than four thousand ships transit the Port's entrance channel each year. Clearly, safety of navigation at Port Everglades is of the highest importance, and maintenance dredging is an essential aspect of the port's continuing operations.

Rinker Materials Corporation strongly supports your request to the EPA and the designation of an Offshore Dredged Material Disposal Site offshore Port Everglades.

Please feel free to contact me should you have questions about this matter.

Sincerely,

James S. Jenkins III

James S. Jenkins III
Vice President Cement Operations

JSJ:lg

CROWLEY AMERICAN TRANSPORT, INC.

May 31, 1995

Department of the Army
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Attention: Planning Division, Environmental Coordination Section

I refer to correspondence from A.J. Salem, Chief, Planning Division, Jacksonville District Corp of Engineers, regarding your request to the U.S. Environmental Protective Agency (EPA) to designate an offshore dredged material disposal site. This site offshore of Port Everglades would be the designated area for dredged material from the Port Everglades area. The attached letter states that the entrance channel and turning basin must receive periodic maintenance dredging to ensure safe navigation.

Port Everglades is the site of a major terminal for Crowley American Transport, Inc. which serves South America, Mexico, Latin America and the Caribbean. Safety of navigation and clear, unobstructed access to our berths at Southport, Port Everglades, is a major concern. Considering that Crowley American Transport, Inc., estimates 572 vessels in 1995, maintenance dredging and navigational safety is a major priority to our continuing operation.

Crowley American Transport, Inc. strongly supports your request to the EPA and the designation of an offshore dredged material disposal site adjacent to Port Everglades.

If you have any questions on this matter, please feel free to contact me directly.

Sincerely,

Joseph P. Shea Jr.
Director of Operations, South Florida

JPS/bcp

ELLER
& COMPANY, INC.
701 S.E. 24th STREET / FT. LAUDERDALE, FLORIDA 33316 / P.O. BOX 13133
PHONE (305) 525-3381 / TELEX: (RCA) 275168
CABLE: "ELLERCO" / FAX: (305) 524-2644
"COMPLETE MARITIME SERVICES"

June 6, 1995

Department of the Army
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-0019

Attention: Planning Division, Environmental Coordination Section

Gentlemen:

You are referred to the April 17, 1995 letter from A.J. Salem, Chief, Planning Division, Jacksonville District Corps of Engineers, regarding your request to the U.S. Environmental Protection Agency (EPA) to designate an Offshore Dredged Material Disposal Site offshore Port Everglades, Florida for the disposal of dredged material from the Port Everglades area. Our company is port agent and stevedore for most of the cruise lines serving Port Everglades, as well as many of the cargo lines. It is vital to our principals that the entrance channel and turning basin of Port Everglades receive periodic maintenance dredging to ensure safe navigation.

We, therefore, strongly support your request to the EPA and the designation of an offshore Dredged Material Site offshore Port Everglades. If we can be of any assistance, please let me know.

Yours very truly,

ELLER & COMPANY, INC.

A. C. Novacek

Arthur C. Novacek
President

ACN/jd

PORT EVERGLADES

PORT EVERGLADES PILOTS' ASSOCIATION
Post Office Box 13017
PORT EVERGLADES, FLORIDA 33316
Telephone (305) 522-4491 / 7

Florida's Deepest Harbor

June 8, 1995

Department of the Army
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-0019

Attn: Planning Division, Environmental Coordination Section

Dear Sir:

Reference is made to the April 17, 1995, letter from A.J. Salem, Chief, Planning Division, Jacksonville District Corps of Engineers, regarding your request to the U.S. Environmental Protection Agency (EPA) to designate an Offshore Dredged Material Disposal Site offshore Port Everglades, Florida, for the disposal of dredged material from the Port Everglades area. As the referenced letter states, the entrance channel and turning basin of Port Everglades must receive periodic maintenance dredging to ensure safe navigation.

Port Everglades is a major U.S. seaport, the second largest cruise port in the world, and the major petroleum port for South Florida. More than seven/eight thousand ships transit the Port's entrance channel each year. Clearly, safety of navigation at Port Everglades is of the highest importance, and maintenance dredging is an essential aspect of the port's continuing operations.

The Port Everglades Pilots' Association <u>strongly</u> supports your request to the EPA and the designation of an Offshore Dredged Material Site offshore Port Everglades.

Please feel free to contact us should you have questions about this matter.

Sincerely,

PORT EVERGLADES PILOTS' ASSOCIATION

Brian F. Hanley

Captain Brian F. Hanley
Co-Managing Pilot

BFH/be
cc: Port Everglades Association
File

N
W E
S
S.N. SHIP MANAGEMENT, INC.

TANKER AND BULK SPECIALISTS
CRUISE SHIP AGENTS

June 9, 1995

Department of the Army
Jacksonville District of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Attention: Planning Division, Environmental Coordination Section

Dear Sir:

Reference is made to the April 17, 1995, letter from A.J. Salem, Chief, Planning Division, Jacksonville District Corps of Engineers, regarding your request to the U.S. Environmental Protection Agency (EPA) to designate an Offshore Dredged Material Disposal Site offshore Port Everglades, Florida, for the disposal of dredged material from Port Everglades area. As the referenced letter states, the entrance channel and turning basin of Port Everglades must receive periodic maintenance dredging to ensure safe navigation.

Port Everglades is a major U.S. seaport, the second largest cruise port in the world, and the major petroleum port for South Florida. More than four thousand ships transit the Port's entrance channel each year. Clearly, safety of navigation at Port Everglades is of the highest importance, and maintenance dredging is an essential aspect of the port's continuing operations.

S.N. Ship Management, Inc., strongly supports your request to the EPA and the designation of an Offshore Dredged Material Disposal Site offshore Port Everglades.

Please feel free to contact us, should you have any questions about this matter.

Sincerely,

S.N. Ship Management, Inc.

Joseph G. Nochella
President

cc: Mr. Erik Hvide, President, Port Everglades Assoc., Inc., Fort Laud., FL

2170 S.E. 17th STREET • SUITE 204 • FORT LAUDERDALE, FLORIDA 33316
PHONE (305) 766-7880 • FAX (305) 766-7886 • TELEX 408934

MAR, INCORPORATED
Casting Off for Your Horizons
MAR

June 5, 1995

Department of the Army
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-0019

Attention: Planning Division, Environmental Coordination Section

Dear Sir:

Reference is made to the April 17, 1995, letter from A.J. Salem, Chief, Planning Division, Jacksonville District Corps of Engineers, regarding your request to the U.S. Environmental Protection Agency (EPA) to designate an Offshore Dredged Material Disposal Site offshore Port Everglades, Florida for the disposal of dredged material from the Port Everglades area. As the letter states, the entrance channel and turning basin of Port Everglades must receive periodic maintenance dredging to ensure safe navigation.

Port Everglades is a major U.S. seaport, the second largest cruise port in the world, and the major petroleum port for South Florida. More than four thousand ships transit the Port's entrance channel each year. Clearly, safety of navigation at Port Everglades is of the highest importance, and maintenance dredging is an essential aspect of the port's continuing operations.

MAR, Incorporated strongly supports your request to the EPA and the designation of an Offshore Dredged Material Disposal Site offshore Port Everglades.

Please feel free to contact me should you have any questions about this matter.

Sincerely,

MAR, Incorporated

Denise A. Leibmann

Denise A. Leibmann
Vice President/General Manager
MAR, Incorporated, Marine Division

cc: J. Erik Hvide

1800 ELLER DRIVE, SUITE 110 • P.O. BOX 350590 • FT. LAUDERDALE, FLORIDA 33335 • PHONE: 305-525-1379 • FAX: 305-462-3933

STATE OF FLORIDA
DEPARTMENT OF COMMUNITY AFFAIRS
"Helping Floridians create safe, vibrant, sustainable communities"

LAWTON CHILES
Governor

JAMES F. MURLEY
Secretary

December 1, 1997

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-3 1997
OFFICE OF
INTERGOVERNMENTAL PROGRAMS

Mr. Dennis R. Duke
Department of the Army
Jacksonville District Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

RE: Department of the Army - Scoping Letter - Information Gathering to Define Issues and Concerns that will be Addressed in an Environmental Impact Statement for the Designation of Ocean Dredged Material Disposal Sites for Palm Beach Harbor and Port Everglades Harbor - Florida
SAI: FL9709300724C

Dear Mr. Duke:

The Florida State Clearinghouse, pursuant to Presidential Executive Order 12372, Gubernatorial Executive Order 95-359, the Coastal Zone Management Act, 16 U.S.C. §§ 1451-1464, as amended, and the National Environmental Policy Act, 42 U.S.C. §§ 4321, 4331-4335, 4341-4347, as amended, has coordinated a review of the above-referenced project.

The Department of Environmental Protection (DEP) has identified a number of issues and concerns for consideration in the draft Environmental Impact Statement (EIS). The EIS should include complete descriptions of the disposal sites, including: bathymetry and other geophysical characteristics; sediment and water chemistry; biological communities; and physical oceanographic characteristics. The state requests that EPA and the Corps consult with the DEP on data needs, survey protocols, and review of preliminary survey results. The EIS should provide detailed historic and projected future disposal quantities, types and frequencies. Detailed dredged material dispersion modeling should project both short term sedimentation, mound formation and stability, and long term resuspension and redistribution. The EIS should include the terms and parameters that will be included in the Site Management and Monitoring Plans for these sites. These plans should also be developed in close consultation with the DEP and the Site Management and Monitoring Plan teams. The EIS should fully evaluate the need for an ocean disposal site, as opposed to alternative disposal options. The analysis should be based on an ecosystem protection and enhancement strategy rather than on a comparison of land costs versus barge disposal costs. A determination of consistency with the Florida Coastal Management Program should also be included. The DEP requests an advance copy of the preliminary draft EIS for informal review and comment prior to publication in the Federal Register. Please refer to the enclosed DEP comments.

The referenced scoping notice is not subject to consistency review; however, the notice is provided by the applicant to ensure that the state's comments and concerns are addressed in the draft and final EIS. The state appreciates the efforts. The applicant is also advised that based on our preliminary evaluation of the proposed action and the adoption of the recommendations provided by the DEP, at this stage, the state does not object to the project. Comments received from the South Florida and Treasure Coast Regional Planning Councils are also enclosed for your review.

Thank you for the opportunity to review the scoping notice. If you have any questions regarding this letter, please contact Ms. Cherie Trainor, Clearinghouse Coordinator, at (850) 922-5438.

Sincerely,

G. Steven Pfeiffer
Assistant Secretary

GSP/ct

Enclosures

cc: Liz Gulick, Treasure Coast Regional Planning Council
Eric Silva, South Florida Regional Planning Council
Lynn Griffin, Department of Environmental Protection

COUNTY: State

Message:

DATE: 09/30/97
COMMENTS DUE-2 WKS: 10/15/97
CLEARANCE DUE DATE: 11/14/97
SAI#: FL9709300724

STATE AGENCIES	WATER MANAGEMENT DISTRICTS	OPB POLICY UNITS
X Agriculture Community Affairs Environmental Protection Game and Fresh Water Fish Comm Marine Fisheries Commission OTED State Transportation	South Florida WMD	Environmental Policy/C & ED

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OCT 07 1997
State of Florida Clearinghouse

The attached document requires a Coastal Zone Management Act/Florida Coastal Management Program consistency evalutation and is categorized as one of the following:

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_X_ Direct Federal Activity (15 CFR 930, Subpart C). Federal Agencies are required to furnish a consistency determination for the State's concurrence or objection.

___ Outer Continental Shelf Exploration, Development or Production Activities (15 CFR 930, Subpart E). Operators are required to provide a consistency certification for state concurrence/objection.

___ Federal Licensing or Permitting Activity (15 CFR 930, Subpart D). Such projects will only be evaluated for consistency when there is not an analogous state license or permit.

Project Description:

Department of the Army - Scoping Letter - Information Gathering to Define Issues and Concerns that will be Addressed in an Environmental Impact Statement for the Designation of Ocean Dredged Material Disposal Sites for Palm Beach Harbor and Port Everglades Harbor - Florida.

To: Florida State Clearinghouse
Department of Community Affairs
2555 Shumard Oak Boulevard
Tallahassee, FL 32399-2100
(850) 922-5438 (SC 292-5438)
(904) 414-0479 (FAX)

EO. 12372/NEPA

- [x] No Comment
- [ ] Comments Attached
- [ ] Not Applicable

Federal Consistency

- [x] No Comment/Consistent
- [ ] Consistent/Comments Attached
- [ ] Inconsistent/Comments Attached
- [ ] Not Applicable

From:
Division/Bureau: FORESTRY / FRP+SS
Reviewer: Bob McDonald
Date: 10-6-97

Department of Environmental Protection

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

Lawton Chiles
Governor

Virginia B. Wetherell
Secretary

November 24, 1997

RECEIVED
NOV 26 1997
State of Florida Clearinghouse

Ms. Cherie Trainor, Director
Florida State Clearinghouse
Florida Department of Community Affairs
2555 Shumard Oak Boulevard
Tallahassee, Florida 32399-2100

Dear Ms. Trainor:

Re: Scoping Notice, Port Everglades and Palm Beach Ocean Dredged Material Disposal Sites (ODMDS) Designation, SAI No. FL 9709300724

The Corps of Engineers is proposing to draft an Environmental Impact Statement (EIS) to evaluate the designation of new dredged material disposal sites offshore of both Palm Beach and Port Everglades. The sites would be designated primarily to receive dredged material from federal port and channel projects at these locations. A scoping notice was previously coordinated on the proposed Port Everglades site. However, because of similar site conditions and the proximity of the two sites, the EIS will be expanded to cover both designations. The Department of Environmental Protection has coordinated a review of this proposed designation and has identified the following issues and concerns, which should be considered in the document.

Based on some surveys conducted in 1989, the Environmental Protection Agency (EPA) has identified preferred sites. The Port Everglades site is approximately 4 nmi offshore, 650-700 ft. deep. The Palm Beach site is approximately 4.5 nmi offshore, 525-625 ft. deep. In the near future, EPA will be conducting a literature search of available information on the offshore in this area, as well as conducting further geophysical and biological surveys of the preferred sites to supplement previous survey information. This is expected to include side scan sonar and biological grab sampling. Although there may be useful information from the site surveys conducted nine years ago, the age of this data warrants updating, especially with respect to chemical and biological characteristics.

To support the designations, the draft EIS should include complete descriptions of the sites, including: bathymetry and other geophysical characteristics; sediment and water chemistry; biological communities; and physical oceanographic characteristics. Surveys

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NOV 26 1997
State of Florida Clearinghouse

and sampling should be conducted throughout the site and the surrounding area at least . nmi beyond each site boundary. Because of the depths of these sites, significant benthic communities are not anticipated. However, the EIS should report any fisheries habitat or other important biological resource characteristics found at these depths. We request that EPA and the Corps consult with the Department on data needs, survey protocols, and to review preliminary survey results.

The EIS needs to provide detailed historical and projected future disposal quantities, types and frequencies. Sediment quality data and toxicity testing in accordance with accepted Green Book procedures should be provided for all reaches of channels and turning basins which are proposed for offshore disposal. The Department will not approve the offshore disposal of beach quality material.

As is the case at the Miami ODMDS, the primary issue of concern at these sites will be the potential for dredged material to transport to reefs and bottom habitat located downcurrent. Although the behavior of eddy currents at these sites may differ from the system off of Miami, the EIS should include detailed dredged material dispersion modeling to project both short term sedimentation, mound formation and stability, and long term resuspension and redistribution. Modeling projections and historical records should provide conclusive predictions of the fate of disposed material so that impact assessments and monitoring decisions are well-founded. We recommend a continuation of the consultation with NOAA-AOML and UM-RSMAS ongoing at the Miami site on matters pertaining to current conditions, hydrographic modeling and sediment transport.

The EIS should also include the terms and parameters to be included in the Site Management and Monitoring Plans for these sites. These plans should be developed in close consultation with the Department and Site Management and Monitoring Plan teams.

In addition to the above technical components needed for a complete EIS, the document should also address more fundamental issues. As a primary matter, the EIS should fully evaluate the need for an ocean disposal site as opposed to alternative disposal options. This analysis should be based on an ecosystem protection and enhancement strategy rather than a simplistic comparison of land costs versus barge disposal costs. For instance, reuse options (in addition to beach disposal) should be given full consideration so that beneficial uses for the material are sought rather than discarding the sediments as waste. In comparing options, true project costs should be computed which reflect the economic value of better environmental results, the economic value of lost or injured resources, and the true costs of ocean disposal. For example, the derivation of the cost figures for ocean disposal should include such costs as: ODMDS site surveys (both past and future); current studies and dispersion modeling; disposal monitoring, bathymetric surveys and other ODMDS site management plan compliance activities.

The draft EIS should include a determination of consistency with the Florida Coastal Management Program (FCMP). The determination should address all relevant statutory authorities administered by the Department currently included in the FCMP, particularly sections 161.142 and 161.161, F.S., which addresses the retention of beach quality material in the littoral system; section 370.025, F.S., which addresses the protection of marine resources; and Chapter 373, part IV, F.S., which addresses environmental resource permit requirements. The Department is available to assist EPA and the Corps with these determinations.

The Department requests to be provided with an advance copy of the preliminary draft EIS for these designations for informal review and comment prior to publication in the Federal Register. This opportunity will be invaluable in insuring that the official draft is published with most concerns resolved, thereby allowing a streamlined review of the draft and final EIS.

We appreciate the opportunity to comment on this notice. If there are any questions concerning this response, please contact me at 487-2231.

Cordially,

Susan Goggin

for Lynn Griffin
Environmental Administrator
Intergovernmental Programs

cc: Kirby Green
Paul Moses
Pam McVety
Deborah Parrish
Carlos Rivero deAguilar
Ed Conklin
Al Devereaux

COUNTY: State

Message:

DATE: 09/30/97
COMMENTS DUE-2 WKS: 10/15/97
CLEARANCE DUE DATE: 11/14/97
SAI#: FL970930072

STATE AGENCIES	WATER MANAGEMENT DISTRICTS	OPB POLICY UNITS
Agriculture Community Affairs Environmental Protection X Game and Fresh Water Fish Comm Marine Fisheries Commission OTED State Transportation	South Florida WMD	Environmental Policy/C & ED OCT 10 1997 OFFICE OF ENVIRONMENTAL SERVICES RECEIVED BY GFC OCT 1 1997 OFFICE OF ENVIRONMENTAL SERVICES

The attached document requires a Coastal Zone Management Act/Florida Coastal Management Program consistency evalutation and is categorized as one of the following:

___ Federal Assistance to State or Local Government (15 CFR 930, Subpart F). Agencies are required to evaluate the consistency of the activity.

_X_ Direct Federal Activity (15 CFR 930, Subpart C). Federal Agencies are required to furnish a consistency determination for the State's concurrence or objection.

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___ Federal Licensing or Permitting Activity (15 CFR 930, Subpart D). Such projects will only be evaluated for consistency when there is not an analogous state license or permit.

N/A SV

Project Description:

Department of the Army - Scoping Letter - Information Gathering to Define Issues and Concerns that will be Addressed in an Environmental Impact Statement for the Designation of Ocean Dredged Material Disposal Sites for Palm Beach Harbor and Port Everglades Harbor - Florida.

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OCT 14 1997

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State of Florida Clearinghouse

To: Florida State Clearinghouse
Department of Community Affairs
2555 Shumard Oak Boulevard
Tallahassee, FL 32399-2100
(850) 922-5438 (SC 292-5438)
(904) 414-0479 (FAX)

EO. 12372/NEPA

- [x] No Comment
- [ ] Comments Attached
- [ ] Not Applicable

Federal Consistency

- [ ] No Comment/Consistent
- [ ] Consistent/Comments Attached
- [ ] Inconsistent/Comments Attached
- [ ] Not Applicable

From:
Division/Bureau: OES - GFC - Vero Beach
Reviewer: Stephen R. Lau, Fish Biologist
Date: October 7, 1997

COUNTY: State

Message:

DATE: 09/30/97
COMMENTS DUE-2 WKS: 10/15/97
CLEARANCE DUE DATE: 11/14/97
SAI#: FL970930072

STATE AGENCIES	WATER MANAGEMENT DISTRICTS	OPB POLICY UNITS
Agriculture Community Affairs Environmental Protection Game and Fresh Water Fish Comm X Marine Fisheries Commission OTED State Transportation RECEIVED OCT 0 1 1997 MARINE FISHERIES COMMISSION	South Florida WMD RECEIVED OCT 07 1997 State of Florida Clearinghouse	Environmental Policy/C & ED

The attached document requires a Coastal Zone Management Act/Florida Coastal Management Program consistency evalutation and is categorized as one of the following:

___ Federal Assistance to State or Local Government (15 CFR 930, Subpart F). Agencies are required to evaluate the consistency of the activity.

_X_ Direct Federal Activity (15 CFR 930, Subpart C). Federal Agencies are required to furnish a consistency determination for the State's concurrence or objection.

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___ Federal Licensing or Permitting Activity (15 CFR 930, Subpart D). Such projects will only be evaluated for consistency when there is not an analogous state license or permit.

Project Description:

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- [ ] Not Applicable

Federal Consistency

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- [ ] Consistent/Comments Attached
- [ ] Inconsistent/Comments Attached
- [ ] Not Applicable

From:
Division/Bureau: ______________________
Reviewer: [signature]
Date: 10/6/97

COUNTY: State

Message:

DATE: 09/30/97
COMMENTS DUE-2 WKS: 10/15/97
CLEARANCE DUE DATE: 11/14/97
SAI#: FL970930072[illegible]

STATE AGENCIES	WATER MANAGEMENT DISTRICTS	OPB POLICY UNITS
Agriculture Community Affairs Environmental Protection Game and Fresh Water Fish Comm Marine Fisheries Commission X OTED State Transportation	South Florida WMD	Environmental Policy/C & ED

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OCT 09 1997
State of Florida Clearinghouse

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Project Description:

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Federal Consistency

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- [ ] Consistent/Comments Attached
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- [ ] Not Applicable

From:
Division/Bureau: OTTED
Reviewer: M Blakeslee
Date: 10/6/97

COUNTY: State

Message:

DATE: 09/30/97
COMMENTS DUE-2 WKS: 10/15/97
CLEARANCE DUE DATE: 11/14/97
SAI#: FL9709300724(

STATE AGENCIES	WATER MANAGEMENT DISTRICTS	OPB POLICY UNITS
Agriculture Community Affairs Environmental Protection Game and Fresh Water Fish Comm Marine Fisheries Commission OTED X State Transportation	South Florida WMD EIS-WAIT	Environmental Policy/C & ED ALLFLA SAI-CORPS 975239

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Project Description:

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To: **Florida State Clearinghouse**
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- [ ] Comments Attached
- [ ] Not Applicable

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- [ ] Consistent/Comments Attached
- [ ] Inconsistent/Comments Attached
- [ ] Not Applicable

From:
Division/Bureau: Historical Resources
Reviewer: [signature] Laura A. Kammerer
Date: 10/21/97 10-21-97

FLORIDA DEPARTMENT OF TRANSPORTATIO

LAWTON CHILES
GOVERNOR

605 Suwannee Street, Tallahassee, Florida 32399-0450

THOMAS F. BARRY,
SECRETARY

RECEIVED
OCT 15 1997
State of Florida Clearinghouse

M E M O R A N D U M

Date: October 14, 1997

To: State Clearinghouse

From: Robert G. Hebert, Jr.
Administrator-Ports/Intermodal
Florida Department of Transportation
SC 278-5704 FAX SC 277-3403

Copies: FDOT ICAR Coordinator w/att., Public Transportation Manager-District 4, Florida Coastal Management Director (DCA), File

Subject: ICAR Federal Consistency Project Review Process
Port Everglades-Ocean Dredged Material Disposal Sites
SAI# FL9709300724C

In accordance with departmental procedure 525-010-205, and State Clearinghouse requirements for review and comment on potential federal projects that may affect state programs and objectives, please be advised that the above-referenced proposed study or project:

___ Does influence and impose a potential impact on existing state programs or objectives under Rail Office jurisdiction to the extent noted in the following comments:

X Does not influence or impose a potential impact on existing state programs or objectives under Rail Office jurisdiction at this time, and no comments or recommendations are required.

Should further information or explanation be required, please feel free to contact the Rail Office at (850) 414-4500.

RGH/
Attachment

COUNTY: State

Message:

DATE: 09/30/97
COMMENTS DUE-2 WKS: 10/15/97
CLEARANCE DUE DATE: 11/14/97
SAI#: FL970930072

STATE AGENCIES	WATER MANAGEMENT DISTRICTS	OPB POLICY UNITS
Agriculture Community Affairs Environmental Protection Game and Fresh Water Fish Comm Marine Fisheries Commission OTED State X Transportation	South Florida WMD RECEIVED OCT 15 1997 State of Florida Clearinghouse	Environmental Policy/C & ED

The attached document requires a Coastal Zone Management Act/Florida Coastal Management Program consistency evalutation and is categorized as one of the following:

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Project Description:

Department of the Army - Scoping Letter - Information Gathering to Define Issues and Concerns that will be Addressed in an Environmental Impact Statement for the Designation of Ocean Dredged Material Disposal Sites for Palm Beach Harbor and Port Everglades Harbor - Florida.

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EO. 12372/NEPA

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- [ ] Comments Attached
- [ ] Not Applicable

Federal Consistency

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- [ ] Consistent/Comments Attached
- [ ] Inconsistent/Comments Attached
- [ ] Not Applicable

From:
Division/Bureau: FDOT RAIL OFFICE
Reviewer: [signature], ADMINISTRATOR - PORTS / INTERMODAL
Date: 10/14/97

OCT- 9-97 THU 1:05 PM SO[illegible] FL WATER MGMT DIST FAX NO. 56[illegible] 87 6896

COUNTY: State

DATE:	09 97
COMMENTS DUE-2 WKS:	10 97
CLEARANCE DUE DATE:	11 97
SAI#:	FL[illegible] 300724C

Message:

STATE AGENCIES	WATER MANAGEMENT DISTRICTS	OPB POLICY UNITS
Agriculture Community Affairs Environmental Protection Game and Fresh Water Fish Comm Marine Fisheries Commission OTED State Transportation	X South Florida WMD	Environmental Policy/C & E[illegible]

RECEIVED
OCT 09 1997
State of Florida Clearinghouse

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Project Description:

Department of the Army - Scoping [illegible] Information Gathering to Define Iss[illegible] [illegible] Concerns that will be Addressed in Environmental Impact Statement fo[illegible] Designation of Ocean Dredged Mat[illegible] Disposal Sites for Palm Beach Harbor and [illegible] [illegible] Harbor - Florida.

To: Florida State Clearinghouse
Department of Community Affairs
2555 Shumard Oak Boulevard
Tallahassee, FL 32399-2100
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- [ ] No Comment
- [ ] Comments Attached
- [x] Not Applicable

Federal Consistency

- [ ] No Comment/Consist[illegible]
- [ ] Consistent/Comments [illegible]hed
- [ ] Inconsistent/Comment[illegible] [illegible]ached
- [x] Not Applicable

UNDER THE OPERATING AGREEMENT BETWEEN FDEP AND [illegible] WMDs, FDEP WILL BE TAKING THE LEAD IN THE REV[illegible] OF THIS PROJECT.

From:

Division/Bureau: REGULATION DEPT.

Reviewer: JIM GOLDEN

Date: 10/8/97

COUNTY: State

Message:

DATE: 09/30/97
COMMENTS DUE-2 WKS: 10/15/97
CLEARANCE DUE DATE: 11/14/97
SAI#: FL9709300724

STATE AGENCIES	WATER MANAGEMENT DISTRICTS	OPB POLICY UNITS
Agriculture Community Affairs Environmental Protection Game and Fresh Water Fish Comm Marine Fisheries Commission OTED State Transportation	South Florida WMD	X Environmental Policy/C & ED RECEIVED OCT 1 1997 OFFICE OF PLANNING & BUDGETING ENVIRONMENTAL POLICY UNIT

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Project Description:

Department of the Army - Scoping Letter - Information Gathering to Define Issues and Concerns that will be Addressed in an Environmental Impact Statement for the Designation of Ocean Dredged Material Disposal Sites for Palm Beach Harbor and Port Everglades Harbor - Florida.

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☐ No Comment
☐ Comments Attached
☐ Not Applicable

Federal Consistency

☐ No Comment/Consistent
☐ Consistent/Comments Attached
☐ Inconsistent/Comments Attached
☐ Not Applicable

10-2-97
Kara, please send draft letter to us for review. Thank you Celia

From:
Division/Bureau: ______
Reviewer: ______
Date: ______

South
Florida
Regional
Planning
Council

RECEIVED
OCT 30 1997
State of Florida Clearinghouse

October 28, 1997

Ms. Keri Akers
Florida State Clearinghouse
Department of Community Affairs
2555 Shumard Oak Boulevard
Tallahassee, FL 32399-2100

RE: SFRPC #97-1003, SAI #FL9709300724C - Response to a request for comments on a scoping letter to define issues and concerns to be addressed by an Environmental Impact Statement for ocean dredge disposal sites at Palm Beach Harbor and Port Everglades Harbor, U.S. Army Corps of Engineers, Palm Beach and Broward Counties.

Dear Ms. Akers:

We have reviewed the above-referenced project and have the following comments:

- Council staff is concerned about the cumulative impacts of this and similar projects. Staff analysis indicates that the proposed project may adversely impact benthic resources, designated as natural resources of regional significance in the *Strategic Regional Policy Plan for South Florida*. The South Florida ecosystem is sensitive and is subject to significant growth pressures. While this project may have little effect on the system by itself, the cumulative impacts on the water quality and ecological integrity of the region are of concern to Council staff and need to be considered with all projects. The project should be consistent with the goals and policies of the Broward County comprehensive plan.

- Staff recommends that, if this permit is granted, 1) impacts to the natural systems be minimized to the greatest extent feasible and 2) the permit grantor determine the extent of sensitive marine life and vegetative communities in the vicinity of the project and require protection and or mitigation of disturbed habitat. This will assist in reducing the cumulative impacts to native plants and animals, fisheries and deep-water habitat that the goals and policies of the *Strategic Regional Policy Plan for South Florida* seek to protect.

- The goals and policies of the *Strategic Regional Policy Plan for South Florida*, in particular those indicated below, should be observed when making decisions regarding this project.

Strategic Regional Goal

3.8 Enhance and preserve natural system values of South Florida's shorelines, estuaries, benthic communities, fisheries, and associated habitats, including but not limited to, Florida Bay, Biscayne Bay and the coral reef tract.

Regional Policies

3.8.1 Enhance and preserve natural shoreline characteristics through requirements resulting from the review of proposed projects and in the implementation of ICE, including but not limited

3440 Hollywood Boulevard, Suite 140, Hollywood, Florida 33021
Broward (954) 985-4416, Area Codes 305, 407 and 561 (800) 985-4416
SunCom 473-4416, FAX (954) 985-4417, SunCom FAX 473-4417
e-mail sfadmin@sfrpc.com

to, mangroves, beaches and dunes through prohibition of structural shoreline stabilization methods except to protect existing navigation channels, maintain reasonable riparian access, or allow an activity in the public interest as determined by applicable state and federal permitting criteria.

3.8.2 Enhance and preserve benthic communities, including but not limited to seagrass and shellfish beds, and coral habitats, by allowing only that dredge and fill activity, artificial shading of habitat areas, or destruction from boats that is the least amount practicable, and by encouraging permanent mooring facilities. Dredge and fill activities may occur on submerged lands in the Florida Keys only as permitted by the Monroe County Land Development Regulations. It must be demonstrated pursuant to the review of the proposed project features that the activities included in the proposed project do not cause permanent, adverse natural system impacts.

3.8.5 Enhance and preserve habitat for endangered and threatened marine species by the preservation of identified endangered species habitat and populations. For threatened species or species of critical concern, on-site preservation will be required unless it is demonstrated that off-site mitigation will not adversely impact the viability or number of individuals of the species.

Thank you for the opportunity to comment. We would appreciate being kept informed on the progress of this project. Please do not hesitate to call if you have any questions or comments.

Sincerely,

Eric Silva
Regional Planner

ES/cp

cc: Cynthia Chambers, Broward County SPGM

FLORIDA STATE CLEARINGHOUSE
RPC INTERGOVERNMENTAL COORDINATION AND RESPONSE SHEET

SAI #: FL9709300724C **DATE:** 09/30/97

COMMENTS DUE TO CLEARINGHOUSE: 10/30/97

AREA OF PROPOSED ACTIVITY: COUNTY: State

☐ FEDERAL ASSISTANCE ☒ DIRECT FEDERAL ACTIVITY ☐ FEDERAL LICENSE OR PERMIT ☐ OCS

PROJECT DESCRIPTION

Department of the Army - Scoping Letter - Information Gathering to Define Issues and Concerns that will be Addressed in an Environmental Impact Statement for the Designation of Ocean Dredged Material Disposal Sites for Palm Beach Harbor and Port Everglades Harbor - Florida.

ROUTING: **RPC**

X Treasure Coast RPC
South FL RPC

RECEIVED
OCT 02 1997
TREASURE COAST REGIONAL PLANNING COUNCIL

PLEASE CHECK ALL THE LOCAL GOVERNMENTS BELOW FROM WHICH COMMENTS HAVE BEEN RECEIVED; ALL COMMENTS RECEIVED SHOULD BE INCLUDED IN THE RPC'S CLEARINGHOUSE RESPONSE PACKAGE. IF NO COMMENTS WERE RECEIVED, PLEASE CHECK "NO COMMENT" BOX AND RETURN TO CLEARINGHOUSE.

COMMENTS DUE TO RPC: 10/21/97

NO COMMENTS: _____

(IF THE RPC DOES NOT RECEIVE COMMENTS BY THE DEADLINE DATE, THE RPC SHOULD CONTACT THE LOCAL GOVERNMENT TO DETERMINE THE STATUS OF THE PROJECT REVIEW PRIOR TO FORWARDING THE RESPONSE PACKAGE TO THE CLEARINGHOUSE.)

NOTES:

ALL CONCERNS OR COMMENTS REGARDING THE ATTACHED PROJECT (INCLUDING ANY RPC COMMENTS) SHOULD BE SENT IN WRITING BY THE DUE DATE TO THE CLEARINGHOUSE. PLEASE ATTACH THIS RESPONSE FORM AND REFER TO THE SAI # IN ALL CORESPONDENCE.

IF YOU HAVE ANY QUESTIONS REGARDING THE ATTACHED PROJECT, PLEASE CONTACT THE STATE CLEARINGHOUSE AT (904) 922-5438 OR SUNCOM 272-5438.

DRAFT

TREASURE COAST REGIONAL PLANNING COUNCIL
INTERGOVERNMENTAL COORDINATION AND REVIEW LOG

TCRPC NUMBER: 97-PB-10-03 (SAI #FL9709300724C)

APPLICANT: United States Army Corps of Engineers

PROJECT DESCRIPTION: Palm Beach & Port Everglades Harbor

The U.S. Army Corps of Engineers, Jacksonville District (Corps), in cooperation with the U.S. Environmental Protection Agency (EPA) Region IV, is gathering information to define issues and concerns that will be addressed in an Environmental Impact Statement (EIS) for the designation of Ocean Dredged Material Disposal Sites (ODMDS) for Palm Beach Harbor and Port Everglades Harbor. The designation process for the two sites was originally to be done separately, but because of the great similarity between the sites, the decision was made to prepare a single EIS covering both.

The areas that are being investigated lie between approximately three and ten nautical miles offshore of Palm Beach Harbor in the Atlantic Ocean.

An upland disposal site study conducted by the Corps in 1994 initially considered 122 potential upland sites. Environmental and economic considerations eliminated all but 12 of these sites. However, these 12 sites still exceed the cost of using an ODMDS, but could be considered for disposal if the material proves unsuitable for ocean disposal.

FUNDING AGENCY: No funding requested

RECOMMENDATIONS: The disposal of dredged material in offshore locations is not considered inconsistent with the SRPP. However, offshore disposal should not result in negative impacts on sensitive natural resources, consistent with **Regional Goal 6.4.** Special concerns should be paid to impacts on coral and worm reef communities consistent with **SRPP Policy 6.4.2.1.**

AGENCIES CONTACTED: City of West Palm Beach
City of Riviera Beach

Town of Palm Beach Shores
Palm Beach County
Port of Palm Beach

GEORGE R. FROST
REGISTERED PROFESSIONAL ENGINEER
POST OFFICE BOX 2675
PALM BEACH, FLORIDA 33480

U.S. Environmental Protection Agency
Region Four
61 Forsyth Street
~~Atlanta, GA 30303~~

1 August 1997

97 AUG -4 PM 3:00

RECEIVED

CERTIFIED RRR

Attn: Mr. Christopher McArthur

Re: Environmental Impact Statement
Ocean Dredge Material Disposal Site
Offshore Palm Beach Harbor, Florida

COPY

Gentlepersons:

As one who has been a continuously and intensely involved observer of the monumental and insidious decimation of our littoral zone by the Corps of Engineers, U. S. Army, I am deeply concerned (enraged would be a more accurate term) over the proposal to establish a permanent offshore disposal area for material that has heretofore has been replaced in the surf zone.

Like many others who have lived or worked near or at the beaches of Florida for well over half a century, I have deep concerns for the demonstrated sorry stewardship of the Corps toward our beaches; if the enforcement conditions on dumping are not airtight, we will reap the results of the dereliction of the "Engineers" once again.

As a matter of history, I, along with Governor Claude Kirk and Senator Jerry Thomas, caused ocean dumping to be halted in the 1970's; I was again involved in a similar effort during the 1979 - 83 period when the interim disposal area was used inappropriately.

I believe that it is imperative that a Scoping Meeting be held on this matter.

THANK YOU ! ! ! We will look forward to meeting you on this subject.

Sincerely,

George Frost

epabeach.087 file corr 6.1

XC: Mayor of Palm Beach & Regional Administrator, EPA

GERALD M. WARD, P.E.
Consulting Engineer
Coastal - Environmental
P.O. Box 10441
Riviera Beach, Florida 33419

Office Location:
Suite 202
31 W 20th Street
Telephones:
561/863-1215
561/863-1216 FAX
E-Mail:
wardgm@gate.net

30 June 1997

US Environmental Protection Agency
Region 4
61 Forsyth Street
Atlanta, Georgia 30303

Attn: Christopher McArthur

Re: Environmental Impact Statement
Ocean Dredge Material Disposal Site
Offshore Palm Beach Harbor, Florida

Gentlemen:

I have your notice of 27 June 1997 in the Federal Register, page 34747. I wish to be placed upon the Project Mailing List, however, in the mean time I dispute your decision not to hold a Scoping Meeting. The utilization of offshore disposal at various times over the past fifty years for the convenience of the Corps of Engineers in relation to Palm Beach Harbor has been the direct cause of millions of dollars of needless government and private expenditures. The last period of extensive offshore disposals about 1979-1983 was clearly tied to major destruction on Palm Beach Island.

In addition, the Jacksonville District is conjuring up future projects besides Palm Beach Harbor (one FIND project to be discussed with Jacksonville District staff 8 July 1997 in West Palm Beach) utilizing offshore disposal.

A Scoping Meeting in Palm Beach County is clearly needed for you to understand the serious problems inherent in further designation of an Ocean Dredge Material Disposal Site Offshore Palm Beach Harbor.

Please advise within 30 days the resolve of my request for a Scoping Meeting.

Very truly yours,

Gerald M. Ward, P.E.
Consulting Engineer

9703EPA1

cc: EPA Region 4, Agency Clerk
Florida Inland Navigation District
FDEP Bureau of Beaches & Coastal Systems Bureau Chief
George Frost, P.E.

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

September 26, 1997

REPLY TO
ATTENTION OF

Planning Division
Environmental Branch

TO WHOM IT MAY CONCERN:

The U.S. Army Corps of Engineers, Jacksonville District (Corps), in cooperation with the U.S. Environmental Protection Agency (EPA) Region IV, is gathering information to define issues and concerns that will be addressed in an Environmental Impact Statement (EIS) for the designation of Ocean Dredged Material Disposal Sites (ODMDS) for Palm Beach Harbor and Port Everglades Harbor. The designation process for the two sites was originally to be done separately, but because of the great similarity between the sites, the decision was made to prepare a single EIS covering both. In June 1996, a letter describing the proposed Port Everglades effort was coordinated with appropriate Federal, State and local agencies and other interested parties and will not be covered further in this letter.

The areas that are being investigated lie between approximately three and ten nautical miles offshore of Palm Beach Harbor in the Atlantic Ocean. The coordinates, depths and distance from shore of each are shown on the enclosed table 1.

An upland disposal site study conducted by the Corps in 1994 initially considered 122 potential upland sites. Environmental and economic considerations eliminated all but 12 of these sites. However, these 12 sites still exceed the cost of using an ODMDS, but could be considered for disposal if the material proves unsuitable for ocean disposal.

The Corps welcomes your views, comments and any information about resources, study objectives and important features within the study area, as well as any suggested improvements. Letters of comment or inquiry should be addressed to the letterhead address to the attention of Planning Division, Environmental Studies Section and received by this office within thirty (30) days of receipt of this letter.

Sincerely,

Dennis R. Duke
Acting Chief, Planning Division

Enclosure

Table 1. Coordinates, ..ater depths and distance from sho.. of the four considered Ocean Dredged Material Disposal Sites for Palm Beach Harbor.

Candidate Site	Corner Coordinates	Depth Ranges	Distance of Center from Shore
Historic Interim Site	26°46.00'N 79°58.92'W 26°46.00'N 79°57.78'W 26°45.00'N 79°57.78'W 26°45.00'N 79°58.92'W	130m to 160m 425ft to 525ft	3.4 nmi
Three Mile Site	26°46.00'N 79°58.25'W 26°46.00'N 79°56.03'W 26°48.00'N 79°58.25'W 26°48.00'N 79°56.03'W	125m to 190m 410ft to 625ft	4.3nmi
Four and Half Mile Site (Preferred Site)	26°47.50'N 79°57.15'W 26°47.50'N 79°56.03'W 26°46.50'N 79°57.15'W 26°46.50'N 79°56.03'W	160m to 190m 525ft to 625ft	4.8nmi
Nine Mile 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	260m to 300m 855ft to 985ft	9.0nmi

The alternative to selecting a site is no action, being defined as not designating an ocean disposal site.

Appendix B

PUBLIC COMMENTS

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
OFFICE OF OCEAN AND COASTAL RESOURCE MANAGEMENT
Silver Spring, Maryland 20910

U.S. EPA, Region 4
ATTN: Wesley B. Crum, Chief
Coastal Section
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW
Atlanta, Georgia 30303

RE: Draft 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

Dear Mr. Crum:

The Office of Ocean and Coastal Resource Management (OCRM) has the following comments on the above mentioned Draft Environmental Impact Statement (DEIS):

Page 103: The correct title of our office is Office of Ocean and Coastal Resource Management

Appendix L: Federal Consistency Evaluation Procedure:

- NOAA regulations require that a consistency determination include a detailed description of the proposed activity, its expected effects on the coastal zone and an evaluation of the activity in light of the applicable enforceable policies of the state coastal management program. The requirements for a consistency determination are set forth in NOAA regulations at 15 C.F.R. part 930, subpart C.

- The content of a consistency determination is located at 15 C.F.R. § 930.39. The definition of coastal effects is located at 15 C.F.R. § 930.11(e). OCRM notes that the application of "coastal effects" in Appendix L may be incomplete for Florida Statutes: Chapters 253 and 258. While the disposal sites are not within state waters, if use of the disposal sites and/or the disposal materials would have reasonably foreseeable effects on the state's submerged lands, then the U.S. EPA must be consistent to the maximum extent practicable with the enforceable policies of Chapters 253 and 258 and those policies should be evaluated for consistency.

The U.S. EPA should fully apply the Coastal Zone Management Act federal consistency 'effects test', as noted above, and consult with the Florida Coastal Management Program on whether the consistency determination is complete. The OCRM is available to provide any assistance you may need. Please feel free to contact Laurie Rounds of my staff at 301-713-3155 ext. 228.

Sincerely,

John King, Chief
Coastal Programs Division

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
9721 Executive Center Dr. N.
St. Petersburg, FL 33702
(727) 570-5312, FAX 570-5517
http://caldera.sero.nmfs.gov

MAY 24 2004

F/SER3:JCL

Mr. James D. Giattina
United States Environmental Protection Agency
Region 4
Atlanta Federal Center
61 Forsyth Street
Atlanta, GA 30303-8960

Dear Mr. Giattina:

This letter is in reference to your letter dated March 24, 2004, requesting section 7 consultation with the National Marine Fisheries Service (NOAA Fisheries), pursuant to the Endangered Species Act of 1973 (ESA). The proposed action is the designation of the Palm Beach Harbor Ocean Dredged Material Disposal Site (ODMDS) and the Port Everglades Harbor ODMDS. For Palm Beach Harbor, the project area is a one square mile ODMDS located 4.5 nautical miles (nm) offshore Palm Beach, Florida. For Port Everglades Harbor, the project area is a one square mile ODMDS located four nm offshore Fort Lauderdale, 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 NOAA Fisheries' Protected Resources Division has reviewed the Environmental Impact Statement (EIS) and Biological Assessment (BA) submitted by the Environmental Protection Agency (EPA), with respect to possible effects on the species listed and the critical habitat designated under the ESA under the purview of NOAA Fisheries.

The project includes the following activities:

- Approximately 50,000 cubic yards of dredged material annually may be placed at each site.
- Clamshell/barge dredging will be utilized for Palm Beach Harbor.
- Hopper dredging will be utilized for Port Everglades Harbor.
- Disposal of dredged material at the proposed sites will be conducted using a near-instantaneous dumping type barge or scow.

Of the ESA-listed species under the purview of NOAA Fisheries, five species of sea turtles including the loggerhead (*Caretta caretta*), green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*), and Kemp's ridley (*Lepidochelys kempii*) are known to occur in the southeast Atlantic and may occur in the action area. Previous NOAA Fisheries' biological opinions issued to the U.S. Army Corps of Engineers in 1991, 1995, 1997, and 2003 have documented that non-hopper type dredges operating in the South Atlantic and Gulf of Mexico are unlikely to adversely affect sea turtles since it is believed that turtles are able to avoid these slower moving dredges. On April 22, 2004, NOAA Fisheries consulted on the routine maintenance dredging of the Port Everglades Federal Navigation Project and concluded that no adverse effects to listed species are expected. NOAA Fisheries believes hopper dredging at Port Everglades Harbor falls is within the scope of the general type of hopper dredging activities proposed, described, and analyzed in the September 25, 1997, Regional Biological Opinion (RBO) to the Corp of Engineers' South Atlantic Division which amended the regional opinion conducted in 1995, and superseded the interim biological opinion issued on April 9, 1997.

Six federally-protected species of whales (blue, *Balaenoptera musculus*; finback, *Balaenoptera physalus*; humpback, *Magaptera novaeangliae;* right, *Eubalaena glacialis*; sei, *Balaenoptera borealis;* and sperm, *Physeter macrocephalus*) are found in the southeast Atlantic, usually off the continental shelf edge in deeper waters. The right whale has been documented to occur within 20 nm of the U.S. coastline 80 percent of the time. It has been reported that the greatest threats to the right whale are ship strikes and fishing interactions. The use of dredges and the disposal of dredged material using a near-instantaneous dumping type barge or scow have not been shown to adversely affect whales, although the RBO requires dredges to maintain a lookout for right whales and carefully avoid them, and reduce speed in limited visibility. During the recently completed Brunswick Harbor Dredging project, onboard observers detected and avoided right whales on numerous occasions when the dredge was operating or in transit to the Brunswick site. Therefore, NOAA Fisheries believes adverse effects to whales are unlikely to occur from the project.

NOAA Fisheries believes the effects of the proposed activity are entirely comparable to the effects of similar activities which have been previously analyzed by the RBO and no new effects of the proposed activity to turtles or whales beyond those effects previously analyzed by the RBO are expected. Thus, takes in association with the use of hopper dredges from the proposed activity have been previously anticipated in the RBO and shall be charged to the annual incidental take statement (ITS) established in the RBO. All terms and conditions of the reasonable and prudent measures of the ITS of the RBO must be adhered to by the applicant during the implementation of the proposed activity. Only incidental takes which occur while these measures are in full implementation are authorized.

The endangered shortnose sturgeon (*Acipenser brevirostrum*) is managed jointly by NOAA Fisheries and the U.S. Fish and Wildlife Service and may occur off Florida. The smalltooth sawfish *(Pristis pectinata)* may also occur off Florida. However, the occurrence of shortnose sturgeon or smalltooth sawfish has not been documented within the vicinity of the action area for this project. Therefore, since there is no evidence suggesting shortnose sturgeon or smalltooth sawfish occur within the action area, and because these species are highly mobile and likely are to move away from the area during the dredging activities if they happened to be present, we believe no effects to the shortnose sturgeon or smalltooth sawfish are likely to occur from the project.

You are also reminded that, in addition to your protected species/critical habitat consultation requirements with NOAA Fisheries' Protected Resources Division pursuant to section 7 of the ESA, prior to proceeding with the proposed action you must also consult with NOAA Fisheries'

Habitat Conservation Division pursuant to the Magnuson-Stevens Fishery Conservation and Management Act's requirements for essential fish habitat (EFH) consultation (16 U.S.C. 1855 (b)(2) and 50 CFR 600.905-.930, subpart K).

We look forward to continued cooperation with EPA in conserving our endangered and threatened resources. If you have any questions about EFH consultation for this project, please contact Ms. Jocelyn Karazsia, at (305) 595-8352. If you have any questions regarding this ESA consultation, please contact Mr. Juan Levesque, fishery biologist, at (727) 570-5779, or by e-mail at Juan.Levesque@noaa.gov.

Sincerely yours,

David Bernhart
Regional Administrator
for Protected Resources

cc: F/SER43 - J. Karazsia, HCD

Ref: I/SER/2004/00415

File: 1514-22.K.1.EPA FL

Bo Crum
Sent by: Bo Crum

05/11/2004 08:00 AM

To: Christopher McArthur/R4/USEPA/US@EPA
cc:
Subject: Offshore dumping EIS

Wesley B. Crum, Chief
Coastal Section
WMD, USEPA, Region 4
61 Forsyth Street
Atlanta, GA 30303
404-562-9352,FAX 9343
crum.bo@epa.gov
----- Forwarded by Bo Crum/R4/USEPA/US on 05/11/2004 08:00 AM -----

Janet Phipps <JPHIPPS@co.palm-beach.fl.us>

05/10/2004 04:56 PM

To: Bo Crum/R4/USEPA/US@EPA
cc:
Subject: Offshore dumping EIS

Mr. Crum,
Attached is a draft of our comments concerning the harbor material offshore dumping DEIS. A hard copy will follow.
Thank you,
Janet Phipps

Janet J. Phipps, Ph.D.
Environmental Analyst
Environmental Resources Management
3323 Belvedere Rd., Bldg. 502
West Palm Beach, FL 33406
Tel: 561/233-2513
Fax: 561/233-2414

EPA offshore dumping DEIS.dc

The following comments are in reference to the Draft Environmental Impact Statement (DEIS) for the Port Everglades Harbor Ocean Dredge Material Disposal Site (ODMDS) dated February 2004.

Roughly nine years ago when the study for the ODMDS began, there were approximately 4500 ship arrivals per year at Port Everglades. Now there are well over 6000. Not only are there almost 35% more ship arrivals, the ships that are arriving are significantly larger. Both the number and size of the ships calling at Port Everglades are anticipated to increase steadily into the future.

In order to accommodate this growth, the port has a desperate need to dredge new channels and berth spaces as well as deepen and widen existing ones. The current channel is operating near capacity. There are no feasible onshore disposal sites for this dredge material. The offshore site is essential.

The study indicated that the location chosen for disposal of dredged material will not adversely effect the environment, recreational boating or commercial shipping. It also indicated that no beach quality material is to be placed in the offshore site. Broward County has a tremendous need for beach quality material in its continuous beach re-nourishment projects. Any beach quality material dredged from Port Everglades will be welcomed additions to the beaches of Broward County. This will actually reduce the need for the removal of sand between the reef systems, thus leaving these valuable resources undisturbed.

The need to provide and maintain safe navigational conditions for the ships calling at Port Everglades is of paramount importance. The rapid growth of South Florida and the previously mentioned growth of the port make this essential. The future growth of South Florida is dependent on it.

Given the level of need for the offshore disposal site and the lack of any adverse impacts of it, there is no reason to delay and every reason to move forward in the designation of the proposed Port Everglades ODMDS.

Please feel free to contact me if you have any questions or if I may be of any further assistance in obtaining the required approvals.

Sincerely,

Captain James J. Ryan
Managing Pilot
Port Everglades Pilots Association
jimryan@pepilots.com
PO Box 13017
Fort Lauderdale, FL 33316
tel: (954) 522-4491
fax: (954) 522-4498

BROWARD COUNTY
FLORIDA
DEPARTMENT OF PORT EVERGLADES - Construction Management & Planning Division
1850 Eller Drive • Fort Lauderdale, Florida, USA 33316 • 954-523-3404 • FAX 954-765-5389

May 4, 2004

Chief Wesley B. Crum
U.S. EPA, Region 4
Coastal Section
Sam Nunn Atlanta Federal Center
61 Forsyth Street, S.W.
Atlanta, GA 30303

Re: **Review and Comments for Port Everglades' Draft Environmental Impact Statement (EIS) for Its Ocean Dredge Material Disposal Site (ODMDS)**

Dear Mr. Crum:

Port staff has reviewed the referenced document and offers the following comments related to the Draft Environmental Impact Statement.

Much has changed at Port Everglades during the nine years that have transpired from the initial Public Notice of April 17, 1995. Time has made it more important to the Port for the designation of an Ocean Dredged Material Disposal Site (ODMDS). Our Southport disposal capabilities have decreased substantially over time due to the developments of the Port's Southport Container Facility. In the past, this area was utilized as a disposal area for both construction and maintenance dredged materials.

It is very important to the Port to be able to dispose of materials related to maintenance and construction activities. In order for the Port to maintain a safe and navigable harbor, it is of the utmost importance for us to be able to dispose of dredged material. As we undergo expansion, the only avenue for this material to be disposed of will be to an offshore disposal facility. Of the two areas under study, the Port prefers the site nearer to shore be selected. Both time and costs will be greatly reduced if the near shore is designated.

Both the COE and Port have always considered dredged material as a valued resource. As such, we look to deposit usable beach quality material on the adjacent beaches surrounding our Port.

Again, we like to thank you for this opportunity to comment on the DEIS and look forward to having this site designated as soon as possible so that we can continue to maintain a safe and navigable Port.

Sincerely,

Allan D. Sosnow

Allan D. Sosnow
Environmental Projects Manager
Construction Management and Planning Division

ADS:keb

FILE: G:\ARCHIVE\ALLAN\ODMDS REVIEW_CRUM.DOC

CROWLEY
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May 11, 2004

U.S. EPA, Region 4
ATTN: Wesley B. Crum, Chief
Coastal Section
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW
Atlanta, Georgia 30303

Dear Chief Crum:

In the nine years since we received public notice for the study of an off shore dredge material site, Port Everglades has grown tremendously.

It has limited area to dispose of dredge material either from maintenance or construction activities.

Port Everglades and the Corps look at dredged material as a possible resource, and if acceptable beach quality material is available, the port would prefer that this material be placed on the beach to eliminate the need for dredging between the reef systems off the port.

It is imperative to the continuation of safe navigational conditions that the designation of this Ocean Dredge Material Disposal Site (ODMDS) occurs as soon as possible.

Very truly yours,

Michael Y. Hopkins

Michael Y. Hopkins
Vice President/Operations
Latin America

MYH/ao

POST OFFICE BOX 359004 • FT. LAUDERDALE • FLORIDA • 33335 • 954.760.7900 • FAX 954.760.9220
www.crowley.com

Department of Environmental Protection

Jeb Bush
Governor

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

Colleen M. Castille
Secretary

May 17, 2004

Mr. Wesley B. Crum, Chief
Coastal Section
U. S. EPA, Region 4
61 Forsyth Street, SW
Atlanta, Georgia 30303

RE: U.S. Environmental Protection Agency and U.S. Army Corps of Engineers – Draft Environmental Impact Statement for Designation of the Palm Beach Harbor and Port Everglades Harbor Ocean Dredged Material Disposal Sites – Palm Beach and Broward Counties, Florida.
SAI # FL200403195639C

Dear Mr. Crum:

The Florida Department of Environmental Protection (Department) State Clearinghouse, pursuant to section 403.061, Florida Statutes (F.S.), Executive Order 12372, Gubernatorial Executive Order 95-359, the Coastal Zone Management Act, 16 U.S.C. §§ 1451-1464, as amended, and the National Environmental Policy Act (NEPA), 42 U.S.C. §§ 4321, 4331-4335, 4341-4347, as amended, has coordinated a review of the above referenced Draft Environmental Impact Statement (DEIS). The DEIS was prepared by the U.S. Environmental Protection Agency (EPA) in cooperation with the U.S. Army Corps of Engineers (USACE) to satisfy the requirements for designating the Palm Beach Harbor and Port Everglades Harbor Ocean Dredged Material Disposal Sites (ODMDS).

The Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA) Section 102(c) authorizes the EPA to designate ODMDSs, precise geographical areas within which ocean disposal of dredged material maybe authorized. Sites are selected to minimize adverse environmental effects of dumping activities and interference with other uses of the marine environment. Historically, interim designated sites were used for the disposal of dredged material from Palm Beach Harbor and Port Everglades. However, the use of the sites was discontinued as a result of the implementation of the Water Resources Development Act of 1992.

EPA proposes to designate two ODMDSs, one located east of the Lake Worth Inlet and Port of Palm Beach, Florida and one located east of Port Everglades, Florida. Alternatives evaluated in the DEIS included: 1) no action or not designating an ODMDS; 2) upland disposal of dredged materials, including their use for beach re-nourishment; 3) and alternative sites for each designation, four for Palm Beach Harbor and three for Port Everglades Harbor. EPA's preferred alternative sites include the "4-mile site" for Port Everglades, 3.8 nautical miles from shore to the western edge of the site in 509 to 607 feet of water; and the "4.5-mile site" for Palm Beach Harbor, 4.3 nautical miles from shore to the western edge of the site in 525 to 625 feet of water. A variety of historical and recent data were used to describe the sites including bathymetry; sediment and water chemistry; biological communities; and physical oceanographic characteristics.

The Department, designated as the state's lead coastal management agency pursuant to section 306(c) of the Coastal Zone Management Act, 16 U.S.C. section 1456(c), and section 380.22, Florida Statutes, hereby notifies the EPA and the USACE that the state, at this time, does not object to the consistency determination provided with the DEIS. All subsequent environmental documents must be reviewed to determine the project's continued consistency with the FCMP. The state's finding is based on consultation with the EPA and the USACE over the last several years to assist in identifying environmental information necessary to locate satisfactory sites, information provided in the DEIS, and the adoption of Site Management and Monitoring Plans as outlined in the DEIS. During review of the DEIS, several issues that should be addressed in the Final EIS were identified. The state's continued concurrence with the project will be based, in part, on the adequate resolution of issues identified during this and subsequent reviews.

Comments from the Department (DEP) staff are discussed below and in the enclosure. The DEIS indicates, and Florida strongly agrees, that where appropriate, beach re-nourishment is the preferred alternative for disposal of beach quality dredged materials. In addition, to ensure that disposed materials remain within the designated site and do not affect resources adjacent to the sites, disposal should not occur during times of high currents such as eddy intrusions.

An exhaustive review was completed of potential upland disposal sites, however, no consideration of alternative uses of non-beach quality material was included in the DEIS as requested in the Department's November 24, 1997 scoping notice response. The Department has recently been contacted about using intracoastal dredged material as landfill cover indicating that a potential need for dredged material might exist. Options for beneficial use should be developed so that offshore disposal is unnecessary. Therefore, we recommend that the ports and the USACE investigate possible beneficial uses of dredged material with nearby counties and, municipalities and document in the FEIS.

While all candidate sites appear to have had geophysical and visual benthic surveys conducted at or in the vicinity of the sites, different spatial and temporal sampling regimes were carried out and therefore, the individual sites were not evaluated equally. Because of the differences in collecting environmental information, it appears that the preferred sites were determined prior to completing detailed survey analysis. The DEIS should have clearly explained that information obtained in the broader surveys was used to identify those sites which are more environmentally acceptable and then more rigorous surveys were conducted.

Video and still photography was collected at the Port Everglades site in 1986. Information was presented in the DEIS regarding the Palm Beach Harbor photo documentation, but the timing of and methods for conducting the surveys are unclear. The state is concerned that the photodocumentation of these sites may be outdated. EISs should include analyses of the results of recent geophysical and visual surveys. The photo documentation should also be used to verify the identification of specific targets identified in contemporaneously conducted side scan sonar surveys.

The DEIS notes that video surveys were conducted within and around both the Palm Beach and Port Everglades preferred sites. Results of the photo documentation showed no preferred habitat for

Oculina varicose in the 4.5 mile Palm Beach site, but *Oculina* is known to occur within 1.7 nautical miles (nmi) of the site. Visual surveys of all areas potentially impacted by disposing of materials at the site, whether inside or outside of the side, should be conducted to ensure that no preferred habitat exists within the impact area. The NEPA analyses should also address the possibility of other deepwater coral resources such as black corals (i.e. *Cirrhipathes luetkeni* or *Tanacetipathes* sp) which have been noted in this area during the review of another project.

In an April 16, 2002 letter to the EPA concerning these proposals, the Department emphasized that site capacity requirements, projected material dispersion and the long-term fate of deposited material should be based on the maximum volume of material expected to be disposed of at each site. The determination of annual average of 50,000 cubic yards (cy) used in the DEIS seems inadequate considering the total amount of dredging that is expected at each port. Modeling and planning at the site to avoid long-term impacts should consider the amount of dredged material expected to be placed in the ODMDS during its lifetime. The modeling completed for the DEIS used a mound site that was 10 times the average annual amount or 500,000 cy to be deposited. This volume appears to be low since larger planned events, including disposing 2 million cy to improve the Palm Beach Harbor, may occur.

The cumulative impacts analysis in NEPA documents should provide the most up-to-date information for and thoroughly evaluate all projects being conducted in the area of impact. Projects evaluated in the DEIS that should be updated include AES Ocean Express and Tractebel Calypso pipelines; telecommunication cables; Port Everglades Harbor Deepening Project (PEHDP); and the Hillsboro Inlet dredging project. Final environmental impact statements with updated information concerning locations and projected impacts of both proposed pipelines were recently released. Cumulative analyses should include this updated information. Where available, information about the telecommunication cables should also be updated. The discussion of the PEHDP should include an estimate of the amount of dredged disposal material that will result from the project, and estimated disposal material volumes for other dredging projects should also be included. Hillsboro Inlet dredging should be added into the analysis of past projects. In addition, NEPA analyses should address the cumulative impacts of using these sites along with the use of other ODMDS along the southeast Florida coasts.

The Florida Fish and Wildlife Conservation Commission (FWCC) requests clarification of why the site modeling found the disposal sites to be non-dispersive despite persistent bottom current patterns.

The Treasure Coast Regional Planning Council (TCRPC) indicates that the preferred offshore site for the disposal of dredged material from Palm Beach Harbor is not in conflict or inconsistent with the Strategic Regional Policy Plan provided that coral reefs and other environmentally sensitive marine resources are not impacted by the disposal operation. Monitoring should occur to ensure that dispersion and transport of disposed dredged material does not impact reefs and other sensitive marine resources. All opportunities to utilize the dredged material for beneficial uses such as beach nourishment or lagoon restoration should be considered prior to disposal.

South Florida Regional Planning Council (SFRPC) staff notes that while the project will further the SFRPC's goals for a more livable, sustainable, and competitive region, the project should be reviewed to ensure that it is consistent with the goals and policies of the *Strategic Regional Policy Plan for South*

Florida regarding protection of shoreline, estuarine and benthic communities, fisheries and associated habitats. Please refer to the enclosed SFRPC letter for further details.

Thank you for the opportunity to review the DEIS and accompanying information. We look forward to continue working with EPA and the USACE to monitor the effects of using these designated sites. If you have any questions regarding this matter, please contact Ms. Lauren P. Milligan at (850) 245-2163.

Sincerely,

Sally B. Mann

Sally B. Mann, Director
Office of Intergovernmental Programs

SBM/lm

Enclosures

cc: √James C. Duck, USACE, Jacksonville
Roxanne Dow, DEP
Lynn Griffin, DEP
George Henderson, FWCC
Wynsum Hatton, TCRPC
Christina Miskis, SFRPC

Project Information	
Project:	FL200403195639C
Comments Due:	April 18, 2004
Letter Due:	May 18, 2004
Description:	ENVIRONMENTAL PROTECTION AGENCY AND U.S. ARMY CORPS OF ENGINEERS - DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR DESIGNATION OF THE PALM BEACH HARBOR AND PORT EVERGLADES HARBOR OCEAN DREDGED MATERIAL DISPOSAL SITES - PALM BEACH AND BROWARD COUNTIES, FLORIDA.
Keywords:	EPA/ACOE-PALM BEACH HARBOR/PORT EVERGLADES DREDGED MATERIAL SITES
CFDA #:	66.999

Agency Comments:
TREASURE COAST RPC - TREASURE COAST REGIONAL PLANNING COUNCIL
The preferred offshore site for the disposal of dredged material from Palm Beach Harbor is not in conflict or inconsistent with the SRPP provided that coral reefs and other environmentally sensitive marine resources are not impacted by the disposal operation. Monitoring should occur to ensure that dispersion and transport of disposed dredged material does not impact reefs and other sensitive marine resources. All opportunities to utilize the dredged material for beneficial uses such as beach nourishment or lagoon restoration should be considered prior to disposal.
SOUTH FL RPC - SOUTH FLORIDA REGIONAL PLANNING COUNCIL
While Council staff believes the project will further our goals for a more livable, sustainable, and competitive region, the project should be reviewed to ensure that it is consistent with the goals and policies of the Strategic Regional Policy Plan regarding protection of shoreline habitat, communities and listed marine species.
BROWARD - BROWARD COUNTY
PALM BEACH -
ENVIRONMENTAL POLICY UNIT - OFFICE OF POLICY AND BUDGET, ENVIRONMENTAL POLICY UNIT
No Comment
FISH and WILDLIFE COMMISSION - FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
FMRI staff requests clarification of why the site modeling found the disposal sites to be non-dispersive despite persistent bottom current patterns.
STATE - FLORIDA DEPARTMENT OF STATE
TRANSPORTATION - FLORIDA DEPARTMENT OF TRANSPORTATION
Released Without Comment
ENVIRONMENTAL PROTECTION - FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
The DEIS indicates, and Florida strongly agrees, that where appropriate, beach re-nourishment is the preferred alternative for disposal of beach quality dredged materials. In addition, to ensure that disposed materials remain within the designated site and do not affect resources adjacent to the sites, disposal should not occur during times of high currents such as eddy intrusions. Staff recommends that the ports and the USACE investigate possible beneficial uses of dredged material with nearby counties and, municipalities and document in the FEIS. (See letter for additional comments.)
SOUTH FLORIDA WMD - SOUTH FLORIDA WATER MANAGEMENT DISTRICT
Released Without Comment

Department of Environmental Protection
Specific Comments for Draft Environmental Statement for Designation of the Palm Beach Harbor ODMDS and the Port Everglades Harbor ODMDS
(May 16, 2004)

Section 1.2.4, page 4. The annual disposal volume to be placed in each proposed ODMDS site is 50,000 cubic yards (cy). Will this volume be adequate considering the dredging projects using the ODMDS sites may need to dispose of material well in excess of 50,000 cy (e.g. Palm Beach Harbor is estimated to have 2 million cy)?

Section 2.3. Figures 1 and 2. These figures and subsequent figures in the text and on the electronic version (CD) are difficult to analyze. The CD maps cannot be enlarged to a readable size as they become too blurry to distinguish features. NEPA documents should provide maps and figures that are clear and readable at most magnifications.

Sections 3 and 4. There are several citations of recognized experts (e.g. Porter, 1987; Marshall 1971) that are not included in the References section of the DEIS. Please correct.

Section 3.4, page 23. The EIS should clearly describe the date of, location, and methods used by Continental Shelf Associates in conducting the video surveys.

According to the text, no preferential substrate for *Oculina* was found in the 4.5 mile Palm Beach Harbor site during the video surveys. While it appears that geophysical surveys were used to determine if this substrate was found within the impact areas calculated by the modeling, video surveys of the area should be conducted to confirm that no preferential substrate for *Oculina* would be impacted. The EIS should provide a map detailing the locations of known *Oculina* and the location of the ODMDS candidate sites.

The state is concerned that an increase in turbidity and/or sedimentation resulting from disposal activity in the ODMDS could affect *Oculina* habitat since it is not clear in the DEIS whether it could exist within the area of impact

The EIS should discuss information discerning whether substrates located in the sites or in proximity to the sites may be preferential to other species of coral besides *Oculina.* By specifically looking for *Oculina* in the video surveys, other important species may have been overlooked. The Tractebel Calypso Pipeline Project documented the presence of deepwater corals, including black corals, offshore Broward County, Florida.

Section 3.5, page 30. Fisheries data provided in tables 5 and 6 should be updated to include the most recently available information.

Section 3.13.1, page 44. More recent accounts of the recreational and commercial fisheries in the area should be included in the FEIS.

Section 3.17, page 57. The discussion should be updated. Both the AES Ocean Express LLC and the Tractebel Calypso LLC natural gas pipeline proposals have a published FEIS. The document should also include information concerning present and future telecommunication and fiber optic cables in the area.

The last sentence notes that the Tractebel Calypso pipeline's proposed route does not interfere with any of the Port Everglades Harbor ODMDS. When comparing maps in the Tractebel Calypso FEIS and maps of the proposed ODMDS, the 4-mile site seems in close in proximity to the pipeline route. The documents should provide a map detailing the location of the ODMDSs in relation to the Tractebel Calypso pipeline or any other significant structure in the area.

Section 3.18.1, page 58. The EIS should include a more thorough discussion about biological activity in the area as described in the DEIS. For example: could the biological disturbances (e.g. mounds and depressions) found at the Palm Beach Harbor 4.5-mile site been made by tilefish? Tilefish have become important fishery in this area and according to fishermen this species may only exist in certain types of sand habitats. Altering the sediments with dredge disposal may destroy essential fish habitat for this fishery.

The EIS should provide more detailed information concerning the surveys completed in the candidate sites including: a map clearly showing the locations of the video and photography; descriptions of when the surveys were conducted; and descriptions of survey methods used.

Section 3.18.2, page 58. NEPA documents should be based on recently obtained information about the area, including video/photography surveys necessary to verify the absence/presence of isolated corals and essential fish habitat. Based on the 1986 video, depressions, mounds, and other biological activity were noted in the area. This biological activity could be indicative of species now being utilized in a commercial fishery that were not in 1986 (e.g. blueline tilefish).

Section 4.3.3, page 60. In the discussion regarding 40 CFR 228.5(b), *Oculina* is noted as being found 1.7nmi west of the preferred Palm Beach Harbor ODMDS. The statement is then made that "At these locations, the likelihood of impacts to nearshore amenities is small." Is this statement applicable to *Oculina,* by referring to it as a nearshore amenity? If not, will there be a likelihood of impacts to *Oculina* from dispersion?

The EIS should clearly discuss whether the completed surveys confirm that no other areas of *Oculina* or other possible coral habitat are in the range of turbidity and sedimentation impact that will result from disposal in the ODMDS. According to the modeling in Appendix I, 2,400m is the maximum distance for sand concentration to be 1mg/l or less from the disposal location, yet it is unclear whether or not the surveys extended at least that far.

Section 4.3.3, page 61. The discussion of dispersion modeling results refers to Section 5.07, however, no Section 5.07 could be found. Please clarify this reference.

Section 4.3.4, page 62. The discussion in "Location in relation to beaches and other amenity areas [CFR 228.6(a)3]", does not discuss the *Oculina* habitat referenced in previous discussions [e.g., CFR 228.5(b)]. *Oculina* habitat should be discussed in this section also.

Section 4.3.4, page 67. Specific Site Selection Criteria 8 [40 CFR 228.6(a) 8] should be re-evaluated to include the tilefish fishery.

Section 4.5, page 74. The cumulative impact section in the NEPA documents should contain a thorough review of the effects of past, present and future projects and their possible cumulative effects with the proposed ODMDSs. Information concerning the telecommunication and fiber optic cables should be included in the EIS, along with any possible cumulative impacts. The Seafarer pipeline should be included in section 4.5.3 Reasonably Foreseeable Future Projects. The Tractebel Calypso and the AES Ocean Express pipeline projects should be updated to include information from their respective FEISs.

Section 4.11, page 80. Please refer to comments from Section 3.4, page 23.

All Appendices. The pages of the appendices should be numbered.

Appendix D, Section 2.0. The same side scan sonar resolution should be used to survey all potential ODMDSs. Employing different survey methods, can result in the appearance that a preferred site was pre-determined instead of using the surveys to determine a suitable site.

The discussion notes that a wider transect spacing was used for secondary areas because these areas were expected to be outside the impact area. The discussion should include an explanation of how the size secondary area to be surveyed was determined. The side scan sonar surveys were conducted in August of 1998, yet the report for the dispersion study was not dated until September 1998. Therefore, the assumption used to determine impact area for the secondary surveys may have been flawed since the side scan surveys were completed before the modeling report which detailed the distance of impact was completed.

The EIS should include information about the transect lengths and the distance surveyed beyond the site boundaries. This is not clear from the text or from the referenced Appendix A figures.

The evaluation of ODMDSs should include still and video photography, geophysical and/or additional surveys which may be necessary to help characterize the significance of features at the ODMDS identified with side scan sonar. Side scan sonar results alone still leave questions as to the significance of features found by this survey method.

Appendix D, Table 1. Please clarify the terms used under heading survey area.

Appendix I, Section 2. Table 4 states that the cohesive/non-cohesive behavior is not considered for the sand and are considered for the silt. The EIS should describe whether or not actual sediment samples were analyzed to justify these two assumptions. The discussion states that "If the sediment contains cohesive material, a combination of buoyancy and suspension may transport the cloud considerable distance from the point of disposal." A sensitivity test should be done to demonstrate how the sediment will behave if a considerable percentage is found to be cohesive.

Discussions note that the void ratio taken for silt-clay is 4.0. Please discuss whether sediment samples were analyzed to determine this value. A sensitivity test should be conducted (i.e., taking void ratio as 2.0 and running the model set-up) to demonstrate the scenario as a result of the void ratio being less than 4.0.

The time to empty the split-hull dredge is presented as 5 sec. But in STFATE model simulation, the 'model time step' is taken as 375-750 sec for Palm Beach and 300-600 sec for Port Everglade (Table 7). Please discuss how a time step of more than 300 sec simulates the effect of a 5 sec disposal (time to empty) time. Also, please clarify any other assumptions you may have taken in this regard.

The EIS should provide the reference and other applicable information to justify the values of the model coefficients listed in Table 7 - specifically from 'CSTRIP' down to 'AKYO'.

In the EIS Figures 36 to 51 should be drawn showing sediment concentrations up to the grid origin. For example, the higher concentrations in the Figures 41 (lower right), 43 (lower right), 48 (lower left and lower right), 49 (lower left and lower right), 50 (lower right) generate concerns because they show considerable higher concentrations and do not show the full distance of impact.

Appendix I, Section 3. The appendix notes that LTFATE has the capability to simulate both non-cohesive and cohesive sediment transport. Then the section describes the effects of waves on non-cohesive sediment transport. Cohesive transport was not further discussed. Are cohesive sediments not as important as non-cohesive sediments? If cohesive sediment transport is important, it should be included in future modeling.

The DPR tidal constituents are used for LTFATE modeling. The EIS should discuss whether any observed time-series of the tidal levels were available for locations near or inside the model area.

The EIS should include discussions to justify the 0.12 mm value used as the mean grain size for the LTFATE modeling. The outer layer of the sediment mound usually consists of finer particles due to their slower settling velocities. These outer layers of finer particles may be more susceptible to ambient currents and turbulent diffusions, thus more prone to spreading.

It is preferable for analyses to include a sensitivity study with finer grid spacing and smaller time steps demonstrating how the selected models behave with smaller spacing and how the results vary for both the locations.

For the LTFATE initial screening, the depth average velocities are calculated for 170-200 m depth which is the depth near the ODMDS. The Department is more concerned about re-suspension of the deposits near to the hard bottoms. The higher concentrations shown in Figures 41 (lower right), 43 (lower right), 48 (lower left and lower right), 49 (lower left and lower right), 50 (lower right) etc. show that sediment may travel and/or be deposited near to the hard bottom area during the dynamic collapse phase. The bathymetry near the hard bottom area is much shallower with mean depth of around 20 m, where storm surge may become higher due to the shallower depth and higher water velocities may be generated. Please note that Figure 4 shows shallower depths than the considered 170-200 m near to the ODMDS site.

The EIS should provide the reference and other applicable information to justify the values of the model coefficients listed in Table 8 and 9.

Appendix I, Section 4. The conclusions state the primary concern when modeling dispersion was movement toward reefs 1-3 km offshore. The NEPA documents should address possible impacts to smaller discrete resources such as *Oculina* and other deepwater corals that could be within the impact area?

Section 4 (Conclusion) states that:
a. "In all Port Everglades ...The majority of the sand in the dredged material...., but some remains in the water column for longer time/distances as indicated by these results."
b. "In all Palm Beach ...The majority of the sand in the dredged material...., but some remains in the water column for longer time/distances as indicated by these results."
NEPA documents should use explicit/defined description and avoid the use of non-descript words such as "some" and "longer time/distances".

Appendix I, J, K. The EIS should provide the site capacity of the ODMDSs. The capacity limit and an estimated mound size should be used in the long-term fate modeling.

The EIS should discuss how the annual average disposal rates are determined, expected use or past disposal events. The DEIS should reflect a disposal rate determined by the anticipated use, such as the proposed disposal of 2 million cy to improve Palm Beach Harbor. It seems unrealistic to use such a low annual average disposal rate (50,000 cy) when much larger disposal projects have been forecasted. The NEPA documents should also discuss the percentage of material in the planned dredging projects that will actually be disposed of in the ODMDS.

Appendix J, page 4, Port Everglades and Palm Beach Harbor. The Site Management Monitoring Plan (SMMP) should include general guidelines to eliminate or minimize impact when dredging and disposal of dredged material should be avoided such as periods of strong currents or eddies as indicated by ADCP data.

Appendix J, page 8, Port Everglades and Palm Beach Harbor. The baseline monitoring surveys and environmental surveys should be overlapping covering the entire ODMDS, no data gaps. The surveys should continue at least .5 mile or at least the maximum predicted impact area around the site, not 500 feet as suggested in the SMMP.

South
Florida
Regional
Planning
Council

April 12, 2004

Ms. Lauren Milligan
Florida State Clearinghouse
Department of Environmental Protection
3900 Commonwealth Boulevard, Mail Station 47
Tallahassee, FL 32399-3000

RE. SFRPC #04-0345, SAI #FL200403195639C, request for comments on a Draft Environmental Impact Statement (DEIS) for designation of the Palm Beach Harbor and Port Everglades Harbor Ocean Dredged Material Disposal Sites (ODMDS), U.S. Army Corps of Engineers, offshore Palm Beach and Broward Counties.

Dear Ms. Milligan:

We have reviewed the above-referenced DEIS have the following comments:

- While Council staff believes the project will further our goals for a more livable, sustainable, and competitive region, the project should be reviewed to ensure that its is consistent with the goals and policies for the *Strategic Regional Policy Plan for South Florida*, particularly the following:

Strategic Regional Goal

3.8 Enhance and preserve natural system values of South Florida's shorelines, estuaries, benthic communities, fisheries, and associated habitats, including but not limited to, Florida Bay, Biscayne Bay and the coral reef tract.

Regional Policies

3.8.1 Enhance and preserve natural shoreline characteristics through requirements resulting from the review of proposed projects and in the implementation of ICE, including but not limited to, mangroves, beaches and dunes through prohibition of structural shoreline stabilization methods except to protect existing navigation channels, maintain reasonable riparian access, or allow an activity in the public interest as determined by applicable state and federal permitting criteria.

3.8.2 Enhance and preserve benthic communities, including but not limited t seagrass and shellfish beds, and coral habitats, by allowing only that dredge and fill activity, artificial shading of habitat areas, or destruction from boats that is the least amount practicable, and by encouraging permanent mooring facilities. Dredge and fill activities may occur on submerged lands in the Florida Keys only as permitted by the Monroe County Land Development Regulations. It must be demonstrated pursuant to the review of the proposed project features that the activities included in the proposed project do not cause permanent, adverse natural system impacts.

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SunCom 473-4416, FAX (954) 985-4417, Sun Com FAX 473-4417
email: sfadmin@sfrpc.com, website: www.sfrpc.com

3.8.5 Enhance and preserve habitat for endangered and threatened marine species by the preservation of identified endangered species habitat and populations. For threatened species or species of critical concern, on-site preservation will be required unless it is demonstrated that off-site mitigation will not adversely impact the viability or number of individuals of the species.

Thank you for the opportunity to comment. If you require further information, please contact me.

Sincerely,

John E. Hulsey, AICP
Senior Planner

JEH/kal

cc: Elliot Auerhahn, Broward County DPEP

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
9721 Executive Center Drive North
St. Petersburg, Florida 33702

May 6, 2004

Mr. Wesley B. Crum, Chief
Coastal Section
U.S. Environmental Protection Agency
61 Forsyth Street, SW
Atlanta, Georgia 30303

Dear Mr. Crum:

The National Marine Fisheries Service (NOAA Fisheries) has reviewed the U.S. Environmental Protection Agency's (EPA) **Draft Environmental Impact Statement (DEIS) for Designation of the Palm Beach Harbor Ocean Dredged Material Disposal Site (ODMDS) and the Port Everglades Harbor ODMDS** dated February 2004. The proposed ODMDSs would be located in the Atlantic Ocean to the east of Lake Worth Inlet and the Port of Palm Beach in Palm Beach County, Florida and to the east of Port Everglades in Broward County, Florida. The ODMDS would accommodate material dredged from Palm Beach Harbor and Port Everglades Harbor. According to the information provided, the need for ocean disposal is based primarily on the lack of economically, logistically, and environmentally feasible alternatives for the disposal of projected quantities of dredged material deemed unsuitable for beach nourishment or other beneficial uses. The DEIS states that the most cost effective method of dredging is clamshell/barge dredging for Palm Beach Harbor and hopper dredging for Port Everglades Harbor. Essential fish habitat consultation for the dredging work is being handled separately.

Section 102 (c) of the Marine Protection, Research, and Sanctuaries Act (MPRSA) authorizes EPA to designate and recommend sites for offshore disposal of dredged material. An ODMDS is a precise geographical area within which ocean disposal of dredged material is authorized. The primary purpose of site designation is to minimize adverse environmental impacts and minimize interference with other uses and activities.

No Action Alternatives and Non-Ocean Disposal Alternatives are evaluated in the DEIS. The EPA concludes that the No Action Alternative would not provide a long-term management option for dredged material disposal due, in part, to anticipated adverse impacts on maintenance of the existing federal navigation projects and subsequent effects on local and regional economies. Non-Ocean Disposal Alternatives (i.e., upland disposal and beach renourishment) are also examined in the DEIS. The EPA concludes that cost effective upland disposal options are not available in the densely developed areas around the Port of Palm Beach and Port Everglades.

The four alternative sites evaluated for the Palm Beach ODMDS include:
Alternative 1: offshore interim site, 2.9 nautical miles (nm) from shore to the western edge of the site;
Alternative 2: 3-mile candidate site, located 3.3 nm from shore;
Alternative 3: (preferred) 4.5-mile site, located 4.3 nm from shore; and
Alternative 4: 9-mile candidate site, located 8 nm from shore.

The three alternative sites evaluated for Port Everglades Harbor ODMDS include:
Alternative 1: interim site, located 1.6 nm from shore;
Alternative 2: (preferred) located 4-mile site, 3.8 nm from shore; and
Alternative 3: 7-mile site, located 6 nm from shore.

According to the information provided, the preferred sites (each approximately one square nm in size) consist primarily of soft-bottom habitat. Each site is located on the upper continental slope near the western edge of the Florida current. The water depth at each site exceeds 150 meters. The acceptability of dredged material for ocean disposal would be determined on a case-by-case basis. The DEIS states that these sites were evaluated and selected with full consideration of the General and Specific Site Selection Criteria set forth in 40 CFR 228.5 and 228.6. NOAA Fisheries comments pursuant to the Site Selection Criteria are provided below.

The interim sites were eliminated from further evaluation, largely to avoid direct impacts to natural reefs in the vicinity of those sites. A 1984 survey conducted by EPA indicated that damage to nearby inshore hardbottom areas may have occurred due to the movement of fine grained material deposited near natural reefs.

The DEIS states that, based on EPA and Army Corps of Engineers (COE) surveys, no natural reefs or features of historical importance are located within or near the preferred sites. Areas of controversy identified during the scoping process include the proximity of the disposal sites to nearshore reefs and the potential for transport of fine-grained material to these reefs. The proximity to other significant marine resources, the adequacy and current status of designation surveys, and the scope, costs, and frequency of monitoring of disposal effects at the proposed sites were also identified as being controversial.

The DEIS states that unavoidable adverse effects from dredged material disposal at any of the alternative sites includes (1) formation of temporary, localized, water column changes associated with suspended sediment plumes; (2) burial and smothering of non-motile infauna and/or epifauna; (3) possible alteration of substrate texture, grain size, and/or chemical composition; and (4) changes in bathymetry (mounding of material).

General comments

NOAA Fisheries is concerned the proposed work could adversely impact resources for which we have management and stewardship responsibilities pursuant to provisions of the Fish and Wildlife Coordination Act and the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). The proposed project is located in areas identified as essential fish habitat (EFH) by the South Atlantic Fishery Management Council (SAFMC). Categories of EFH that occur within the project vicinity include the marine water column, coral, hardbottoms, sargassum, sand habitats, the U.S. Continental Shelf, and the upper regions of the continental slope. Hardbottom areas are designated as EFH by the SAFMC for juvenile and adult red and gag grouper, gray and mutton snapper, white grunt, penaeid shrimp, tilefish, and spiny lobster. Coral reef habitat has been designated as EFH for juvenile and adult red and gag grouper, gray and mutton snapper, white grunt, and spiny lobster. The marine water column has been designated as EFH due to its importance as the medium of transport for nutrients and migrating organisms between estuarine systems and the open ocean. Sargassum has been designated EFH for sea bass, jack, and marbled grouper. In addition, sand bottom has been designated EFH for juvenile lane snapper and adult and subadult brown shrimp, juvenile and adult gag grouper. NOAA Fisheries has also identified EFH for highly migratory species that utilize the water column in this area including nurse, bonnethead, lemon, black tip, and bull sharks. Federally managed species associated with the U.S. Continental Shelf and its upper regions include golden crab and royal red shrimp, respectively.

Detailed information on shrimp, red drum, snapper/grouper complex (containing ten families and 73 species), spiny lobster, and other federally managed fisheries and their EFH is provided in the 1998 comprehensive amendment of the Fishery Management Plans for the South Atlantic Region prepared by the SAFMC[1]. The comprehensive amendment was prepared as required by the Magnuson-Stevens Act. In addition, sargassum, coral and coral reef (including deepwater *Lophelia* and *Enallopsammia* corals), and hardbottom habitats (including deepwater hardbottom habitats), which are located within the vicinity of the proposed ODMDSs, have been designated as habitat areas of particular concern (HAPC) by the SAFMC. HAPCs are subsets of EFH that are rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area. Contrary to the information provided in Section 4.9, of the DEIS, HAPCs are located within the ODMDSs.

The EFH assessment has not been made available for review. The EFH assessment should include a description of the proposed action; an analysis of the effects (including indirect and cumulative effects) of the action on EFH, managed species, and associated species by life history stage; EPA and COE views regarding the effects of the action on EFH; and proposed mitigation.

---

[1]South Atlantic Fishery Management Council (SAFMC). 1998a. Final habitat plan for the south Atlantic region: essential fish habitat requirements for fishery management plans of the South Atlantic Fishery Management Council. Charleston, South Carolina. 639 p.

The EFH assessment should also include the results of site-specific studies, the views of recognized experts on impacts to habitats and species, a literature review, and any other relevant information. Additional guidance on the preparation of the EFH assessment is provided in the Information Needs Section (below).

In connection with our review of the DEIS, NOAA Fisheries is especially concerned regarding the inadequacy of the assessment of potential impacts to deepwater habitats. In the absence of an adequate EFH assessment for these habitats, it would not be possible to determine whether the fishery conservation requirements of the Magnuson-Stevens Act would be met and NOAA Fisheries would have no recourse but to recommend withholding ODMDS approval. Consequently, it is of great importance that the EFH assessment contains the required contents and an adequate level of detail. It also should include quantitative impact estimates based on available information and ongoing and completed studies for each category of EFH. The EFH assessment should also include an evaluation of the deepwater survey results and information regarding efforts to avoid and minimize impacts to deepwater habitats. The importance of this issue is emphasized in the following specific comments which encourage providing the EFH assessment as a supplement to the DEIS.

Specific comments

NOAA Fisheries has a number of specific comments related to our review of the DEIS and other project related documents. In the absence of adequate information or reasonable potential for significant adverse impacts to living marine resources and associated habitats, we may recommend against ODMDS approval and implementation. For simplicity sake we stratified our comments into the following sections:

- EFH Assessment and Deepwater Habitats
- Dredged Material Suitability for Offshore Disposal and Dredge Material Fate Studies
- Conflicts with Other Projects and Cumulative Effects
- Summary Information Needs
- EFH Conservation Recommendation

EFH Assessment and Deepwater Habitats

Pages 30-34. *Section 3.6 Essential Fish Habitat.* As stated above, NOAA Fisheries is concerned that the information provided is insufficient to demonstrate that avoidance and minimization of adverse impacts to EFH have been adequately addressed. To address this, an EFH assessment should be prepared and provided for NOAA Fisheries review.

Page 3. *Table 1: Relationship of Alternatives to Environmental Requirements.* In the absence of an EFH assessment, NOAA Fisheries does not concur with information in this table regarding the assertion that EPA is in full compliance with the Magnuson-Stevens Act.

Pages 20-23. *Deepwater shelf edge habitat and deepwater hardbottoms.* The DEIS states that "no natural reefs have been observed within the proposed project area." Although this area may not support reef-like features, the deepwater hardbottoms and softbottoms, and shelf edge zone are inhabited by managed fishes, such as snappers, groupers, and porgies. Fish distribution is often diffuse in this zone, with fishes aggregating over broken bottom relief in associations similar to those formed at inshore live bottom sites. The lower shelf habitat has a predominately smooth mud bottom, but is interspersed with rocky and coarse gravel substrates where groupers and tilefish may occur. This habitat and its association of fishes roughly marks the transition between fauna of the Continental Shelf and fauna of the Continental Slope. Water depths within this habitat zone range from 110 meters to 183 meters (360 to 600 ft) and bottom water temperatures vary from approximately 11° to 14° C (51° to 57° F). Fishes inhabiting the deeper live or hardbottom areas are believed to be particularly susceptible to heavy fishing pressure and environmental stress (SAFMC 1998).

Water depths at the ODMDSs are within the harvest range of blue-line tilefish (locally called blue or gray tiles). According to local fishers, tilefish prefer certain sediment types and NOAA Fisheries is concerned that alteration of the sediment type found in the ODMDSs could adversely affect the tilefish fishery in this region. Therefore, impacts to the tilefish habitat and other deepwater habitats should be evaluated in the EFH assessment.

Page 60. *General Site Selection Criteria #1: The dumping of materials into the ocean will be permitted only at sites in areas selected to minimize the interference of disposal activities with other activities in the marine environment,* ***particularly avoiding areas of existing fisheries*** *and regions of heavy commercial or recreational navigation* [40 CFR 228.5(a)]. NOAA Fisheries recommends that this General Site Selection Criteria item be re-evaluated in the EFH assessment to address impacts to the existing tilefish fishery.

Page 67. *Specific Site Selection Criteria #8: Interference with shipping, fishing, recreation . . . areas of special scientific importance, and other legitimate uses of the ocean* [40 CFR 228.6(a)]. NOAA Fisheries recommends that this Specific Site Selection Criteria item be re-evaluated in the EFH assessment to address impacts to the existing tilefish fishery.

Pages 23 and 80. *Deepwater corals.* NOAA Fisheries concurs with information in the DEIS regarding acknowledgment that ahermatypic corals are found in deeper waters. According to the information provided, video surveys performed by Continental Shelf Associates did not reveal the presence of deepwater corals at the preferred (4.5-mile) ODMDS for Palm Beach Harbor. However, based on the information provided, NOAA Fisheries is concerned that this study may have been limited to the examination/identification of *Oculina* reefs. A summary of the methods used and survey findings should be provided in the EFH assessment. The findings appear to contradict information, provided in Section 4.11 of the DEIS, regarding the identification of ahermatypic corals that were observed in scattered, isolated forms in the vicinity of the proposed Palm Beach Harbor ODMDS site.

We also note that results of deepwater surveys of locations offshore of Broward County, Florida, which were performed in connection with the Tractebel Calypso Pipeline Project, documented the presence of deepwater corals. Unbranched black corals (i.e., *Cirrhipathes luetkeni*) are relatively common in 70-100 ft waters offshore Broward County; however, branched species (i.e., *Tanacetipathes* sp.) are relatively rare and are substrate limited in water depths of 100-1000 ft (Goldberg, pers. comm., 2003). All species are characterized by slow growth, delayed first reproduction, limited larval dispersal, and low rates of recruitment, low natural adult mortality, and long life. Black coral colonies inhabit areas where few other species occur. They provide important habitat for invertebrates and fish, including commensal species that are dependent upon black coral for survival. Therefore, NOAA Fisheries considers avoidance of these resources as an important conservation biology issue and recommends that the ODMDS designation should be designed to avoid antipatharians and other sensitive deepwater habitats. Avoidance and minimization strategies for the aforementioned deepwater habitats should be clearly described in the EFH assessment.

Appendix D. *Sidescan sonar survey results.* NOAA Fisheries is concerned that the 250 meter transect spacing used in the May 2000, Sidescan Sonar Survey, is too wide to provide the level of coverage needed to conclude that impacts to deepwater habitats would be avoided and minimized through use of the preferred site. Transects that are spaced 100 meters apart are preferred for detection of deepwater habitats. With regard to deepwater hardbottom impacts, sidescan sonar mosaics of the route should be provided which show (1) the proposed ODMDS, (2) the locations of hardbottom that would be impacted, and (3) the locations of known fishery habitats and resources within the surveyed areas. This information is necessary in order to evaluate impacts to these resources. While additional side scan sonar surveys may not be necessary, the EPA and COE should reevaluate any possible features with photo or video at the preferred sites (i.e., the ridge feature in the Port Everglades 4-mile site and the possibility of Oculina within 1.7 nm of the preferred Palm Harbor 4.5-mile site).

In addition, the report does not define "low relief" as described in the Port Everglades 4-mile site. These low relief areas could support important marine habitats. According to the survey results, the Port Everglades 4-mile candidate site and surroundings contained "numerous unidentified highly reflective objects." NOAA Fisheries believes that these areas could support hardbottom habitats including deepwater corals. The level of information provided does not give reasonable assurance that impacts to federally managed resources would be avoided and/or minimized to the maximum extent possible. The results of additional video-truth surveys should be provided in the EFH assessment. In addition, the *low relief* areas and *highly reflective* areas referenced above should be quantitatively and qualitatively described in the EFH assessment.

Dredged Material Suitability for Offshore Disposal and Dredged Material Fate Studies

Page 36. *Spin-off eddies and proximity to the Gulf Stream/Florida Current.* NOAA Fisheries concurs with EPA's concern regarding the fate of dredged material placed at the proposed ODMDSs due to their proximity to the Gulf Stream and spin-off eddies. Large numbers of marine species are concentrated along the frontal boundary of the Gulf Stream is important as a distribution mechanism, especially for early life stages, as are frontal zones and upwelling areas as foraging habitat. It appears that time averaged and prevailing currents were used in the dredged material distribution studies. Although this information may be useful, the EFH assessment should acknowledge and discuss eddies that may potentially re-distribute this material to important marine habitats. In addition, the EFH assessment should address potential adverse effects to marine organisms that utilize the Gulf Stream for distribution or as foraging habitat. Associated measures that would be integrated into the project design to mitigate for such impacts also should be addressed.

Page 60. *General Selection Criteria #2: The locations and boundaries of disposal sites will be chosen so that temporary perturbations in water quality or other environmental conditions can be expected to be reduced to ambient before reaching any beach, shoreline, marine sanctuary, or known geographically limited fishery or shellfishery* [40 CFR 228.5(b)]. NOAA Fisheries is concerned that this response neglects consideration of spin-off eddies and we recommend that the response be re-evaluated to address spin-off eddies and possible transport of sediments to important marine habitats. This information should be provided in the EFH assessment.

Page 3. *Suitability of dredged material.* The DEIS states that the suitability of dredged material destined for ocean disposal will be determined on a case-by-case basis. NOAA Fisheries recommends that evaluation criteria be developed and provided for interagency review. This information could also be provided in the EFH assessment.

Conflicts with Other Projects and Cumulative Effects

Page 74-76. *Cumulative Impacts.* NOAA Fisheries is concerned that the cumulative impacts section of the DEIS is overly narrow and omits several important projects in Broward and Palm Beach counties. The Hillsboro Inlet dredging project should be included in Section 4.5.1 Past Projects. In addition, individual beach renourishment projects and associated offshore dredging and inshore filling activities should be described in this section. The Seafarer Pipeline Project should be listed in Section 4.5.3 Reasonably Foreseeable Future Project. Although the DEIS acknowledges that pipeline activities are proposed, it lacks discussion of effects to projects and potential synergistic or cumulative effects.

Summary of Information Needs

1. The EPA and COE should prepare an EFH assessment for NOAA Fisheries review. The assessment should contain:
   A. A description of the proposed action. This description should include the proposed transport and disposal methods;
   B. An analysis of the effects of the action on EFH, managed species, and associated species by life history stage. This analysis should include, but not limited to the following components:

- i. Direct, indirect, and cumulative effects;
  - ii. Effects of the proposed action on important marine habitats including deepwater habitats;
  - iii. Effects on managed species including tilefish;
  - iv. Effects on infauna and epifauna prey species for managed fisheries.
- C. EPA and COE views regarding the effects of the action on EFH;
- D. Proposed mitigation;
- E. The results of site-specific studies, the views of recognized experts on the habitat or species effects, a literature review, and any other relevant information including:
  - i. Side scan sonar video or photo identification (i.e., the ridge feature in the Port Everglades 4-mile site and the possibility of Oculina within 1.7 nm of the preferred Palm Harbor 4.5-mile site) and a reevaluation of side scan sonar surveys that quantify deepwater habitat impacts and define and characterize terms such as *low relief* and *highly reflective* areas;
  - ii. An evaluation of spin-off eddies and associated potential sediment transport to important marine habitats; and
  - iii. A summary of the Continental Shelf and Associates deepwater video survey methods and findings.

2. The EPA and the COE should develop evaluation criteria, in concert with NOAA Fisheries and other federal and state agencies, to determine the decision sequencing and suitability requirements of the materials to be disposed offshore.

EFH Conservation Recommendation

Environmental Protection Agency approval of ODMDS designation should be withheld pending receipt of an EFH assessment and other information needs as identified by NOAA Fisheries. Based on our review of the pending information, NOAA Fisheries may provide additional EFH conservation recommendations.

Section 305(b)(4)(B) of the Magnuson-Stevens Act and NOAA Fisheries' implementing regulation at 50 CFR Section 600.920(k) require your office to provide a written response to this letter within 30 days of its receipt. If it is not possible to provide a substantive response within 30 days, an interim response should be provided to NOAA Fisheries. A detailed response then must be provided at least ten days prior to final approval of the action. Your detailed response must include a description of measures proposed by your agency to avoid, mitigate, or offset the adverse impacts of the activity. If your response is inconsistent with our EFH conservation recommendation, you must provide a substantive discussion justifying the reasons for not following the recommendation.

The project area is within known distribution limits of federally listed threatened species that are under purview of the NOAA Fisheries. In accordance with the Endangered Species Act of 1973, as amended, it is the responsibility of the appropriate federal regulatory agency to review its activities and programs and identify any activity or program that may affect endangered or threatened species or their habitat. Determinations involving species under NOAA Fisheries jurisdiction should be reported to our Protected Resources Division at the letterhead address. If it is determined that the activities may adversely affect any species listed as endangered or threatened and under NOAA Fisheries purview, then formal consultation must be initiated.

We look forward to working with the EPA, COE, and other agencies in resolving our outstanding concerns in this matter. We appreciate the opportunity to provide comments on the DEIS and we note that additional comments and recommendations, including EFH conservation recommendations, may be provided in response to the EFH assessment and other supplemental information that we are awaiting. Related correspondence should be addressed to the attention of Ms. Jocelyn Karazsia at our Miami Office. She may be reached at 11420 North Kendall Drive, Suite #103, Miami, Florida 33176, or by telephone at (305) 595-8352.

Sincerely,

David H. Rackley

for Miles M. Croom
Assistant Regional Administrator
Habitat Conservation Division

cc:
EPA, WPB
FWS, Vero Beach
DEP, Tallahassee
SAFMC, Charleston
FSER45
FSER45-Karazsia
FSER43-Ruebsamen

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
PROGRAM PLANNING AND INTEGRATION
Silver Spring, Maryland 20910

April 28, 2004

Wesley B. Crum, Chief
U.S. EPA, Region 4
Coastal Section
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW
Atlanta, Georgia 30303

Dear Mr. Crum:

Enclosed are comments on the Draft Environmental Impact Statement for Designation of the Palm Beach Harbor Ocean Dredged Material Disposal Site (ODMDS) and the Port Everglades Harbor ODMDS. We hope our comments will assist you. Thank you for giving the opportunity to review this document.

Sincerely,

Susan A. Kennedy
Acting NEPA Coordinator

Enclosure

MEMORANDUM FOR: Susan A. Kennedy
Acting NEPA Coordinator

FROM: Charles W. Challstrom
Director, National Geodetic Survey

SUBJECT: DEIS-0404-04: Designation of the Palm Beach Harbor and Port Everglades Harbor Ocean Dredged Material Disposal Sites

The subject statement has been reviewed within the areas of the National Ocean Service (NOS) responsibility and expertise and in terms of the impact of the proposed actions on NOS activities and projects.

All available geodetic control information about horizontal and vertical geodetic control monuments in the subject area is contained on the National Geodetic Survey's home page at the following Internet World Wide Web address: http://www.ngs.noaa.gov After entering the this home page, please access the topic "Products and Services" and then access the menu item "Data Sheet." This menu item will allow you to directly access geodetic control monument information from the National Geodetic Survey data base for the subject area project. This information should be reviewed for identifying the location and designation of any geodetic control monuments that may be affected by the proposed project.

If there are any planned activities which will disturb or destroy these monuments, NOS requires not less than 90 days' notification in advance of such activities in order to plan for their relocation. NOS recommends that funding for this project includes the cost of any relocation(s) required.

For further information about geodetic control monuments, please contact:

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May 10, 2004

U.S. EPA, Region 4
ATTN: Wesley B. Crum, Chief
Coastal Section
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW
Atlanta, GA 30303

Dear Mr. Crum:

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR HARBOR DREDGED MATERIAL DISPOSAL

Thank you for providing us the opportunity to comment on the Draft EIS for the dredged material ocean disposal sites for the Palm Beach and Port Everglades Harbors. Palm Beach County supports establishing these areas in deeper water provided they are the last option used for disposal; however, we have concerns and offer the following comments with regard to the Palm Beach site:

Most important to us is the alternative disposal issue. The draft report does mention that the "issues of potentially reducing the opportunity for beneficial use of the dredged material, such as beach nourishment, due to the availability of offshore disposal has yet to be resolved" (sec. 1.1.3), and we are very concerned about this issue as well. It should be a requirement that any material that is beach compatible be used for beach nourishment or for building up nearshore berms. While the EIS indicated that beach compatible sand would not be disposed offshore, we request that a clear definition of beach compatibility be included in the document.

The EIS compared offshore disposal to upland disposal and concluded in all cases that offshore disposal is cheaper than upland disposal. However, use of non-beach compatible material to fill dredged holes in Lake Worth Lagoon was not evaluated and we request that additional analysis be conducted. We are concerned that the lower cost of ocean dumping would preclude the use of dredge material for beneficial uses and request that environmental benefits of the beneficial use be included in the cost/benefit analysis. Palm Beach County is currently involved with the Corps in using Palm Beach Harbor dredge material for environmental restoration and expects that similar projects would be feasible and desirable in the future. While these inshore restoration projects may be more expensive than offshore disposal, the environmental benefit would likely outweigh any additional costs incurred.

The draft states that the rates of disposal of material is estimated at about 50,000 cy/year; yet elsewhere typical projects were described as ranging from 14,000 to 179,000 cy. Lastly, a maximum of 500,000 cy/project was set, and this amount is far larger than the estimated annual disposal amount. Are larger projects anticipated? Is this larger limit related to the statement that the disposal area will be opened up to other federal entities and private dredging projects? We are concerned as to what will be the amounts disposed offshore with this range of numbers provided.

The dispersal models provided information on the potential dispersal of materials of a given makeup. We recommend that if the characteristics of potential disposal material is not within the range of the parameters used for modeling, than the model should be rerun using the differing characteristics before decisions concerning disposal are made.

The data detailing the environmental resources that could be buried in the disposal site has a number of blank areas. Additional studies need to be conducted before concluding that there will be no reef impacts. Reef mounds of *Oculina* coral are in the deeper zones and are very productive communities. We recommend that given that this is intended to be a long-term disposal site, the gaps in the 100 kHz sidescan sonar survey be filled in and that the disposal area vicinity also be scanned using 400 kHz sidescan for higher resolution. Additionally, ROV video monitoring should be conducted in the vicinity of any sidescan anomalies to verify absence of reefs and corals.

The Biological Assessment (Appendix E) should include recognition that Palm Beach County usually has the highest number of leatherback nests and the second highest number of loggerhead and green turtle nests in the continental United States.

In conclusion, our recommendations are that additional sampling is required to ensure that coral reefs will not be impacted; alternative disposal on or near beaches and/or Lake Worth Lagoon deep holes be required for all compatible material (regardless of cost) prior to approving

offshore disposal.

If offshore disposal occurs, then more safeguards for dumping should be required. Disposal 4.5 nmi. offshore can be influenced by speeds and directions of the current. We recommend that the disposal pattern be modified in that the south half of the site be targeted for north currents (and vice versa) with the southernmost ¼ being used for stronger north currents to allow more area for dispersal of materials within the dump site. This will require the vessel to slow upon approaching the dumping site to ascertain current condition before commencing dumping. In addition, by not focusing dumping on one spot, the potential for stacking the material on resources is minimized.

Thank you for the opportunity to provide comments. If you should have any questions, please call me at 561-233-2400 or Janet Phipps at 561-233-2513.

Sincerely,

Richard E. Walesky, Director

REW:jjp

Cc: Robert Weisman, County Administrator
Palm Beach County
John Studt, U.S. Army Corps of Engineers
Tim Rach, Florida Department of Environmental Protection
J.I. Palmer, Jr., Treasure Coast Regional Planning Council

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(MARCH 2003)
POLICIES FOR THE PROTECTION AND RESTORATION OF ESSENTIAL FISH HABITATS FROM BEACH DREDGING AND FILLING AND LARGE-SCALE COASTAL ENGINEERING

Policy Context

This document establishes the policies of the South Atlantic Fishery Management Council (SAFMC) regarding protection of the essential fish habitats (EFH) and habitat areas of particular concern (EFH-HAPCs) impacted by beach dredge and fill activities, and related large-scale coastal engineering projects. The policies are designed to be consistent with the overall habitat protection policies of the SAFMC as formulated and adopted in the Habitat Plan (SAFMC, 1998a) and the Comprehensive EFH Amendment (SAFMC, 1998b).

The findings presented below assess the threats to EFH potentially posed by activities related to the large-scale dredging and disposal of sediments in the coastal ocean and adjacent habitats, and the processes whereby those resources are placed at risk. The policies established in this document are designed to avoid, minimize and offset damage caused by these activities, in accordance with the general habitat policies of the SAFMC as mandated by law.

EFH At Risk from Beach Dredge and Fill Activities

The SAFMC finds:

1) In general, the array of large-scale and long-term beach dredging projects and related disposal activities currently being considered for the United States southeast together constitute a real and significant threat to EFH under the jurisdiction of the SAFMC.

2) The cumulative effects of these projects have not been adequately assessed, including impacts on public trust marine and estuarine resources, use of public trust beaches, public access, state and federally protected species, state critical habitat, SAFMC-designated EFH and EFH-HAPCs.

3) Individual beach dredge and fill projects and related large-scale coastal engineering activities rarely provide adequate impact assessments or consideration of potential damage to fishery resources under state and federal management. Historically, emphasis has been placed on the logistics of dredging and economics, with environmental considerations dominated by compliance with the Endangered Species Act for sea turtles, piping plovers and other listed organisms. There has been little or no consideration of hundreds of other species affected, many with direct fishery value.

4) Opportunities to avoid or minimize impacts of beach dredge and fill activities on fishery resources, and offsets for unavoidable impacts have rarely been proposed or implemented. Monitoring is rarely adequate to develop statistically appropriate impact evaluations.

5) Large-scale beach dredge and fill activities have the potential to impact a variety of habitats across the shelf, including:

   a) waters and benthic habitats near the dredging sites
   b) waters between dredging and filling sites
   c) waters and benthic habitats in or near the fill sites, and
   d) waters and benthic habitats potentially affected as sediments move subsequent to deposition in fill areas.

6) Certain nearshore habitats are particularly important to the long-term viability of commercial and recreational fisheries under SAFMC management, and potentially threatened by large-scale, long-term or frequent disturbance by dredging and filling:

   a) the swash and surf zones and beach-associated bars
   b) underwater soft-sediment topographic features
   c) onshore and offshore coral reefs, hardbottom and worm reefs
   d) inlets

7) Large sections of South Atlantic waters potentially affected by these projects, both individually and collectively, have been identified as EFH or EFH-HAPC by the SAFMC, as well as the Mid-Atlantic Fishery Management Council (MAFMC) in the case of North Carolina. Potentially Affected species and their EFH under federal management include (SAFMC, 1998b):

   a) summer flounder (various nearshore waters, including the surf zone and inlets; certain offshore waters)
   b) bluefish (various nearshore waters, including the surf zone and inlets)
   c) red drum (ocean high-salinity surf zones and unconsolidated bottoms nearshore waters)
   d) many snapper and grouper species (live hardbottom from shore to 600 feet, and – for estuarine-dependent species [e.g., gag grouper and gray snapper] – unconsolidated bottoms and live hardbottoms to the 100 foot contour).

e) black sea bass (various nearshore waters, including unconsolidated bottom and live hardbottom to 100 feet, and hardbottoms to 600 feet)
f) penaeid shrimp (offshore habitats used for spawning and growth to maturity, and waters connecting to inshore nursery areas, including the surf zone and inlets)
g) coastal migratory pelagics [e.g., king mackerel, Spanish mackerel] (sandy shoals of capes and bars, barrier island ocean-side waters from the surf zone to the shelf break inshore of the Gulf Stream; all coastal inlets)
h) corals of various types (hard substrates and muddy, silt bottoms from the subtidal to the shelf break)
i) areas identified as EFH for Highly Migratory Species (HMS) managed by the Secretary of Commerce (e.g., sharks: inlets and nearshore waters, including pupping and nursery grounds)

In addition, hundreds of species of crustaceans, mollusks, and annelids that are not directly managed, but form the critical prey base for most managed species, are killed or directly affected by large dredge and fill projects.

8) Beach dredge and fill projects also potentially threaten important habitats for anadromous species under federal, interstate and state management (in particular, inlets and offshore overwintering grounds), as well as essential overwintering grounds and other critical habitats for weakfish and other species managed by the Atlantic States Marine Fisheries Commission (ASMFC) and the states. The SAFMC also identified essential habitats of anadromous and catadromous species in the region (inlets and nearshore waters).

9) Many of the habitats potentially affected by these projects have been identified as EFH-HAPCs by the SAFMC. The specific fishery management plan is provided in parentheses:

a) all nearshore hardbottom areas (SAFMC, snapper grouper).
b) all coastal inlets (SAFMC, penaeid shrimps, red drum, and snapper grouper).
c) near-shore spawning sites (SAFMC, penaeid shrimps, and red drum).
d) benthic *Sargassum* (SAFMC, snapper grouper).
e) from shore to the ends of the sandy shoals of Cape Lookout, Cape Fear, and Cape Hatteras, North Carolina; Hurl Rocks, South Carolina; *Phragmatopora* (worm reefs) reefs off the central coast of Florida and nearshore hardbottom south of Cape Canaveral (SAFMC, coastal migratory pelagics).
f) Atlantic coast estuaries with high numbers of Spanish mackerel and cobia from ELMR, to include Bogue Sound, New River, North Carolina; Broad River, South Carolina (SAFMC, coastal migratory pelagics).
g) Florida Bay, Biscayne Bay, Card Sound, and coral hardbottom habitat from Jupiter Inlet through the Dry Tortugas, Florida (SAFMC, Spiny Lobster)
h) Hurl Rocks (South Carolina), The *Phragmatopoma* (worm reefs) off central east coast of Florida, nearshore (0-4 meters; 0-12 feet) hardbottom off the east coast of Florida from Cape Canaveral to Broward County; offshore (5-30 meters; 15-90 feet) hardbottom off the east coast of Florida from Palm Beach County to Fowey

Rocks; Biscayne Bay, Florida; Biscayne National Park, Florida; and the Florida Keys National Marine Sanctuary (SAFMC, Coral, Coral Reefs and Live Hardbottom Habitat).

i) EFH-HAPCs designated for HMS species (e.g., sharks) in the South Atlantic region (NMFS, Highly Migratory Species).

10) Habitats likely to be affected by beach dredge and fill projects include many recognized in state-level fishery management plans. Examples of these habitats include Critical Habitat Areas established by the North Carolina Marine Fisheries Commission, either in FMPs or in Coastal Habitat Protection Plans (CHAs).

11) Recent work by scientists in east Florida has documented important habitat values for nearshore, hardbottom habitats often buried by beach dredging projects, is used by over 500 species of fishes and invertebrates, including juveniles of many reef fishes. Equivalent scientific work is just beginning in other South Atlantic states, but life histories suggest that similar habitat use patterns will be found.

<u>Threats to Marine and Estuarine Resources from Beach Dredge and Fill Activities and Related Large Coastal Engineering Projects</u>

The SAFMC finds that beach dredge and fill activities and related large-scale coastal engineering projects (including inlet alteration projects) and disposal of material for navigational maintenance, threaten or potentially threaten EFH through the following mechanisms:

1) Direct mortality and displacement of organisms at and near sediment dredging sites
2) Direct mortality and displacement of organisms at initial sediment fill sites
3) Elevated turbidity and deposition of fine sediments down-current from dredging sites
4) Alteration of seafloor topography and associated current and waves patterns and magnitudes at dredging areas
5) Alteration of seafloor sediment size-frequency distributions at dredging sites, with secondary effects on benthos at those sites
6) Elevated turbidity in and near initial fill sites, especially in the surf zone, and deposition of fine sediment down-current from initial fill sites (ASMFC, 2002)
7) Alteration of nearshore topography and current and wave patterns and magnitudes associated with fill
8) Movement of deposited sediment away from initial fill sites, especially onto hardbottoms
9) Alteration of large-scale sediment budgets, sediment movement patterns and feeding and other ecological relationships, including the potential for cascading disturbance effects
10) Alteration of large-scale movement patterns of water, with secondary effects on water quality and biota
11) Alteration of movement patterns and successful inlet passage for larvae, post-larvae, juveniles and adults of marine and estuarine organisms

12) Alteration of long-term shoreline migration patterns (inducing further ecological cascades with consequences that are difficult to predict)
13) Exacerbation of transport and/or biological uptake of toxicants and other pollutants released at either dredge or fill sites

In addition, the interactions between cumulative and direct (sub-lethal) effects among the above factors certainly triggers non-linear impacts that are completely unstudied.
SAFMC Policies for Beach Dredge and Fill Projects and Related Large Coastal Engineering Projects

The SAFMC establishes the following general policies related to large-scale beach dredge and fill and related projects, to clarify and augment the general policies already adopted in the Habitat Plan and Comprehensive Habitat Amendment (SAFMC 1998a; SAFMC 1998b):

1) Projects should avoid, minimize and where possible offset damage to EFH and EFH-HAPCs.

2) Projects requiring expanded EFH consultation should provide detailed analyses of possible impacts to each type of EFH, with careful and detailed analyses of possible impacts to EFH-HAPCs and state CHAs, including short and long-term, and population and ecosystem scale effects. Agencies with oversight authority should require expanded EFH consultation.

3) Projects requiring expanded EFH consultation should provide a full range of alternatives, along with assessments of the relative impacts of each on each type of EFH, HAPC and CHAs.

4) Projects should avoid impacts on EFH, HAPCs and CHAs that are shown to be avoidable through the alternatives analysis, and minimize impacts that are not.

5) Projects should include assessments of potential unavoidable damage to EFH and other marine resources, using conservative assumptions.

6) Projects should be conditioned on the avoidance of avoidable impacts, and should include compensatory mitigation for all reasonably predictable impacts to EFH, taking into account uncertainty about these effects. Mitigation should be local, up-front and in-kind, and should be adequately monitored, wherever possible.

7) Projects should include baseline and project-related monitoring adequate to document pre-project conditions and impacts of the projects on EFH.

8) All assessments should be based upon the best available science, and be appropriately conservative so follow and precautionary principles as developed for various federal and state policies.

9) All assessments should take into account the cumulative impacts associated with other beach dredge and fill projects in the region, and other large-scale coastal engineering projects that are geographically and ecologically related.

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SAFMC Policy Statement Concerning Dredging and Dredge Material Disposal Activities

Ocean Dredged Material Disposal Sites (ODMDS) and SAFMC Policies.

The shortage of adequate upland disposal sites for dredged materials has forced dredging operations to look offshore for sites where dredged materials may be disposed. These Ocean Dredged Material Disposal Sites (ODMDSs) have been designated by the U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (COE) as suitable sites for disposal of dredged materials associated with berthing and navigation channel maintenance activities. The South Atlantic Fishery Management Council (SAFMC; the Council) is moving to establish its presence in regulating disposal activities at these ODMDSs. Pursuant to the Magnuson Fishery Conservation and Management Act of 1976 (the Magnuson Act), the regional fishery management Councils are charged with management of living marine resources and their habitat within the 200 mile Exclusive Economic Zone (EEZ) of the United States. Insofar as dredging and disposal activities at the various ODMDSs can impact fishery resources or essential habitat under Council jurisdiction, the following policies address the Council's role in the designation, operation, maintenance, and enforcement of activities in the ODMDSs:

The Council acknowledges that living marine resources under its jurisdiction and their essential habitat may be impacted by the designation, operation, and maintenance of ODMDSs in the South Atlantic. The Council may review the activities of EPA, COE, the state Ports Authorities, private dredging contractors, and any other entity engaged in activities which impact, directly or indirectly, living marine resources within the EEZ.

The Council may review plans and offer comments on the designation, maintenance, and enforcement of disposal activities at the ODMDSs.

ODMDSs should be designated or redesignated so as to avoid the loss of live or hard bottom habitat and minimize impacts to all living marine resources.

Notwithstanding the fluid nature of the marine environment, all impacts from the disposal activities should be contained within the designated perimeter of the ODMDSs.

The final designation of ODMDSs should be contingent upon the development of suitable management plans and a demonstrated ability to implement and enforce that plan. The Council encourages EPA to press for the implementation of such management plans for all designated ODMDSs.

All activities within the ODMDSs are required to be consistent with the approved management plan for the site.

The Council's Habitat and Environmental Protection Advisory Panel when requested by the Council will review such management plans and forward comment to the Council. The Council may review the plans and recommendations received from the advisory sub-panel and comment to the appropriate agency. All federal agencies and entities receiving a comment or recommendation from the Council will provide a detailed written response to the Council regarding the matter pursuant to 16 U.S.C. 1852 (i). All other agencies and entities receiving a comment or recommendation from the Council should provide a detailed written response to the Council regarding the matter, such as is required for federal agencies pursuant to 16 U.S.C. 1852 (i).

ODMDSs management plans should indicate appropriate users of the site. These plans should specify those entities/ agencies which may use the ODMDSs, such as port authorities, the U.S. Navy, the Corps of Engineers, etc. Other potential users of the ODMDSs should be acknowledged and the feasibility of their using the ODMDSs site should be assessed in the management plan.

Feasibility studies of dredge disposal options should acknowledge and incorporate ODMDSs in the larger analysis of dredge disposal sites within an entire basin or project. For example, Corps of Engineers analyses of existing and potential dredge disposal sites for harbor maintenance projects should incorporate the ODMDSs as part of the overall analysis of dredge disposal sites.

The Council recognizes that EPA and other relevant agencies are involved in managing and/or regulating the disposal of all dredged material. The Council recognizes that disposal activities regulated under the Ocean Dumping Act and dredging/filling carried out under the Clean Water Act have similar impacts to living marine resources and their habitats. Therefore, the Council urges these agencies apply the same strict policies to disposal activities at the ODMDSs. These policies apply to activities including, but not limited to, the disposal of contaminated sediments and the disposal of large volumes of fine-grained sediments. The Council will encourage strict enforcement of these policies for disposal activities in the EEZ. Insofar as these activities are relevant to disposal activities in the EEZ, the Council will offer comments on the further development of policies regarding the disposal/ deposition of dredged materials.

The Ocean Dumping Act requires that contaminated materials not be placed in an approved ODMDS. Therefore, the Council encourages relevant agencies to address the problem of disposal of contaminated materials. Although the Ocean Dumping Act does not specifically address inshore disposal activities, the Council encourages EPA and other relevant agencies to evaluate sites for the suitability of disposal and containment of contaminated dredged material. The Council further encourages those agencies to draft management plans for the disposal of contaminated dredge materials. A consideration for total removal from the basin should also be considered should the material be contaminated to a level that it would have to be relocated away from the coastal zone.

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May 7, 2004

Wesley B. Crum, Chief
Coastal Section
U. S. Environmental Protection Agency
61 Forsyth Street, SW
Atlanta, GA 30303

Dear Mr. Crum:

The South Atlantic Fishery Management Council (Council) offers the following comments on the U.S. Environmental Protection Agency's (EPA) Draft Environmental Impact Statement (DEIS) for Designation of the Palm Beach Harbor Ocean Dredged Material Disposal Site (ODMDS) and the Port Everglades Harbor ODMDS dated February 2004. These comments are relative to impacts on Essential Fish Habitat (EFH), Essential Fish Habitat- Habitat Areas of Particular Concern (EFH-HAPCs) and Council policies on Beach Dredging and Filling and Large-Scale Coastal Engineering and Ocean Dredged Material Disposal Sites. These comments are based on staff review of the proposal and the Council's approved habitat policies and Habitat Plan. In addition, these comments have been coordinated with the Florida Sub-Panel of our Habitat and Environmental Protection Advisory Panel (Habitat AP).

The ODMDS sites as proposed in the DEIS will impact areas identified as Essential Fish Habitat (EFH) in the 1998 Comprehensive Amendment Addressing Essential Fish Habitat in Fishery Management Plans (FMPs) of the South Atlantic Region prepared by the Council. These FMPs include coral, coral reef and live bottom habitat, red drum, shrimp, spiny lobster, coastal migratory pelagic species, and the snapper-grouper complex. This comprehensive amendment was prepared in accordance with provisions described in the 1996 reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act, P.L. 104-297 (MSFCMA) and has been approved by the Secretary of Commerce.

Specific comments are as follows:

1. The proposed activities could have potential adverse effects on areas designated as EFH and EFH-HAPCs by the Council. Categories of EFH found within proximity of the area of proposed activity include the water column, coral and coral reefs, hardbottom areas, *Sargassum*, sand and soft sediment habitats, the Continental Shelf and upper Continental Slope. The marine water column is important in the transport of nutrients, spawning, larval dispersal and migrating organisms. Coral and coral reef habitat constitutes EFH for juvenile and adult stages of species in the snapper grouper complex (comprising 73 species in 9 families) and spiny lobster. Hardbottom areas have been designated as EFH for snapper grouper species, including tilefishes; spiny lobster and penaeid shrimp. *Sargassum* constitutes EFH for species in the snapper grouper complex as well as dolphin. Sand habitats and soft sediments have been designated as EFH for species in the snapper grouper complex and penaeid shrimp. Species associated with the Continental Shelf and upper Slope include golden crab and royal red shrimp, respectively. EFH-HAPCs that would be impacted

by the proposed activity include *Sargassum*, coral and coral reefs (including deepwater corals such as *Lophelia* and *Enallopsammia*) and hardbottom habitats. The Council's Comprehensive Habitat Amendment contains additional information on EFH and EFH-HAPC designation for species under Council jurisdiction. The Council and Habitat AP are particularly concerned about impacts the proposed activity may have on deepwater habitats. The information provided in the DEIS is insufficient to demonstrate that the proposed activities will avoid and/or minimize impacts to EFH.

2. The proposed ODMDSs are within the depth range occupied by tilefishes which are managed under the Council's Snapper Grouper FMP. However, no discussion of the potential impacts to the local tilefish fishery were included in the DEIS. According to local fishermen, tilefish prefer certain sediment types. The DEIS includes possible alterations in sediment texture, grain size, and/or chemical composition as one of the unavoidable adverse effects of the proposed activity. Thus the proposed activity has the potential of adversely affecting the local tilefish fishery. These impacts must be evaluated.

3. The DEIS includes results of studies conducted to determine the fate of dredged material disposed at the proposed ODMDSs. These studies were deemed necessary due to the proximity of the proposed activity areas to the Gulf Stream and spin-off eddies. The Gulf Stream has been designated as EFH for many of the species managed by the Council, including those in the snapper grouper complex. It appears that time-averaged and prevailing currents were used in the fate studies and no discussion was included as to how eddies could potentially re-distribute this material to other habitats such as nearshore reefs.

4. The cumulative impacts section of the DEIS is not complete in that it fails to discuss potential synergistic or cumulative effects of other ongoing and planned activities in Broward and Palm Beach Counties. The Council is aware of other projects in the area that were omitted from the DEIS.

5. The side-scan sonar survey described in Appendix D of the DEIS was not of adequate resolution to detect the presence of deepwater habitats and evaluate impacts to these habitats. NOAA Fisheries in their comments on the DEIS recommends transects every 100 meters. Furthermore, the survey indicated the presence of an "east west low relief ridge" but failed to investigate whether this area contained hardbottom habitat. Underwater videos off Broward County in the depth range of the proposed activity have shown sparse hardbottom. Also, the presence of "numerous unidentified highly reflective objects" should be further investigated. Ground-truthing with underwater video should be conducted.

6. The Council's Policy for the Protection and Restoration of Essential Fish Habitat from Beach Dredging and Filling and Large-Scale Coastal Engineering (attached) identifies numerous threats to marine and estuarine resources from such activities. The unavoidable adverse effects from the proposed ODMDSs as described in the DEIS encompass many of these threats. In addition, the Council's Policy Statement Concerning Dredging and Dredge Material Disposal Sites (attached) establishes the Council's role in the designation, operation, maintenance, and enforcement of activities in the ODMDSs.

Thank you for the opportunity to provide comments on the DEIS. If you have any questions or need additional information please contact Roger Pugliese or Myra Brouwer at the Council office.

Sincerely,

David Cupka

David Cupka
Chairman

by RCM

cc: Council members & staff
Habitat and Coral Advisory Panels
Monica Smit-Brunello
Ginny Fay, Joe Kimmel, Miles Croom and David Dale
Nancy Thompson and John Merriner

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May 10, 2004

U.S. EPA, Region 4
ATTN: Wesley B. Crum, Chief
Coastal Section
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW
Atlanta, GA 30303

Dear Mr. Crum:

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR HARBOR DREDGED MATERIAL DISPOSAL

Thank you for providing us the opportunity to comment on the Draft EIS for the dredged material ocean disposal sites for the Palm Beach and Port Everglades Harbors. Palm Beach County supports establishing these areas in deeper water provided they are the last option used for disposal; however, we have concerns and offer the following comments with regard to the Palm Beach site:

Most important to us is the alternative disposal issue. The draft report does mention that the "issues of potentially reducing the opportunity for beneficial use of the dredged material, such as beach nourishment, due to the availability of offshore disposal has yet to be resolved" (sec. 1.1.3), and we are very concerned about this issue as well. It should be a requirement that any material that is beach compatible be used for beach nourishment or for building up nearshore berms. While the EIS indicated that beach compatible sand would not be disposed offshore, we request that a clear definition of beach compatibility be included in the document.

The EIS compared offshore disposal to upland disposal and concluded in all cases that offshore disposal is cheaper than upland disposal. However, use of non-beach compatible material to fill dredged holes in Lake Worth Lagoon was not evaluated and we request that additional analysis be conducted. We are concerned that the lower cost of ocean dumping would preclude the use of dredge material for beneficial uses and request that environmental benefits of the beneficial use be included in the cost/benefit analysis. Palm Beach County is currently involved with the Corps in using Palm Beach Harbor dredge material for environmental restoration and expects that similar projects would be feasible and desirable in the future. While these inshore restoration projects may be more expensive than offshore disposal, the environmental benefit would likely outweigh any additional costs incurred.

The draft states that the rates of disposal of material is estimated at about 50,000 cy/year; yet elsewhere typical projects were described as ranging from 14,000 to 179,000 cy. Lastly, a maximum of 500,000 cy/project was set, and this amount is far larger than the estimated annual disposal amount. Are larger projects anticipated? Is this larger limit related to the statement that the disposal area will be opened up to other federal entities and private dredging projects? We are concerned as to what will be the amounts disposed offshore with this range of numbers provided.

The dispersal models provided information on the potential dispersal of materials of a given makeup. We recommend that if the characteristics of potential disposal material are not within the range of the parameters used for modeling, than the model should be rerun using the differing characteristics before decisions concerning disposal are made.

The data detailing the environmental resources that could be buried in the disposal site has a number of blank areas. Additional studies need to be conducted before concluding that there will be no reef impacts. Reef mounds of *Oculina* coral are in the deeper zones and are very productive communities. We recommend that given that this is intended to be a long-term disposal site, the gaps in the 100 kHz sidescan sonar survey be filled in and that the disposal area vicinity also be scanned using 400 kHz sidescan for higher resolution. Additionally, ROV video monitoring should be conducted in the vicinity of any sidescan anomalies to verify absence of reefs and corals.

The Biological Assessment (Appendix E) should include recognition that Palm Beach County usually has the highest number of leatherback nests and the second highest number of loggerhead and green turtle nests in the continental United States.

In conclusion, our recommendations are that additional sampling is required to ensure that coral reefs will not be impacted; alternative disposal on or near beaches and/or Lake Worth Lagoon deep holes be required for all compatible material (regardless of cost) prior to approving offshore disposal.

If offshore disposal occurs, then more safeguards for dumping should be required. Disposal 4.5 nmi. offshore can be influenced by speeds and directions of the current. We recommend that the disposal pattern be modified in that the south half of the site be targeted for north currents (and vice versa) with the southernmost ¼ being used for stronger north currents to allow more area for dispersal of materials within the dump site. This will require the vessel to slow upon approaching the dumping site to ascertain current condition before commencing dumping. In addition, by not focusing dumping on one spot, the potential for stacking the material on resources is minimized.

Thank you for the opportunity to provide comments. If you should have any questions, please call me at 561-233-2400 or Janet Phipps at 561-233-2513.

Sincerely,

Richard E. Walesky

Richard E. Walesky, Director

REW:jjp

Cc: Robert Weisman, County Administrator
Palm Beach County
John Studt, U.S. Army Corps of Engineers
Tim Rach, Florida Department of Environmental Protection
J.I. Palmer, Jr., Treasure Coast Regional Planning Council

May 11, 2004

TO: Lauren Milligan, Office of Intergovernmental Programs

FROM: Roxane Dow, Bureau of Beaches and Coastal Systems

SUBJECT: DEIS for Designation of the Palm Beach Harbor and Port Everglades Harbor ODMS

The Bureau has reviewed the draft environmental impact statement (DEIS) for the designation of 2 ocean dredged material disposal sites (ODMS) for the referenced ports. We have no specific objections to the designation of these sites. Side scan sonar was used to survey for hard bottom habitat and the modeling conducted by the Waterways Experiment Station seems to assure that turbidity plumes will not effect any nearby reefs. The DEIS makes it quite clear that beach quality material will be placed on the adjacent beaches when included in any maintenance dredging event. Final decisions about where dredged materials will actually be placed will be based upon the descriptions of sediment quality submitted as part of the permit applications to the Bureau.

We note, however, that the DEIS does not include an investigation of other beneficial reuse options, as requested in the Department's November 24, 1997 letter in response to the scoping notice. An exhaustive review was completed of potential upland disposal sites, but no consideration of alternative use of non-beach quality material was found in the document. We have recently been approached about the use of intracoastal dredged material for use as landfill cover, and recommend that the ports and the USACE discuss the possibility of use of maintenance dredged material with nearby counties and municipalities as well as the DEP Southeast District office.

We have some recommendations to improve the document. The DEP Southeast District Office should be consulted on the most recent applications and status on the placement of fiber optic cables and gas transmission lines. The terminology for beach placement should be standardized throughout the document; the Bureau's preferred term is "beach nourishment", as most if not all of the possible placement beaches have been "restored". We do not use the outdated term "renourishment". The first sentence on page 75 on nutrient loadings from wastewater treatment plant ocean outfalls needs to be revised to make the statement more meaningful, and an appropriate reference should be cited. Some appendices are missing, notably the Biological Assessments, and others are included that are not cited in the Table of Contents.

Finally, we have previously requested that the USACE revise its statement on coastal zone consistency with Chapter 161, Florida Statutes in all documents. Chapter 161, Florida Statutes is much more than the stated regulation of construction projects seaward of mean high water. It includes the state's long term Strategic Beach Management Plan and it's associated inlet management plans, as well as authority with reguard to activities proposed seaward of the Coastal Construction Control Line. We would be happy to meet with the USACE to revise this section to assure that future planning activities adequately consider the full range of programs included in Chapter 161 and Florida's Coastal Zone Management Program.

Thank you for the opportunity to comment. Please call me if you have any questions.

cc. Michael Barnett, P.E.
Paden Woodruff

No.	Agency/ Commenter Name	Comment	Response	Action
1	NOAA- Office of Ocean and Coastal Resource Management	Page 103: the correct title of our office is Office of Ocean and Coastal Resource Management.	It is assumed that this comment refers to the agency list provided on page 88; no page 103 exists for the EIS.	The agency list was updated to provide the correct agency title.
2		Appendix L: NOAA regulations require that a consistency determination include a detailed description of the proposed activity, its expected effects on the coastal zone and an evaluation of the activity in light of the applicable enforceable policies of the state coastal management program. The requirements for a consistency determination are set forth in NOAA regulations at 15 CFR part 930 subpart C.	A description of the proposed project will be added to Appendix L (now Appendix N). It is believed that expected effects on the coastal zone and an evaluation of activity in light of applicable enforceable policies of Florida's coastal management program as outlined in 15 CFR Part 930 Subpart C.	A description of the proposed project was added to Appendix L.
3		The content of a consistency determination is located at 15 CFR S 930.39. The definition of coastal effects is located at 15 CFR S 930.11(e). OCRM notes that the application of "coastal effects in Appendix L may be incomplete for Florida Statutes: Chapters 253 and 258. While the disposal sites are not within state waters, if use of the disposal sites and/or the disposal materials would have reasonably foreseeable effects on the state's submerged lands, then the EPA must be consistent to the maximum extent practicable with the enforcement policies of Chapters 253 and 258 and those policies should be evaluated for consistency.	As detailed in Appendix N and the project EIS, no foreseeable significant impacts to state submerged lands are anticipated as a result of the proposed project. As such, the proposed project is believed to be consistent with Florida Statutes, Chapters 253 (State Lands) and 258 (State Parks and Preserves). Statements to this effect will be included in Appendix N.	Statements were added to Appendix L as indicated in the comment's response.
4		The EPA should fully apply the Coastal Zone Management Act federal consistency effects test and consult with the FL Coastal Management Program on whether the consistency determination is complete.	Noted.	None taken.
5	NOAA- NMFS	Five species of sea turtles, including the loggerhead, green, leatherback, hawksbill, and Kemp's ridley may occur in the action area. Non-hopper dredges are unlikely to adversely affect sea turtles. NOAA believes hopper dredging at Port Everglades Harbor falls within the scope of the general type of hopper dredging activities proposed, described, and analyzed in the September 25, 1997 Regional Biological Opinion (RBO).	Noted.	NOAA's opinion regarding project effects on the listed sea turtle species was added to the EIS.
6		The blue, finback, humpback, right, sei, and sperm whale are found in the SE Atlantic. The right whale has been documented to occur within 20 nm of the US coastline 80% of the time. The use of dredges and the disposal of dredged material using a near-instantaneous dumping barge/scow may not adversely affect whales, although the RBO requires dredges to maintain a lookout for right whales and carefully avoid them. Adverse effects to whales are unlikely to occur from the project.	Noted.	NOAA's opinion regarding project effects on the listed whale species was added to the EIS.

7	NMFS	The effects of the proposed activity are entirely comparable to those that have been previously analyzed by the RBO. Thus, taken in association with the use of hopper dredges from the proposed activity have been previously anticipated in the RBO and shall be charged to the annual incidental take statement (ITS) established in the RBO. All terms and conditions of the reasonable and prudent measures of the ITS must be adhered to during the implementation of the proposed activity. Only incidental takes that occur while these measures are in full implementation are authorized.	Noted.	None taken.
8		The endangered shortnose sturgeon may occur off FL. The smalltooth sawfish may also occur. However, the occurrence of these species has not been documented in the vicinity of the project area. No effects to these species are likely to occur from the project.	Noted.	NOAA's opinion regarding project effects on the shortnose sturgeon and smalltooth sawfish was added to the document.
9		Prior to proceeding with the proposed action, NOAA Fisheries' Habitat Conservation Division must be consulted pursuant the Magnuson-Stevens Fishery Conservation and Management Act's requirements for EFH consultation.	Noted. EFH consultation has been initiated between EPA and NMFS.	Consultation has been initiated between EPA and NMFS; an EFH assessment is in preparation for inclusion in the EIS.
10	Port Everglades Pilots Association	Currently there are 35% more ship arrivals at Port Everglades than 9 years ago, and the ships are significantly larger. The number and size of ships calling at PE are anticipated to increase in the future. The need to provide and maintain safe navigational conditions at PE is of paramount importance. Given the level of need for the offshore disposal site and the lack of adverse impacts, there is no reason to delay and every reason to move forward with designation.	Noted. The EPA and USACE concur with this comment.	None taken.
11	Department of Port Everglades	In order for the Port to maintain a safe and navigable harbor, it is of the utmost importance for us to be able to dispose of dredged material. As we undergo expansion, the only avenue for this material to be disposed of will be to an offshore disposal facility. Of the two areas under study, the Port prefers the site nearer to the shore be selected.	Noted.	None taken.
12	Crowley Liner Services	It is imperative to the continuation of safe navigational conditions that the designation of this ODMDS occurs as soon as possible.	Noted. The EPA and USACE concur with this comment.	None taken.
13	FL Dept. of Environmental Protection	The Department hereby notifies the EPA and USACE that the state, at this time, does not object to the consistency determination provided with the DEIS.	Noted.	None taken.
14		All subsequent environmental documents must be reviewed to determine the project's continued consistency with the FCMP.	Noted.	None taken.
15		The DEIS indicates, and FL strongly agrees, that where appropriate, beach re-nourishment is the preferred alternative for disposal.	Noted. The EPA and USACE concur with this comment.	None taken.

16	FDEP	To ensure that disposed materials remain within the designated site and do not affect resources adjacent to the sites, disposal should not occur during times of high currents such as eddy intrusions.	The Site Management and Monitoring Plans have accounted for the current varibility at the site. A disposal zone with a radius of 600 feet has been established to assure that disposed dredged material is deposited within the disposal site boundaries. The size of this zone is based on short-term fate modeling conducted by EPA of the disposal plumes under mutiple current regimes (including high currents) measured near the proposed ODMDSs. In addition, the modeling discussed in the Draft EIS (Appendix I) utilized exceedence velocities of 99% in its analysis. Efforts at the Miami ODMDS to restrict disposal during periods of onshore current events have indicated that these events are of short duration and occur at a frequency of 2.5% (Proni et. Al, 1998)	None taken.
17		An exhaustive review was completed of potential upland disposal sites; however, no consideration of alternative uses of non-beach quality material was included in the DEIS as requested in the Department's 1997 scoping notice response. The Department has recently been contacted about using intracoastal material as landfill cover indicating that a potential need for dredged material might exist. Options for beneficial use should be developed so that offshore disposal is unnecessary. Therefore, we recommend that the ports and USACE investigate possible beneficial uses of dredged material with nearby counties and municipalities and document in the FEIS.	Beneficial use of dredged material is always given primary consideration by the USACE for each dredging event. Every attempt will be made to find beneficial uses for material dredged from the two harbors in future dredging operations. However, beneficial use is such a project-specific option and specific beneficial uses depend on such a wide array of factors that an exhaustive accurate review of beneficial uses of dredged material is not possible for this EIS.	None taken.
18		Different spatial and temporal sampling regimes were carried out at the candidate sites and therefore the individual sites were not evaluated equally. It appears that the preferred sites were determined prior to completing detailed survey analysis. The DEIS should have clearly explained that information obtained in the broader surveys was used to identify those sites which are more environmentally acceptable and then more rigorous surveys were conducted.	The different spatial and temporal sampling regimes used in the various surveys are in part the result of changing decisions regarding the project since its inception in the 1980s. Initial surveys focused more heavily on the then-preferred sites. Later surveys included the other candidate sites to ensure that at least the minimum acceptable number of sampling stations were collected from each candidate site. Additional information will be added to the EIS providing summaries of the timing and methods for each referenced survey.	Text was added to the EIS providing summaries of timing and methods for all surveys referenced in the EIS.

19	FDEP	Video and still photography was collected at the PE site in 1986. Information was presented in the DEIS regarding PB photo documentation, but the timing of and methods for conducting the surveys are unclear. The state is concerned that photodocumentation of these sites may be outdated. EISs should include analyses of recent geophysical and visual surveys. The photodocumentation should also be used to verify the identification of specific targets in side scan sonar surveys.	See the response to comment 18 above regarding the timing and methods of the surveys. Photodocumentation of representative hard bottom and rubble areas detected in the sidescan sonar surveys was obtained (see Section 3.18). The additional sidescan sonar surveys conducted by EPA in 1998 verified the extent of the previously identified habitats. However, EPA does not believe there is any reason to believe that these habitats have changed since they were identified in the 1980's and there should be no concern that the photodocumention is outdated.	See the action to comment 18 above.
20		Photodocumentation results show no preferred habitat for Oculina varicose in the 4.5-mile PB site, but Oculina is known to occur within 1.7 nm of the site. Visual surveys of all areas potentially impacted by disposing of materials at the site, whether inside or outside the site, should be conducted to ensure that no preferred habitat exists within the impact area.	Sidescan sonar results (Appendix E figure 7) indicate hard bottom approximately 1.5 nm northwest of northwestern boundary of the Palm Beach Harbor 4.5-mile site. This area coincides with the depth contour of the Oculina within 1.7 nm of the 4.5-mile site identified by Reed (1980) and is therefore likely similar substrate. Consequently, the sidescan sonar survey is deemed to be of sufficient resolution to locate occurrences of Oculina or other corals in the project area. Analysis of the sidescan sonar results indicates that no other such areas are apparent in the vicinity of the study area. The data collected in the sidescan sonar and other previous surveys of the project area were deemed adequate by the EPA to ensure that Oculina and other corals would not be affected by the proposed project. Sidescan surveys extended at least one nm to the east and west of the alternative sites and 2 nm to the north and sourth. No further surveys are planned.	None taken.
21		The NEPA analyses should address the possibility of other deepwater coral resources such as black coral which have been noted in this area.	See the response to comment 20 above.	See the action to comment 21 above.

22	FDEP	In a 2002 letter to the EPA, the Dept. emphasized that site capacity requirements, project material dispersion and the LTFATE of deposited material should be based on the maximum volume of material expected to be disposed at each site. The determination of an annual average of 50,000 cy seems inadequate considering the total amount of dredging expected at each port. Modeling and planning at the site to avoid long-term impacts should consider the amount of dredged material expected to be placed in the ODMDS during its lifetime. The modeling completed for the DEIS used a mound site 10x the average annual amount (500,000 cy) to be deposited. This volume appears to be low since larger planned events, including 2 million cy at PB) may occur.	Text will be added to the document reflecting revised volumes for disposal at each site. The 2 million cy dredging event at PB is no longer planned. Feasibility studies will be conducted for any expansion projects at the harbors. These feasibility studies will determine what capacity is necessary to accommodate dredged material resulting from expansion activities, and will examine disposal options. Should ocean disposal be deemed appropriate, and should the designated ODMDSs prove to be of adequate capacity, then they may be used for the disposal of dredged material from expansion projects. Should the sites' capacities prove inadequate or ocean disposal be deemed inappropriate, other disposal or use options will be pursued.	Text was added to the EIS reflecting revised disposal volumes for each site.
23		The cumulative impacts analysis should provide the most up-to-date information for and thoroughly evaluate all projects being conducted in the area of impact. Projects evaluated in the DEIS that should be updated include AES Ocean Express and Tractebel Calypso pipelines; telecommunication cables; PE Harbor Deepening Project; and the Hillsboro Inlet dredging project. FEISs with updated information concerning locations and projected impacts of both proposed pipelines were recently released. Cumulative analyses should include this updated information. Where available, information about the telecommunication cables should also be updated. The discussion of the PEHDP should include an estimate of the amount of dredged material from the project and estimated disposal volumes for other dredging projects should also be included. Hillsboro Inlet dredging should be added into the analysis of past projects. In addition, NEPA analyses should address the cumulative impacts of using these sites along with other ODMDSs along the SE FL coasts.	The cumulative impacts section will be expanded to provide additional discussion on proposed pipelines, telecommunication cables, and other appropriate projects. The proposed project involves designation of ODMDSs in deepwater locations, and as such any cumulative impacts resulting from the project would only occur to deepwater areas. Consequently, a cumulative impact assessment inovlving the Hillsboro Inlet, which involved nearshore placement, is outside the scope of this project. Similarly, a cumulative impact assessment involving other ODMDSs in southeast Florida, which are significantly beyond the area of influence for the project, is likewise beyond the scope of the poject.	Information about proposed pipelines and telecommunication cables in the vicinity of the project area was incorporated into this section.
24		The FWCC requests clarificaiton of why the site modeling found the disposal sites to be non-dispersive despite persistent bottom currents.	Information on methodology and assumptions for dispersion studies of the project area is contained in Appendix I. The parameters used in the models were based on the best available information. The State of Florida was involved in the Scoping process for these studies and provided input on the models during this time.	None taken.

25	FDEP	The Treasure Coast Regional Planning Council indicates that the preferred offshore site for PB is not in conflict or inconsistent with the Strategic Regional Policy Plan provided that coral reefs and other environmentally sensitive marine resources are not impacted by the disposal operation. Monitoring should occur to ensure that dispersion and transport of disposed materials does not impact reefs and other sensitive marine resources. All opportunities to utilize the dredged material for beneficial uses such as beach nourishment or lagoon restoration should be considered prior to disposal.	Noted. Monitoring is planned for the proposed ODMDSs and is detailed in Appendix J. Concerns regarding beneficial use of dredged material are addressed in comment 17 above.	None taken.
26		South FL Regional Planing Council staff notes that while the project will further the council's goals for a more livable, sustainable, and competitive region, the project should be reviewed to ensure that it is consistent with the goals and policies of the Strategic Regional Policy Plan for South FL regarding protection of shoreline, estuarine and benthic communities, fisheries and associated habitats.	Noted. The EPA and USACE believe the project to be consistent with the council's goals and policies.	None taken.
27		Section 1.2.4, p. 4: The annual disposal volume to be placed in each proposed ODMDS is 50,000 cy. Will this volume be adequate considering the dredging projects using the ODMDS will need to dispose of volumes well in excess of 50,000 cy?	See the response to comment 22 above.	See the action to comment 22 above.
28		Section 2.3, Figures 1-2: These figures and subsequent figures in the text and on the CD are difficult to analyze. The CD maps cannot be enlarged to a readable size. NEPA documents should provide maps and figures that are clear and readable at most magnifications.	Enhanced figures will be provided in the Final EIS.	Enhanced figures have been provided.
29		Sections 3-4: There are several citations of recognized experts (Porter, 1987; Marshall, 1971) not included in the References section.	Missing citations will be included in the References section of the Final EIS.	Missing citations have been included in the References section of the EIS.
30		Section 3.4, p. 23: The EIS should clearly describe the date of, location, and methods used by CSA in conducting the video surveys.	See the response to comment 19 above.	See the action to comment 19 above.
31		Section 3.4, p. 23: According to the text, no preferential substrate for Oculina was found in the 4.5 mile PB site during the video surveys. While it appears that geophysical surveys were used to determine if this substrate was found within the impact areas calculated by the modeling, video surveys of the area should be conducted to confirm that no preferential substrate for Oculina would be impacted. The EIS should provide a map detailing the locations of known Oculina and the location of the ODMDS candidate sites.	See the response to comment 20 above. Known Oculina locations in the vicinity of the proposed Palm Beach Harbor site will be added to Figure 6 in the Final EIS.	Known Oculina locations were added to Figure 6.
32		Section 3.4, p. 23: The state is concerned that an increase in turbidity and/or sedimentation resulting from disposal activity in the ODMDS should affect Oculina habitat since it is not clear in the DEIS whether it could exist within the area of impact.	Concerns regarding the presence of Oculina and other corals in the project area are addressed in comment 20 above.	See the action to comment 20 above.

33	FDEP	The EIS should discuss information discerning whether substrates located in the sites or in proximity to the sites may be preferential to other species of coral besides Oculina. By specifically looking for Oculina in video surveys, other important species may have been overlooked. The Tractebel Calypso Pipeline Project documented the presence of deepwater corals including black coral offshore Broward County.	The video surveys did not specifically look for Oculina. A summary of the video surveys including species identified is presented in Section 3.18 of the Final EIS. The Tractebel Calypso Pipeline Project did not document the presence of any deepwater corals at the depth or distance offshore of the Port Everglades Harbor 4-mile site. (see Section 3.6 of the Tractebel Final EIS)	See the action to comment 20 above.
34		Section 3.5, p. 30: Fisheries data provided in tables 5 and 6 should be updated to include the most recently available version.	Tables 5 and 6 will be updated to include the most recently available information.	Tables 5 and 6 have been updated using NMFS' EFH Plan for the South Atlantic Region, updated February 2002.
35		Section 3.13.1, p. 44: More recent accounts of the recreational and commercial fisheries in the area should be included in the FEIS.	More recent data regarding recreational and commercial fisheries will be included in the FEIS.	More recent data regarding artificial reefs in the vicinity of the project area was included in the EIS. Additional data regarding fisheries in the area is available in the EFH assessment.
36		Section 3.17, p. 57: The discussion should be updated. Both the AES Ocean Express LLC and the Tractebel Calypso LLC natural gas pipeline proposals have a published FEIS. The document should also include information concerning present and future telecommunication and fiber optic cables in the area. The last sentence notes that the Tractebel Calypso pipeline's proposed route does not interfere with any of the PE ODMDS. When comparing maps in the Calypso FEIS with the DEIS, the site seems in close proximity of the pipeline route. The document should provide a map detailing the location of the ODMDSs in relation to the Tractebel Calypso pipeline or any other significant structure in the area.	Additional information regarding the Ocean Express and Calypso pipelines and telecommunication cables will be incorporated into this section. As recorded in the FEIS for the Calypso Pipeline, the Federal Energy Regulatory Commission, in its response to the EPA's letter dated 17 September 2003 regarding potential conflicts with the pipeline and the rpoposed sites, stated the the proposed pipeline alignment would not impact either Port Everglades Harbor site. Accurate information regarding the specific location and layout of the proposed pipelines is not currently available; consequently a map providing the locations of the pipelines with respect to the proposed ODMDSs would not provide meaningful data and such a figure is not intended for inclusion at this time.	Additional information regarding proposed pipelines and telecommunications cables was incoproted into this section.

37	FDEP	Section 3.18.1, p. 58: The EIS should include a more thorough discussion about biological activity in the area as described in the DEIS. Could the biological disturbances (mounds and depressions) found at the PB 4.5 mile site have been made by tilefish? Tilefish have become important fishery in this area and according to fishermen this species may only exist in certain types of sand habitats. Altering the sediments with dredge disposal may destroy EFH for this fishery.	Tilefish habitat (as well as that of other fish species) in relation to the project area has been addressed in the EFH assessment. The substrate at the PB 4.5 site appears to be too sandy and silty for tilefish. The tilefish require a malleable (clayey) substrate to create burrows.	Tilefish habitat was addressed in the EFH assessment.
38		Section 3.18.1, p. 58: The EIS should provide more detailed information concerning the surveys completed in the candidate sites including a map clearly showing the locations of the video and photography; descriptions of when the surveys were conducted and descriptions of survey methods used.	See the response to comment 18 above. No maps depicting survey locations are planned at this time as we believe the added narrative provides sufficient description of the scope of the surveys.	See the action to comment 18 above.
39		Section 3.18.2, p. 58: NEPA documents should be based on recently obtained information, including video/photography surveys necessary to verify the absence/presence of isolated corals and essential fish habitat. Based on the 1986 video, depressions, mounds, and other biological activity were noted in the area. This biological activity could be indicative of species now being utilized in a commercial fishery that were not in 1986 (e.g., tilefish).	See the response to comment 37 above.	See the action to comment 37 above.
40		Section 4.3.3, p. 60: In the discussion regarding 40 CFR 228.5(b), Oculina is noted as being found 1.7 nm west of the preferred PB ODMDS. The statement is then made that "at these locations, the likelihood of impacts to nearshore amenities is small." Is this statement applicable to Oculina, by referring to it as a nearshore amenity? If not, will there be a likelihood of impacts to Oculina from dispersion?	Oculina is considered a nearshore amenity in this case, and as such the statement is applicable to Oculina.	None taken.
41		Section 4.3.3, p. 60: The EIS should clearly discuss whether the completed surveys confirm that no other areas of Oculina or other possible coral habitat are in the range of turbidity and sedimentation impact that will result from disposal in the ODMDS. According to Appendix I, 2,400 m is the maximum distance for sand concentration to be 1 mg/l or less from the disposal location, yet it is unclear whether or not the surveys extended at least that far.	Concerns regarding the presence of Oculina and other corals in the project area are addressed in comment 20 above. The surveys provided coverage extending at least one nm (3700 m) from the western edge of the preferred sites, therby providng adequate coverage for disposal events within the disposal site.	None taken.
42		Section 4.3.3, p. 61: The discussion of dispersion modeling results refers to Section 5.07; however, no Section 5.07 could be found.	The reference will be corrected in the Final EIS.	The reference has been corrected.
43		Section 4.3.4, p. 62: The discussion in "location in relation to beaches and other amenity areas [CFR 228.6(a) 3]" does not discuss the Oculina habitat referenced in previous discussions [e.g., CFR 228.5(b)]. Oculina should be discussed in this section also.	Oculina will be discussed in this section in the Final EIS.	Text regarding Oculina in the vicinity of the project area was added to this section.
44		Section 4.3.4, p. 67: Specific Site Section Criteria 8 [40 CFR 228.6(a) 8] should be re-evaluated to include the tilefish fishery.	Specific Criteria #8 will be re-evaluated to include the tilefish fishery.	Specific Criteria #8 was reevaluated with respect to tilefish.

45	FDEP	Section 4.5, p. 74: The cumulative impact section in the NEPA documents should contain a thorough review of the effects of past, present and future projects and their possible cumulative effects with the proposed ODMDSs. Information concerning the telecommunication and fiber optic cables should be included in the EIS, along with any possible cumulative impacts. The Seafarer pipeline should be included in Section 4.5.3 Reasonably Foreseeable Future Projects. The Tractebel Calypso and AES Ocean Express pipeline projects should be updated to include information from their respective FEISs.	See the response to comment 23 above.	See the action to comment 23 above.
46		Section 4.11, p. 80: Please refer to comments from Section 3.4, p. 23.	See the response to comment 19, 20, 31, and 32 above.	See the action to comment 19, 20, 31, and 32 above.
47		The pages of all appendices should be numbered.	Numbering of appendices pages is not planned at this time. Colored dividers will be added to hard copies of the Final EIS to provide easier reference to the locations of the various appendices.	Colored dividers have been added to the appendices.
48		Appendix D, Section 2.0: The same side scan sonar resolution should be used to survey all potential ODMDSs. Employing different survey methods can result in the appearance that a preferred site was pre-determined instead of using the surveys to determine a suitable site.	A constant range setting and vessel speed was utilized for all of the alternate sites. All of the alternative sites received the minimum 100% coverage. Overlap was increased at the PE-4 and PB-5 due to the concern expressed by the State of Florida regarding possible presence of hardbottom in these areas.	None taken.
49		Appendix D, Section 2.0: The discussion notes that a wider transect spacing was used for secondary areas because these areas were expected to be outside the impact area. The discussion should include an explanation of how the size secondary area to be surveyed was determined. The side scan sonar surveys were conducted in August 1998, yet there report for the dispersion study was no dated until September 1998. Therefore, the assumption used to determine the impact area for the secondary surveys may have been flawed since the side scan surveys were completed before the modeling report which detailed the distance of impact was completed.	The size of the secondary areas was determined by modeling conducted by EPA prior to the 1998 dispersion study. The modeling conducted by EPA examined deposition patterns under multiple current regimes as measured by a nearby ADCP. The mound was found to extend up to 0.5 nmi from the disposal location at the PB-4.5 mile site and PE-4 mile site and up to 1 nmi from the disposal location for the PB-9 mile and PE-7 mile sites.	None taken.
50		Appendix D, Section 2.0: The EIS should include information about the transect lengths and the distance surveyed beyond the site boundaries. This is not clear from the text or from the referenced Appendix A figures.	A minimum of 0.5 nmi was surveyed to the east and west of each alternative site and 1 nmi to the north and south. Transects at the PE-4 mile and PB-4.5 mile sites were extended 2 nm in each direction with less overlap to address concerns raised by the State of Florida regarding potential hard bottom in the area.	Text was added to the main body of the EIS summarizing survey activities and methods.

51	FDEP	Appendix D, Section 2.0: The evaluation of ODMDSs should include still and video photography, geophysical and/or additional surveys which may be necessary to help characterize the significance of features at the ODMDS identified with side scan sonar. Side scan sonar results alone still leave questions as to the significance of features found by this survey method.	See the response to comment 20 above.	See the action to comment 20 above.
52		Appendix D, Table 1: Please clarify the terms used under heading survey area.	PE-A refers to the area encompassing and immediately surrounding (0.5nm) the Port Everglades Harbor 4 Mile alternative site. PB—A refers to the area encompassing and surrounding the Palm Beach Harbor 4.5 mile, 3 mile and interim site alternatives. PB-B refers to the area encompassing and surrounding the Palm Beach Harbor 9 Mile alternative site. PE-B refers to the area encompassing and surrounding the Port Everglades Harbor 7 mile alternative site. PE-C and PE-D refer to the down and up current areas of the Port Everglades Harbor 4 mile alternative site. PB-C and PB-D refer to the down and up current areas of the Palm Beach Harbor 4.5 mile site.	None taken.
53		Appendix I, Section 2: Table 4 states that the cohesive/non-cohesive behavior is not considered for the sand and are considered for the silt. The EIS should describe whether or not actual sediment samples were analyzed to justify these two assumptions. The discussion states that "if the sediment contains cohesive material, a combination of buoyancy and suspension may transport the cloud considerable distance from the point of disposal." A sensitivity test should be done to demonstrate how the sediment will behave if a considerable percentage is found to be cohesive.	The State of Florida was involved in the Scoping Process of this study and was invited to comment on the methodology of the study during this process. It was assumed that the final version of the study met with the approval of the State. No modifications of the study are planned at this time. However, the cohesive properties of the material were not measured. A conservative assumption that the silt fraction was cohesive was utilized. Sand cannot be cohesive.	None taken.
54		Appendix I, Section 2: Discussions note that the void ratio taken for silt-clay is 4.0. Please discuss whether sediment samples were analyzed to determine this value. A sensitivity test should be conducted (i.e., taking void ration as 2.0 and running the model set-up) to demonstrate the scenario as a result of the void ration being less than 4.0.	See the response to comment 53 above. Void ratio relates to the properties of the material once it has settled on the bottom and has no bearing on the dispersion characteristics of the suspended sediment plume.	See the action to comment 53 above.
55		Appendix I, Section 2: The time to empty the split-hull dredge is presented as 5 seconds. But in the STFATE model simulation, the model time step is taken as 375-750 seconds for PB and 300-600 seconds for PE (Table 7). Please discuss how a time step of more than 300 seconds simulates the effects of a 5 second disposal (time to empty) time. Also, please clarify any other assumptions you may have taken in this regard.	See the response to comment 53 above. The time step refers to the transport-dispersion phase and not the convective descent or dyanmic collapse. The time step for these initial phases is not an input parameter.	See the action to comment 53 above.

56	FDEP	Appendix I, Section 2: The EIS should provide the reference and other applicable information to justify the values of the model coefficients listed in Table 7 - specifically from CSTRIP down to AKYO.	See the response to comment 53 above. Typical values were used as site specific coefficients were not available.	See the action to comment 53 above.
57		Appendix I, Section 2: In the EIS Figures 36-51 should be drawn showing sediment concentrations up to the grid origin. For example, the higher concentrations in the Figure 41 (lower right), 43 (lower left and lower right), 48 (lower left and lower right), 49 (lower left and lower right), 50 (lower right) generate concerns because they show considerable higher concentrations and do not show the full distance of impact.	See the response to comment 53 above. EPA agrees with the comment, however, the data files are no longer available. The Model Simulation section of the report provides distances at which the concentrations fall below 1 mg/l.	See the action to comment 53 above.
58		Appendix I, Section 3: The appendix notes that LTFATE has the capability to simulate both non-cohesive and cohesive sediment transport. Then the section describes the effects of waves on non-cohesive sediment transport. Cohesive transport was not further discussed. Are cohesive sediments not as important as non-cohesive sediments? If cohesive sediment transport is important, it should be included in future modeling.	See the response to comment 53 above. Cohesive transport is very complex compared to non-cohesive transport. In general, cohesive sediments are more resistant to erosion. As a screening level model did not show that the non-cohesive materials would be significantly eroded, modeling of cohesive materials was not warranted.	See the action to comment 53 above.
59		Appendix I, Section 3: The DPR tidal constituents are used for LTFATE modeling. The EIS should discuss whether any observed time-series of the tidal levels were available for locations near or inside the model area.	See the response to comment 53 above. No observed tidal elevations are available for the project areas.	See the action to comment 53 above.
60		Appendix I, Section 3: The EIS should include discussions to justify the 0.12 mm value used as the mean grain size for the LTFATE modeling. The outer layer of the sediment mound usually consists of finer particles due to their slower settling velocities. These outer layers of finer particles may be more susceptible to ambient currents and turbulent diffusions, thus more prone to spreading.	See the response to comment 53 above.	See the action to comment 53 above.
61		Appendix I, Section 3: It is preferable for analyses to include a sensitivity study with finer grid spacing and smaller time steps demonstrating how the selected models behave with smaller spacing and how the results vary for both the locations.	See the response to comment 53 above.	See the action to comment 53 above.
62		Appendix I, Section 3: For the LTFATE initial screening, the depth average velocities are calculated for 170-200 m depth which is the depth near the ODMDS. The Department is more concerned about re-suspension of the deposits near to the hard bottoms. The higher concentrations shown in Figures 41 (lower right), 43 (lower right), 48 (lower left and lower right), 49 (lower left and lower right), 50 (lower right) etc. show that sediment may travel and/or be deposited near the hard bottom area during the dynamic collapse phase. The bathymetry near the hard bottom area is much shallower with mean depth of around 20 m, where storm surge may become higher due to the shallower depth and higher water velocities may be generated. Please note that Figure 4 shows shallower depths than the considered 170-200 m near the ODMDS site.	See the response to comment 53 above. EPA disagrees with these conclusions. The referenced figures show concentrations during the transport-dispersion phase 5,000 meters (2.7nm) from the reefs. The existence of suspended material does not indicate that measureable deposition will occur. Measurable deposition outside of the disposal site is not expected. Analysis of resuspension outside of the site boundaries is therefore not warranted.	See the action to comment 53 above.

63	FDEP	Appendix I, Section 3: The EIS should provide the reference and other applicable information to justify the values of the model coefficients listed in Tables 8-9.	See the response to comment 53 above. References are provided in the text of the report.	See the action to comment 53 above.
64		Appendix I, Section 4: The conclusions state that the primary concern when modeling dispersion was movement toward reefs 1-3 km offshore. The NEPA documents should address possible impacts to smaller discrete resources such as Oculina and other deepwater corals that could be in the impact area.	Noted. The EPA and USACE concur with this comment.	Text added to Section 4.3.4 Criteria #3.
65		Appendix I, Section 4 states twice that "the majority of the sand in the dredged material . . . but some remains in the water column for longer time/distances as indicated by these results." NEPA documents should use explicit/defined description and avoid the use of non-descript words such as "some" and "longer time/distances."	See the response to comment 53 above. Section 4 is the report conclusions. The terms are quantified in the results (figures 36-51).	See the action to comment 53 above.
66		Appendix I,J,K: The EIS should provide the site capacities of the ODMDSs. The capacity limit and an estimated mound size should be used in the LTFATE modeling.	Project size limits are detailed in the SMMPs (see Appendix J). The size limits are based on modeling performed by WES (now ERDC).	None taken.
67		The EIS should discuss how the annual average disposal rates are determined, expected use or past disposal events. The DEIS should reflect a disposal rate determined by the anticipated use, such as the proposed disposal of 2 million cy to improve PBH. It seems unrealistic to use such a low annual average disposal rate (50,000 cy) when much larger disposal projects have been forecast. The NEPA documents should also discuss the percentage of material in the planned dredging projects that will actually be disposed of in the ODMDS.	See response to comment 22 above.	See action to comment 22 above.
68		Appendix J, p. 4: The SMMP should include general guidelines to eliminate or minimize impact when dredging and disposal of dredged material should be avoided such as periods of strong currents or eddies as indicated by ADCP data.	See response to comment 16 above	None taken.
69		Appendix J, p. 8: The baseline monitoring surveys and environmental surveys should be overlapping covering the entire ODMDS, no data gaps. The surveys should continue at leat 0.5 mi or at least the maximum predicted impact area around the site, not 500 feet as suggested in the SMMP.	It is unclear as to whether the State is asking for additional baseline monitoring. The State will be consulted on revisions to the SMMPs. No data gaps exist in the baseline monitoring that EPA is aware of. As deposition outside of the disposal site boundaries is not expected, extension of bathymetry surveys 0.5 nm beyond the boundaries is not warranted.	None taken.

70	South FL Regional Planning Council	The DEIS should be reviewed for consistency with the following goals and policies:	See the response to comment 25 above.	See the action to comment 25 above.
71		1. Enhance and preserve natural system values of South FL's shorelines, estuaries, benthic communities, fisheries, and associated habitats.		
72		2. Enhance and preserve natural shoreline characteristics through requirements resulting from the review of proposed projects and in the implementation of ICE through prohibition of structural shoreline stabilization methods except to protect existing navigation channels, maintain reasonable riparian access, or allow an activity in the public interest as determined by applicable state and federal permitting criteria.		
73		3. Enhance and preserve benthic communities, including but not limited to seagrass and shellfish beds, and coral habitats, by allowing only that dredge and fill activity, artificial shading of habitat areas, or destruction from boats that is the least amount practicable, and by encouraging permanent mooring facilities. Dredge and fill activities may occur on submerged lands in the FL keys only as permitted by the Monroe County Land Development Regulations. It must be demonstrated pursuant to the review of the proposed project features that the activities included in the proposed project do not cause permanent, adverse natural system impacts.		
74		4. Enhance and preserve habitat for endangered and threatened marine species by the preservation of identified endangered species habitat and populations. For threatened species or species or critical concern, on-site preservation will be required unless it is demonstrated that off-site mitigation will not adversely impact the viability or number of individuals of the species.		
75	NMFS	NOAA Fisheries is concerned the proposed work could adversely impact resources for which we have management and stewardship responsibilities pursuant to provisions of the Fish and Wildlife Conservation Act and the Magnuson-Stevens Act. The proposed project is located in areas identified as EFH by the SAFMC. EFH categories in the area include marine water column, coral, hardbottoms, sargassum, sand habitats, the US Continental Shelf, and the upper regions of the continental slope. Hardbottom areas are designated as EFH by the SAFMC for juvenile and adult red and gag grouper, gray and mutton snapper, white grunt, penaeid shrimp, tilefish, and spiny lobster. Coral reef habitat has been designated as EFH for juvenile and adult red and gag grouper, gray and mutton snapper, white grunt, and spiny lobster. The marine water column has been designated as EFH due to is importance as a nutrient and organism transport medium. Sargassum has been designated as EFH for sea bass, jack, and marbled grouper. Sand bottom has been designated as EFH for juvenile lane snapper and adult and subadult brown shrimp, juvenile and adult gag grouper.	Noted.	EFH Assessment developed.

75 (c.)	NMFS	NOAA fisheries has also identified EFH for highly migratory species that utilize the water column in this area including nurse, bonnethead, lemon, black tip, and bull sharks. Federally managed species associated with the US Continental Shelf and its upper regios include golden crab and royal red shrimp. See the 1998 comprehensive amendent to the SAR's FMP for more information.	(See above response.)	(See above action.)
76		Sargassum, coral, and coral reef (including Lophelia and Enallopsammia corals) and hardbottom habitats (including deepwater hardbottom habitats), which are located within the vicinity of the proposed ODMDSs, have been designated as HAPCs by the SAFMC. HAPCs are subsets of EFH that area rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area. Contrary to information in Section 4.9, HAPCs area located within the ODMDSs.	Noted.	Statement in section 4.9 removed and EFH Assessment developed.
77		The EFH assessment has not been made available for review. The EFH assessment should include a description of the proposed action; an analysis of the effects (including indirect and cumulative effects) of the action on EFH, managed species, and associated species by life history stage; EPA and USACE views regarding the effects of the action on EFH; and proposed mitigation. The EFH assessment should also include the results of site-specific studies, the views of recognized experts on impacts to habitats and species, a literature review, and any other relevant information.	An EFH Assessment has been prepared to address NOAA concerns regarding the projects compliance with the MSA.	EFH Assessment developed.
78		NOAA is especially concerned regarding the inadequacy of the asessment of potential impacts to deepwater habitats. In the absense of an adequate EFH assessment for these habitats, it would not be possible to determine whether the fishery conservation requirements of the Magnuson-Stevens Act would be met and NOAA Fisheries would have no recourse but to recommend withholding ODMDS approval. Consequently, it is of great importance that the EFH assessment contains the required contents and an adequate level of detail. It also should include quantitative impact estimates based on available information and ongoing and completed studies for each category of EFH. The EFH assessment should also include an evaluation of the deepwater survey results and information regarding efforts to avoid and minimize impacts to deepwater habitats. NOAA encourages providing the EFH assessment as a supplement to the DEIS.	See response to comment 77 above	See response to comment 77 above
79		Section 3.6 EFH: NOAA is concerned that the information provided is insufficient to demonstrate that avoidance and minimization of adverse impacts to EFH have been adequately addressed. To address this, an EFH assessment should be prepared and provided for NOAA Fisheries review.	See response to comment 77 above	See response to comment 77 above

80	NMFS	Table 1: In the absence of an EFH assessment, NOAA Fisheries does not concur with information in this table regarding the assertion that EPA is in full compliance with the Magnuson-Stevens Act.	An EFH assessment is being prepared to address NOAA concerns regarding the projects compliance with the MSA.	An EFH assessment has been prepared and was submitted to NMFS on 15 July.
81		Pages 20-23: The DEIS states that "no natural reefs have been observed within the proposed project area." Although this area may not support reef-like features, the deepwater hardbottoms and softbottoms, and shelf edge zone are inhabited by managed fishes, such as snappers, groupers, and porgies. Fish distribution is often diffuse in this zone, with fishes aggregating over broken bottom relief in associations similar to those formed at inshore live bottom sites. The lower shelf habitat has a predominantly smooth mud bottom, but is interspersed with rocky and coarse gravel substrates where groupers and tilefish may occur. This habitat and its associations of fishes roughly marks the transition between fauna of the Continental Shelf and fauna of the Continental Slope. Water depths within this habitat zone range from 110-183 m and bottom water temepratures vary from approximately 11-14 degrees C. Fishes inhabiting the deeper live or hardbottom areas are beleived to be particularly susceptible to heavy fishing pressure and environmental stress.	Noted. The EPA and USACE concur with this comment. This concern will be addressed in the EFH assessment.	See the action to comment 80 above.
82		Pages 20-23: Water depths at the ODMDSs are within the harvest range of blue-line tilefish. According to local fishers, tilefish prefer certain sediment types and NOAA Fisheries is concerned that alterations of the sediment type found in the ODMDSs could adversely affect the tilefish fishery in this region. Therefore, impacts to the tilefish habitat and other deepwater habitats should be evaluated in the EFH assessment.	Noted.	None taken.
83		Page 60: NOAA Fisheries recommends that General Criteria #1 be re-evaluated in the EFH assessment to address impacts to the existing tilefish fishery.	Based on the EFH Assessment (see Appendix I), no modification to General Criteria #1 is warranted.	None taken.
84		Page 67: NOAA Fisheries recommends that Criteria #8 be re-evaluated in the EFH assessment to address impacts to the existing tilefish fishery.	See the response to comment 44 above.	See the action to comment 44 above.
85		Pages 23 and 80: NOAA Fisheries concurs with information in the DEIS regarding acknowledgment that ahermatypic corals are found in deeper waters. According to the information provided, video surveys performed by CSA did not reveal the presence of deepwater corals at the preferred PB ODMDS. However, based on the information provided, NOAA Fisheries is concerned that this study may have been limited to the examination/identification of Oculina reefs. A summary of the methods used and survey findings should be provided in the EFH assessment. The findings appear to contradict information provided in Section 4.11 of the DEIS, regarding the identification of ahermatypic corals observed in scattered, isolated forms in the vicinity of the proposed PB site.	See the response to comment 20 above.	See the action to comment 20 above.

86	NMFS	Pages 23 and 80: NOAA notes that results of deepwater surveys offshore of Broward County performed in connection with the Calypso pipeline project, documented the presence of deepwater corals. Unbranched black corals are relatively common in 70-100 ft waters off Broward County; however, branched species are relatively rare and are substrate limited in water depths of 100-1000 ft. All species are characterized by slow growth, delayed first reproduction, limited larval dispersal, and low rates of recruitment, low natural adult mortality, and long life. Black coral colonies inhabit areas where few other species occur. They provide important habitat for invertebrates and fish, including commensal species dependant upon black coral for survival. Therefore, NOAA Fisheries considers avoidance of these resources as an important conservation biology issue and recommends that the ODMDS designation should be designed to avoid antipatharians and other sensitive deepwater habitats. Avoidance and minimization strategies for the aforementioned deepwater habitats should be clearly described in the EFH assessment.	Noted. The EPA and USACE concur with this comment.	See the action to comment 80 above.
87		Appendix D: NOAA Fisheries is concerned that the 250 m transect is too wide to provide the level of coverage needed to conclude that impacts to deepwater habitats would be avoided and minimized through use of the preferred site. Transects spaced 100 m apart are preferred for detection of deepwater habitats.	EPA disagrees. The transect spacing and range setting utilized provided 200% coverage (100% overlap). A range of 100 meter would have required flying the towfish at approximately 10 meters above the bottom. Due to the depths and currents at the sites, 10 meters was not sufficient clearance to assure the towfish would not be damaged due to impacts with the bottom. With the settings utlized, EPA was able to identify hard bottom habitats.	None taken.
88		Appendix D: Sidescan sonar mosaics of the route should be provided which show 1) the proposed ODMDS; 2) the locations of hardbottom that would be impacted; 3) the location of known fishery habitats and resources within the surveyed areas. This information is necessary to evaluate impacts to these resources.	EPA agrees that these maps would be useful.	Maps have been included with EFH Assessment.
89		Appendix D: While additional side scan sonar surveys may not be necessary, the EPA and USACE should reevaluate any possible features with photo or video at the preferred site (i.e., the ridge at the PE4-mi site and the possibility of Oculina within 1.7 nm of the PB 4.5 mi site).	The rubble and ridge features were previously photodocumented by CSA (1986). The Oculina has been previously documented by Reed (1980).	Additional discussion of the video surveys is provided in Section 3.18 of the EIS and in the EFH Assessment.

90	NMFS	Appendix D: The report does not define "low relief" as described in the PE 4mi site. These low areas could support important marine habitats. According to the survey, the PE 4 mi site and surroundings contained numerous unidentified highly reflective objects. NOAA believes these areas could support hardbottom habitats including deepwater corals. The level of information provided does not give reasonable assurance that impacts to federally managed resources would be avoided and/or minimized to the maximum extent possible.	Low relief is characterized as acoustic returns without sufficient shadows to determine an object height. This was estimated to be less than 0.5 meters. The highly reflective objects were located outside the disposal site boundaries.	Additional information is provided in the EFH Assessment.
91		The results of additional video-truth surveys should be provided in the EFH assessment. Low relief areas and highly reflective areas should also be quantitatively and qualitatively described in the EFH assessment.	Noted.	The EFH Assessments include additional descriptions of the survey results.
92		Page 36: NOAA concurs with EPA's concern regarding the fate of dredged material placed at the proposed ODMDSs due to their proximity to the Gulf Stream and spinoff eddies. Large numbers of marine species are concentrated along the frontal boundary of the Gulf Stream, which is important as a distribution mechanism, especially for early life stages, as are frontal zones and upwelling areas as foraging habitat.	Noted. The EPA and USACE concur with this comment.	None taken.
93		Page 36: It appears that time averaged and prevailing currents were used in the dredged material distribution studies. While this is useful, the EFH assessment should acknowledge and discuss eddies that may potentially redistribute this material to important marine habitats.	20 minute averaged currents were utilized. This is short considering the time scales of disposal plumes and should be sufficient for characterizing advection and dispersion during eddy events.	The EFH Assessments address the potential for eddy transport shoreward.
94		The EFH assessment should also address potential adverse effects to marine organisms that use the Gulf Stream for distribution or as foraging habitat. Associated measures that would be integrated into the project design to mitigate for such impacts also should be addressed.	Noted.	The EFH Assessments address potential impacts to marine organisms that use the Gulf Stream and discusses mitigation.
95		Page 60, General Criteria #2: NOAA is concerned that the response neglects consideration of spinoff eddies and we recommend that the response be reevaluated to address spinoff eddies and possible transport of sediments to important marine habitats. This information should be provided in the EFH assessment.	See the response to comment 16 above.	See the action to comment 16 above.
96		Page 3: The DEIS states that the suitability of dredged material destined for ocean disposal will be determined on a case-by-case basis. NOAA recommends that evaluation criteria be developed and provided for emergency review. This information should also be provided in the EFH assessment.	Evaluation criteria for review of suitability of dredged material for ocean disposal are clearly outlined in the EPA/USACE publication *Evaluation of Dredged Material Proposed for Ocean Disposal* (Office of Water Publication WH-556F). These criteria are always adhered to for disposal operations. Inclusion of these criteria in the EFH assessment is not deemed necessary.	None taken.

97	NMFS	P. 74-76: NOAA is concerned that the cumulative impacts section is overly narrow and omits several important projects in Broward and Palm Beach counties. The Hillsboro Inlet dredging project should be included in Section 4.5.1. Individual beach renourishment projects and associated offshore dredging and inshore filling activities should be described in this section also. The Seafarer Pipeline project should be listed in Section 4.5.3. Although the DEIS acknowledges that pipeline activities are proposed, it lacks discussion of effects to projects and potential synergistic or cumulative effects.	See response to comment 23 above. Associated offshore dredging at Port Everglades and Palm Beach Harbors will be discussed in this section. Beach renourishment projects involve nearshore placement and as such (as with the Hillsboro Inlet project) are outside the scope of this project.	See response to comment 23 above.
98		The EPA and USACE should prepare an EFH assessment for NOAA review. The assessment should contain: A. A description of the proposed action, including the proposed transport and disposal methods; B. An analysis of the effects of the action on EFH, managed species, and associated species by life history stage, including the following: i. Direct, indirect, and cumulative effects; ii. Effects of the proposed action on important marine habitats including deepwater habitats; iii. Effects on managed species including shellfish; iv. Effects on infauna and epifauna prey species of managed fisheries. C. EPA and USACE views regarding the effects of the action on EFH; D. Proposed mitigation; E. The results of site-specific studies, the views of recognized experts on the habitat or species effects, a literature review, and any other relevant information including: i. Side scan sonar video or photo identification and a reevaluation of side scan sonar surveys that quantify deepwater habitat impacts and define and characterize terms such as low relief and highly reflective areas; ii. An evaluation of spinoff eddies and associated potential sediment transport to important marine habitats; iii. A summary of the CSA deepwater video survey methods and findings.	Noted.	The EFH Assessment was developed.
99		The EPA and USACE should develop evaluation criteria in concert with NOAA and other agencies to determine the decision sequencing and suitability requirements of the materials to be disposed offshore.	See response to comment 96 above.	See action to comment 96 above.
100		EPA approval of ODMDS designation should be withheld pending receipt of an EFH assessment and other information needs as identified by NOAA. Based on our review of pending information, NOAA may provide additional EFH conservation recommendations.	EPA agrees.	Site designation (rulemaking) will not occur until EFH consultation has been completed.

101	NMFS	The Magnuson-Stevens Act and NOAA's implementing regulation require a written response to this letter within 30 days of receipt. An interim response should be provided if a substantive response is not possible. A detailed response must be provided at least 10 days prior to final approval of the action. The detailed response must include a description of measures proposed by your agency to avoid, mitigate, or offset the adverse impacts of the activity. If your response is inconsistent with our EFH conservation recommendations, you must provide a substantive discussion justifying the reason for not following the recommendation.	An interim response was provided within 30 days of receipt of NOAA comments.	An interim response was provided to NOAA.on June 2, 2004.
102		The project area is within distribution limits of federally listed species under purview of NOAA. It is the responsibility of the appropriate federal regulatory agency to review its activities and programs and identify any activity or program that may affect endangered or threatened species or their habitat. Determinations involving species under NOAA jurisdiction should be reported to our Protected Resources Division. If it is determined that the activities may adversely affect any species listed as endangered or threatened and under NOAA purview, then formal consultation must be initiated.	EPA agrees and has conducted such review. EPA determined that designation will not affect any threatened or endangered species. EPA sought comments from NOAA Fisheries regarding this determination. NOAA's response is included in the Final EIS.	None taken.
103	National Geodetic Survey	All available geodetic control information about horizontal and vertical geodetic control monuments in the subject area is contained on the NGS's website. This information should be reviewed for identifying the location and designation of any geodetic control monuments that may be affected by the project.	The NGS website will be queried for identification of any monuments in the vicinity of the preferred sites.	The NGS website was queried for any monuments within one mile of all boundaries of the PB 4.5-mile site and the PE 4-mile site. According to the website query, no monuments exist in the areas specified.
104		If any planned activities will disturb of destroy these monuments, NOS requires not less than 90 days' notification in advance of such activities in order to plan for their relocation. NOS recommends that funding for this project include the cost of any relocations required.	No monuments were identified by the NGS website query; therefore it is assumed that no monuments will be impacted by any project activities.	None taken.
105	Palm Beach County	PBC supports establishing ODMDSs in deeper water provided they are the last option used for disposal; however we are concerned and offer the below comments.	PBC's concern is duly noted.	None taken.
106		We are very concerned about the alternative disposal issue. It should be a requirement that any material that is beach compatible be used for beach nourishment or for building up nearshore berms. While the EIS indicated that beach compatible material would not be disposed offshore, we request that a clear definition of beach compatibility be included in the document.	The State of Florida's definition of beach compatibility material will be added to the EIS.	The State of Florida's definition of beach quality material has been added to the EIS.

107	Palm Beach County	The EIS compared offshore disposal to upland disposal and concluded in all cases that offshore disposal is cheaper. However, use of non-beach compatible material to fill dredged holes in Lake Worth Lagoon was not evaluated and we request that additional analysis be conducted. We are concerned that the lower cost of ocean dumping would preclude the use of dredged material for beneficial uses and request that environmental benefits of the beneficial use be included in the cost/benefit analysis. PBC is currently involved with the USACE in using PBH dredged material for environmental restoration and expects that similar projects would be feasible and desirable in the future. While these inshore restoration projects may be more expensive than offshore disposal, the environmental benefit would likely outweigh any additional costs.	See the response to comment 17 above.	See the action to comment 17 above.
108		The draft states that the rates of disposal of material is estimated at ~50,000 cy/year; yet elsewhere typical projects were described as ranging from 14,000-179,000 cy. Lastly, a maximum of 500,000 cy/project was set, and this amount is far larger than the estimated annual disposal amount. Are larger projects anticipated? Is this larger limit related to the statement that the disposal area will be opened up to other federal entities and private dredging projects? We are concerned as to what will be the amounts disposed offshore with this range of numbers provided.	See the response to comment 22 above.	See the action to comment 22 above.
109		The dispersal models provided information on the potential dispersal of materials of a given makeup. We recommend that if the characteristics of potential disposal material is not within the range of the parameters used for modeling, then the model should be rerun using the differing characteristics before decisions concerning disposal are made.	The EPA and USACE believe that the model runs accurately represent the material to be deposited at the sites. The model is conservative and used different parameters at each site to capture the variability of material in Palm Beach and Port Everglades Harbors.	None taken.
110		The data detailing the environmental resources that could be buried in the disposal site has a number of blank areas. Additional studies need to be conducted before concluding that there will be no reef impacts. Reef mounds of Oculina coral are in the deeper zones and are very productive communities. We recommend that the gaps in the 100 kHz sidescan sonar survey be filled in and that the disposal area vicinity also be scanned using 400 kHz sidescan for higher resolution. ROV video monitoring should be conducted in the vicinity of any sidescan anomalies to verify absence of reefs and corals.	The data gaps are only in the electronic record. The sidescan sonar surveys provide 100% overlap (200% coverage). Paper records are available for all electronic data gaps. Rubble areas within the PE-4 Mile site have been characterized by video and still camera surveys.	See the action to comment 18 above.
111		Appendix E should include recognition that PBC usually has the highest number of leatherback nests and the second highest number of loggerhead and green turtle nests in the continental US.	This information will be added to Appendix E.	The information was added to Appendix E.
112		Our recommendations are that additional sampling is required to ensure that coral reefs will not be impacted; alternative disposal on or near beaches and/or lake Worth Lagoon deep holes be required for all compatible material (regardless of cost) prior to approving offshore disposal.	See the response to comment 20 regarding sufficiency of existing survey data. See the response to comment 17 regarding beneficial use of dredged material.	None taken.

113	Palm Beach County	If offshore disposal occurs, then more safeguards for dumping should be required. Disposal 4.5 nm offshore can be influenced by speeds and directions of the current. We recommend that the disposal pattern be modified in that south half of the site be targeted for north currents (and v.v.) with the southernmost 1/4 being used for stronger north currents to allow for dispersal of materials within the dump site. This will require the vessel to slow upon approaching the dumping site to ascertain current condition before commencing dumping. In addition, by not focusing dumping on one spot, the potential for stacking the material on resources is minimized.	See the response to comment 16 above. In addition, surface currents are not always indicative of subsurface currents. Surface currents and vessel track could be influenced by wind. Relying solely on the vessel's interpretation of current velocity could result in material being deposited outside the disposal site boundaries. The large amount of dispersion at these depths and the current variability is expected to result in variablity of mound placement. However, it is also desirable to maintain the disposal mound within the disposal site. Therefore, disposal should occur near the center of the disposal site.	None taken.
114	SAFMC	The array of large-scale and long-term beach dredging projects and related disposal activities currently being considered for the US southeast together constitute a real and significant threat to EFH under SAFMC jurisdiction.	Noted.	None taken.
115		The cumulative effects of these projects have not been adequately assessed, including impacts on public trust marine and estuarine resources, use of public trust beaches, public access, state and federally protected species, state critical habitat, SAFMC-designated EHz and EFH-HAPCs.	Cumulative effects of projects on marine resources will be addressed in the EFH assessment.	See the action to comment 80 above.
116		Individual beach dredge and fill projects and related large-scale coastal engineering activities rarely provide adequate impact assessments or consideration of potential damage to fishery resources under state and federal management. Historically, emphasis has been placed on the logistics of dredging and economics, with environmental considerations dominated by compliance with the ESA for sea turtles, piping plovers and other listed organisms. There has been little or no consideration of hundreds of other species affected, many with direct fishery value.	Noted.	None taken.
117		Opportunities to avoid or minimize impacts of beach dredge and fill activities on fishery resources, and offsets for unavoidable impacts have rarely been proposed or implemented. Monitoring is rarely adequate to develop statistically appropriate impact evaluations.	The EPA and USACE disagree with this comment. Opportunities to avoid or minimize impacts to environmental resources resulting from federal projects area always proposed and considering. Serious consideration is given to monitoring with intent to develop impact evaluations.	None taken.
118		Large-scale beach dredge and fill activities have the potential to impact a variety of habitats across the shelf, including a) waters and benthic habitats near the dredging sites; b) waters between dredging and filling sites; c) waters and benthic habitats in or near the fill sites; d) waters and benthic habitats potentially affected as sediments move subsequent to deposition in fill areas.	Noted.	None taken.

119	SAFMC	Certain nearshore habitats are particularly important to the long-term viability of commercial and recreational fisheries under SAFMC management, and potentially threatened by large-scale, long-term or frequent disturbance by dredging and filling: a) the swash and surf zones and beach-associated bars; b) underwater soft-sediment topographic features; c) onshore and offshore coral reefs, hardbottom and worm reefs; d) inlets.	Noted.	None taken.
120		Large sections of S Atlantic waters potentially affected by these projects, both individually and collectively, have been identified as EFH or EFH-HAPC by SAFMC, as well as the MAFMC in the case of NC. Potentially affected species and their EFH under federal management include: summer flounder (various nearshore waters, including the surf zones and inlets; certain offshore waters); bluefish (various nearshore waters, including the surf zone and inlets); red drum (ocean high-salinity surf zones and unconsolidated bottoms nearshore waters); many snapper and grouper sp. (live hardbottom from shore to 600 ft, and - for estuarine-dependent species [e.g., gag grouper and gray snapper] - unconsolidated bottoms and live hardbottoms to the 100 ft contour); black sea bass (various nearshore waters, including unconsolidated bottom and live hardbottom to 100 ft, and hardbottoms to 600 ft); penaeid shrimp (offshore habitats used for spawning and growth to maturity, and waters connecting to inshore nursery areas, including the surf zone and inlets); coastal migratory pelagics [e.g., king mackerel, Spanish mackerel] (sandy shoals of capes and bars, barrier island ocean-side waters from the surf zone to the shelf break inshore of the Gulf Stream; all coastal inlets); corals of various types (hard substrates and muddy, silt bottoms from the subtidal to the shelf break); areas identified as EFH for Highly Migratory Species (HMS) managed by the Secretary of Commerce [e.g., sharks] (inlets and nearshore waters, including pupping and nursery grounds)	Noted.	None taken.
121		Hundreds of species of crustaceans, molluscs, and annelids that are not directly managed, but form the critical prey base for most managed species, are killed or directly affected by large dredge and fill projects.	Noted. The proposed action is not a dredge or fill project.	None taken.

122	SAFMC	Beach dredge and fill projects also potentially threaten important habitats for anadromous fish species under federal, interstate and state management (in particular, inlets and offshore overwintering grounds), as well as essential overwintering grounds and other critical habitats for weakfish and other species managed by the Atlantic States Marine Fisheries Commission (ASMFC) and the states. The SAFMC also identified essential habitats of anadromous and catadromous species in the region (inlets and nearshore waters).	Noted. The proposed action is not a beach dredge or fill project.	None taken.
123		Many of the habitats potentially affected by these projects have been identified as EFH-HAPCs by the SAFMC. The specific fishery management plan is provided in parentheses: all nearshore hardbottom areas (SAFMC, snapper grouper) all coastal inlets (SAFMC, penaeid shrimps, red drum, and snapper grouper) nearshore spawning sites (SAFMC, penaeid shrimps, and red drum) benthic Sargassum (SAFMC, snapper grouper) from shore to the ends of the sandy shoals of Cape Lookout, Cape Fear, and Cape Hatteras, NC; Hurl Rocks, SC; Phragmatopora (worm reefs) reefs off the central coast of FL and nearshore hardbottom south of Cape Canaveral (SAFMC, coastal migratory pelagics) Atlantic coast estuaries with high numbers of Spanish mackerel and cobia from ELMR, to include Bogue Sound, New River, NC; Broad River, SC (SAFMC, coastal migratory pelagics) FL Bay, Biscayne Bay, Card Sound, and coral hardbottom habitat from Jupiter Inlet through the Dry Tortugas, FL (SAFMC, spiny lobster) Hurl Rocks (SC), the Phragmatopoma off the E coast of FL from Cape Canaveral to Broward County; offshore (5-30 m) hardbottom off the E coast of FL from PBC to Fowey Rocks; Biscayne Bay, FL; Biscayne National Park, FL; and the FL Keys National Marine Sanctuary (SAFMC, coral, coral reefs and live hardbottom habitat) EFH-HAPCs designated fro HMS species in the S Atlantic Region (NMFS, HMS)	Noted.	EFH Assessments have been developed that address effects to these habitats.
124		Habitats likely to be affected by beach dredge and fill projects include many recognized in state-level fishery management plans. Examples of these habitats include Critical Habitat Areas established by the NC Marine Fisheries Commission, either in FMPs or in Coastal Habitat Protection Plans.	Noted. The proposed action is not a dredge or fill project.	None taken.
125		Recent work by scientist in E FL has documented important habitat values for nearshore hardbottom habitats often buried by beach dredging projects, is used by over 500 species of fish and invertebrates, including juveniles of many reef fishes. Equivalent scientific work is just beginning in other S Atlantic states, but life histories suggest that similar habitat use patterns will be found.	Noted. The proposed action is not a beach dredgingl project.	None taken.

126	SAFMC	The SAFMC finds that beach dredge and fill activities and related large-scale coastal engineering projects (including inlet alteration projects) and disposal of material for navigational maintenance, threaten or potentially threaten EFH through the following mechanisms: direct mortality and displacement of organisms at and near sediment dredging sites direct mortality and displacement of organisms at initial sediment fill sites elevated turbidity and deposition of fine sediments down-current from dredging sites alteration of seafloor topography and associated current and waves patterns and magnitudes at dredging areas alteration of seafloor sediment size-frequency distributions at dredging sites, with secondary effects on benthos at those sites elevated turbidity in and near initial fill sites, especially in the surf zone, and deposition of fine sediment down-current from initial fill sites Alteration of nearshore topography and current and wave patterns and magnitudes associated with fill movement of deposited sediment away from initial fill sites, especially onto hardbottoms alteration of large-scale sediment budgets, sediment movement patterns and feeding and other ecological relationships, including the potential for cascading disturbance effects alteration of large-scale movement patterns of water, with secondary effects on water quality and biota alteration of movement patterns and successful inlet passage for larvae, post-larvae, juveniles and adults of marine and estuarine organisms alteration of long-term shoreline migration patterns (inducing further ecological cascades with consequences that are difficult to predict) exacerbation of transport and/or biological uptake of toxicants and other pollutants released at either dredge or fill sites	Noted. Some of these comments are not applicable to the project, notably the following: 1) direct mortality and displacement of organisms at and near sediment dredging sites; 2) elevated turbidity and deposition of fine sediments down-current from dredging sites	None taken.
127		The interactions between cumulative and direct (sublethal) effects among the above factors certainly triggers nonlinear impacts that are completely unstudied.	Noted.	None taken.
128		Projects should avoid, minimize, and where possible offset damage to EFH and EFH-HAPCs.	Noted. The EPA and USACE concur with this comment.	None taken.
129		Projects requiring expanded EFH consultation should provide detailed analyses of possible impacts to each type of EFH, with careful and detailed analyses of possible impacts to EFH-HAPCs and state CHAs, including short and long-term and population and ecosystem scale effects. Agencies with oversight authority should require expanded EFH consultation.	This action is concerned solely with the designation of ODMDSs and not with any actual dredging or disposal activities. As such, this comment is not applicable to the project.	None taken.

130	SAFMC	Projects requiring EFH consultation should provide a full range of alternatives, along with assessments of the relative impacts of each on each type of EFH, HAPC and CHAs.	See the response to comment 129 above.	See the response to comment 129 above.
131		Projects should avoid impacts on EFH, HAPCs and CHAs that are shown to be avoidable through the alternatives analysis, and minimize impacts that are not.	See the response to comment 129 above.	See the response to comment 129 above.
132		Projects should include assessments of potential unavoidable impacts, and should include compensatory mitigation for all reasonably predictable impacts to EFH, taking into account uncertainty about these effects. Mitigation should be local, up-front and in-kind, and should be adequately monitored, wherever possible.	See the response to comment 129 above.	See the response to comment 129 above.
133		Projects should include baseline and project-related monitoring adequate to document pre-project conditions and impacts of the projects on EFH.	See the response to comment 129 above.	See the response to comment 129 above.
134		All assessments should be based upon the best available science, and be appropriately conservative so follow and precautionary principles as developed for various federal and state policies.	Noted. EPA and the USACE concur with this comment.	The EFH assessment utilizes the best available science, and is appropriately conservative.
135		All assessments should take into account the cumulative impacts associated with other beach dredge and fill projects in the region, and other large-scale coastal engineering projects that are geographically and ecologically related.	See the response to comment 23 above.	See the action to comment 23 above.
136		The ODMDS sites as proposed will impact areas identified as EFH in the 1998 Comprehensive Amendment Addressing EFH in FMPs of the SAR prepared by the Council. These FMPs include coral, coral reef and live hardbottom habitat, red drum, shrimp, spiny lobster, coastal migratory pelagic species, and the snapper-grouper complex.	Noted.	EFH Assessments have been developed that address effects to these habitats.
137		The proposed activities could have potential adverse effects on areas designated as Efh and EFH-HAPCs by the Council. Categories of EFH found within proximity of the area of proposed activity include the water column, coral and coral reefs, hardbottom areas, Sargassum, sand and soft sediment habitats, the Continental Shelf and upper Continental Slope. The marine water column is important in the transport of nutrients, spawning, larval dispersal and migrating organisms. Coral and coral reef habitat constitutes EFH for juvenile and adult stages of species in the snapper grouper complex and spiny lobster. Hardbottom areas have been designated as EFH for snapper grouper species, including tilefish; spiny lobster and penaeid shrimp. Sargassum constitutes EFH for species in the snapper grouper complex, as well as dolphin. Sand habitats and soft sediments have been designated as EFh for species in the snapper grouper complex and penaeid shrimp. Species associated with the Continental Shelfand upper Slope include golden crab and royal red shrimp, respectively. EFH-HAPCs that would be impacted by the	Noted.	EFH Assessments have been developed that address effects to these habitats.

137 (c.)	SAFMC	proposed activity includeSargassum, coral and coral reefs (including deepwater corals such as Lophelia and Enallopsammia) and hardbottom habitats. The information provided in the DEIS is insufficient to demonstrate that the proposed activities will avoid and/or minimize impacts to EFH.	(See above response.)	(See above action.)
138		The proposed ODMDSs are within the depth range occupied by tilefish which are managed under the Council's snapper grouper FMP. However, no discussion of the potential impacts to the local tilefish fishery were included in the DEIS. According to local fishermen, tilefish prefer certain sediment types. The DEIS includes possible alterations in sediment texture, grain size, and/or chemical composition as one of the unavoidable adverse effects of the proposed activity. Thus the proposed activity has the potential of adversely affecting the local tilefish fishery. These impacts must be evaluated.	Noted.	EFH Assessments have been developed that evaluate effects to tilefish habitats.
139		The DEIS includes results of studies conducted to determine the fate of dredged material disposed at the proposed ODMDSs. These studies were deemed necessary due to the proximity of the proposed activity areas to the Gulf Stream and spinoff eddies. The Gulf Stream has been designated as EFH for many of the species managed by the Council, including those in the snapper grouper complex. It appears that time-averaged and prevailing currents were used in the fate studies and no discussion was included as to how eddies could potentially redistribute this material to other habitats such as nearshore reefs.	Time-averaged currents were not used in the fate studies. Other aspects of this comment are addressed in comment 93 above.	See the action to comment 93 above.
140		The cumulative impacts section of the DEIS is not complete in that it fails to discuss potential synergistic or cumulative effects of other ongoing and planned activities in Broward and Palm Beach Counties. The Council is aware of other projects in the area that were omitted from the DEIS.	See response to comment 23 above. A query was made of open projects in Palm Beach and Broward Counties using the DEP's website. No open projects that may result in cumulative impacts to the area in conjunction with the proposed project were found in the Clearinghouse's database.	See action to comment 23 above.
141		The sidescan sonar survey described in Appendix D was not of adequate resolution to detect the presence of deepwater habitats and evaluate impacts to these habitats. NOAA recommends 100 m transects. Furthermore, the survey indicated the presence of an east west low relief ridge but failed to investigate whether this area contained hardbottom habitat. Underwater videos off BC in the depth range of the proposed activity have shown sparse hardbottom. Also, the presence of numerous unidentified highly reflective objects should be further investigated. Ground truthing with underwater video should be conducted.	See the response to comments 87 to 91 above.	See the action to comments 87-91 above.

142	SAFMC	The Council's Policy for the Protection and Restoration of EFH from Beach Dredging and Filling and Large Scale Coastal Engineering identifies numerous threats to marine and estuarine resources from such activities. The unavoidable adverse effects from the proposed ODMDSs as described in the DEIS encompass many of these threats. The Council's Policy Statement Concerning Dredging and Dredge Material Disposal Sites establishes the Council's role in the designation, operation, maintenance, and enforcement of activities in the ODMDSs.	Noted. EPA encourages the Council and the Council's habitat and Environmental Protection Advisory Panel's review of the Site Management and Monitoring Plans. EPA and the USACE will consider any comments received.	None taken.
143	Bureau of Beaches and Coastal Systems	The Bureau has no specific objections to the designation of the sites. Side scan sonar was used to survey for hardbottom habitat and the modeling conducted by WES seems to assure that turbidity plumes will not affect any nearby reefs. The DEIS makes it quite clear that beach quality material will be placed on the adjacent beaches when included in any maintenance dredging event. Final decisions about where dredged materials will actually be placed will be based upon the descriptions of sediment quality submitted as part of the permit applications to the Bureau.	Noted.	None taken.
144		The DEIS does not include an investigation of other beneficial reuse options, as requested in the Dept.'s Nov 1997 scoping response letter. An exhaustive review was completed of potential upland disposal sites, but no consideration of alternative use of non-beach quality material was found in the document. We have recently been approached about the use of non-beach quality material for use as landfill cover, and recommend that the ports and the USACE discuss the possibility of use of maintenance of dredged material with nearby counties and municipalities as well as the DEP Southeast District office.	See response to comment 17 above.	See action to comment 17 above.
145		The DEP Southeast Office should be consulted on the most recent applications and status on the placement of fiber optic cables and gas transmission lines.	The DEP Southeast Office will be contacted regarding telecommunication cables, fiber optic cables, and gas transmission lines.	Jayne Bergstrom of the Southeast Office (561-681-6661) was contacted regarding locatoins of cables and pipelines in the vicinity of the project area. The information she provided has been incorporated into the appropriate sections of the EIS.
146		The terminology for beach placement should be standardized throughout the document; the Bureau's preferred term is "beach nourishment" as most if not all of the possible placement beaches have been "restored."	The preferred federal term for authorized deposition of dredged material on beaches is "placement." The preferred federal term for other beach deposition activities is "renourishment..	None taken.

147	Bureau of Beaches and Coastal Systems	The first sentence on p. 75 on nutrient loadings from wastewater treatment plant ocean outfalls needs to be revised to make the statement more meaningful, and an appropriate reference should be cited.	The sentence will be changed to address the comment.	The sentence was changed to "Recent studies on the impact of sewage outfalls on marine habitat indicate that nutrient loading would be the likely source of any impacts to the habitat (EPA, 1998)."
148		Some appendices are missing, notably the Biological Assessments, and others are included that are not cited in the TOC.	It is unclear why appendices would be missing from the provided document. All appendices included in the EIS were cited in the TOC. Future versions of the document will be checked to ensure that this remains the case.	The document was checked to ensure that all referenced appendices were included and all included appendices were referenced in the TOC.
149		We have previously requested that the USACE revise its statement on coastal zone consistency with Ch. 161, FL Statutes in all documents. Ch 161 is much more than the stated regulation of construction projects seaward of mean high water. It includes the state's long term Strategic Beach Management Plan and its associated inlet management plans, as well as authority with regard to activities proposed seaward of the Coastal Construction Control Line. We would be happy to meet with the USACE to revise this section to assure that future planning activities adequately consider the full range of programs included in Ch 161 and FL's Coastal Zone Management Program.	The consistency statement for Ch. 161 will be updated in the Final EIS to reflect the concerns stated in this comment. The concerns regarding other USACE documents are beyond the scope of this project.	The consistency statement for Ch. 161 was updated.
150	Mara Shlackman	The DEIS is only for the dumpsite, not for what is being put in the dumpsite. This raises concerns since they will be dredging the port and surrounding canals and dumping it in the ocean. Aspergillus and other diseases such as Pfisteria could be spread in the dredged mud. Large amounts of petroleum, chemicals, mercury and contaminated materials may be in port dredge materials.	See the response to comment 96 above.	See the action for comment 96 above.
151		Endangered species use the proposed dump area.	Consultation has been initiated with NMFS regarding endangered and migrant species. See comments 5 and 6 above and their responses.	See the actions to comment 5 and 6 above.
152		Cumulative water quality issues include sewer outfall, ocean dumping, and cruise ship dumping.	See the response to comment 23 above.	See the action to comment 23 above.
153		Upland disposal sites were not a viable option for the placement of dredged materials from Port Everglades; they were considered environmentally valuable.	Noted.	None taken.
154		Ocean dump sites were more cost effective than upland disposal.	Noted.	None taken.
155		The site may also be an option for dumping from other Federal or private dredging projects.	Noted. This issue is addressed in Sections 1.2.4 and 4.5.	None taken.

156	Mara Shlackman	Areas of controversy identified during the process include proximity to nearshore reefs and the potential for transport of fine-grained material to these reefs, proximity to other significant marine resources and the frequency and cost of monitoring effects of the disposal at the proposed sites.	Noted.	None taken.
157	SHPO	It is the opinion of this office that it is unlikely that selection of the two preferred ODMDSs above will affect archaeological or historical resources eligible for listing on the NRHP, or otherwise of significance; therefore the project appears to be consistent with the historic preservation aspects of Florida's Coastal Zone Management Act, the NHPA and NEPA.	Noted. EPA and the USACE concur with this comment.	None taken.

Appendix C

PALM BEACH HARBOR DISPOSAL AREA STUDY

PALM BEACH HARBOR

DISPOSAL AREA STUDY

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INTRODUCTION

The Jacksonville District of the U.S. Army Corps of Engineers performed this study to determine the availability of upland sites in the vicinity of Palm Beach Harbor for disposal of dredged material. The purpose of the study was to determine the availability and feasibility of using upland sites in comparison to offshore dredged material disposal for Palm Beach Harbor. Upland disposal sites underwent an analysis of environmental, engineering, and economic criteria. The economic assessment included the cost to purchase the required land, construct the necessary features, and transport the dredged material to the site. The analysis involves environmental and economic impacts of offshore and upland disposal to obtain a cost comparison which would indicate the most feasible method of disposal. The analysis and evaluation presented in this study include information and conditions existing during the latter half of 1994. Further, more detailed study would be required to implement any upland site recommended in this report.

As this study is primarily for the disposal of dredged material from the Palm Beach Harbor Federal Project, the Federal navigation channel was the major concern. Any material dredged from local access channels and berthing areas was not a consideration at this time. The Intracoastal Waterway - Jacksonville to Miami (IWW) was also excluded from this study as it is not part of the Palm Beach Harbor Federal Project. The IWW crosses Palm Beach Harbor turning basin in Lake Worth. It provides a channel depth of 10 feet over a bottom width of 125 feet. Therefore, portions of the IWW and Palm Beach Harbor Federal projects overlap. The deeper depths of Palm Beach Harbor are maintained in the overlap area (turning basin). The IWW has disposal sites for future maintenance work. Figure 1 is provided to show the location of Palm Beach Harbor. Figure 2 is provided to show the location of the maintenance areas (shoals).

INITIAL INVESTIGATIONS

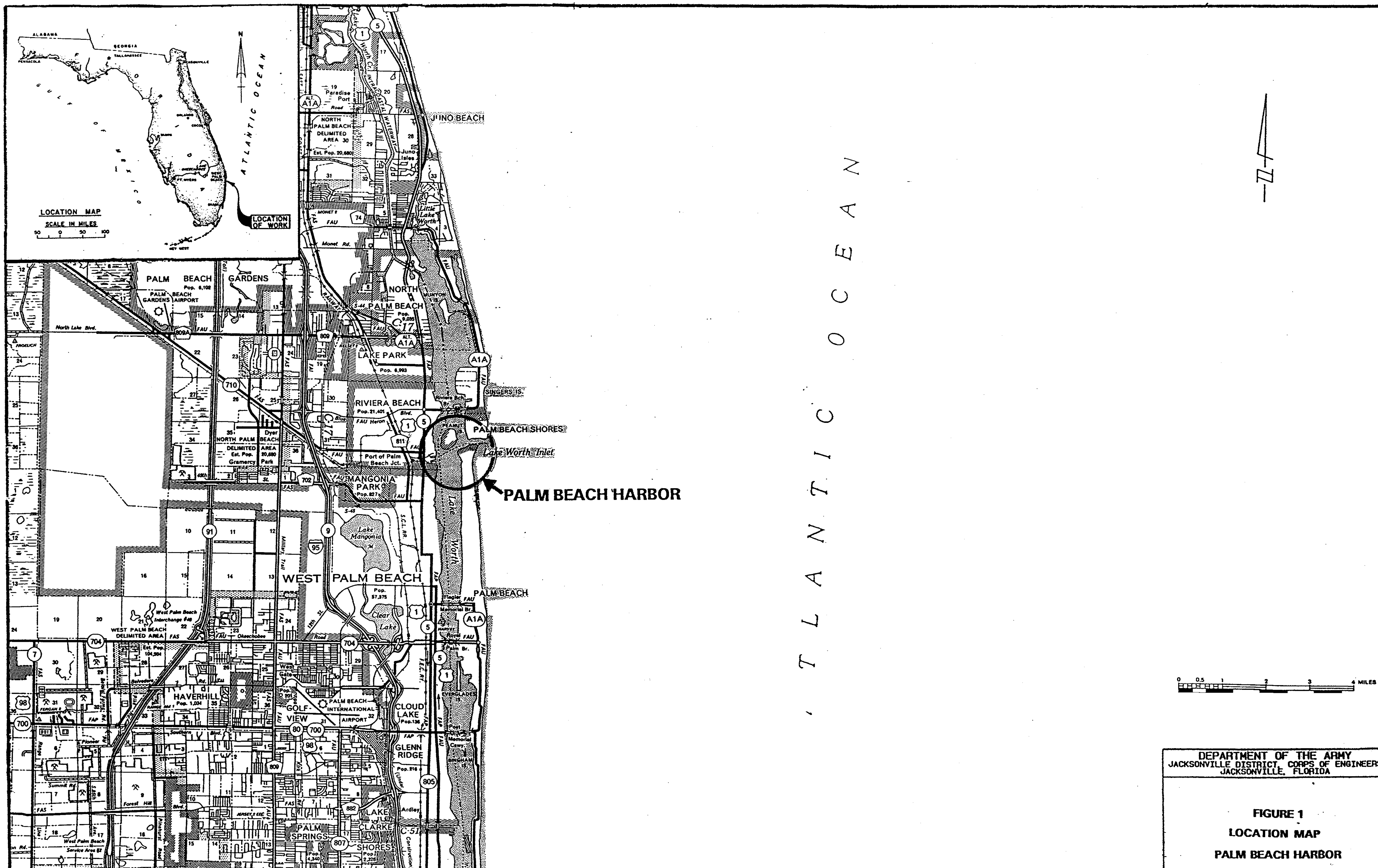
Initial investigations centered on obtaining and reviewing any previous disposal area studies for Palm Beach and other harbors. Recent aerial maps of Palm Beach County were inspected to determine the availability of upland disposal areas within a ten mile arc from the Palm Beach Harbor Turning Basin. Prior studies and reports provided a methodology for an upland area evaluation which included environmental, engineering and economic considerations. Information from several reports on Palm Beach Harbor (Survey-Review Report, General and Detail Design Memorandums, and Feasibility Report and Environmental Assessment) and the Port Everglades Harbor Disposal Area Study were helpful in preparing for this analysis and understanding the problems associated with dredged material disposal.

SHOAL CHARACTERISTICS

The initial analysis involved a determination of dredged material quantity and classification as well as the dredging interval for the entrance channel and turning basin of the harbor. A dredging history on the Federally constructed entrance channel and main turning basin is available in the Jacksonville District Office. That history contains the quantity of material removed from the entrance channel and turning basin during each dredging event with a recorded time frame. Analysis of the data determined the annual shoaling rate and dredging interval for the entrance channel and turning basin in the harbor. After determination of the annual shoaling rate and dredging interval, an analysis of the Palm Beach Harbor maintenance dredging history determined the location and average depth of shoals within the entrance channel, inner channel and turning basin. Shoal material from the inner and entrance channels has been utilized for beach nourishment and was not included in this study. Shoal quantity, surface area, and depth are important factors related to dredging costs for shoal removal. The results of that analysis are presented in table 1.

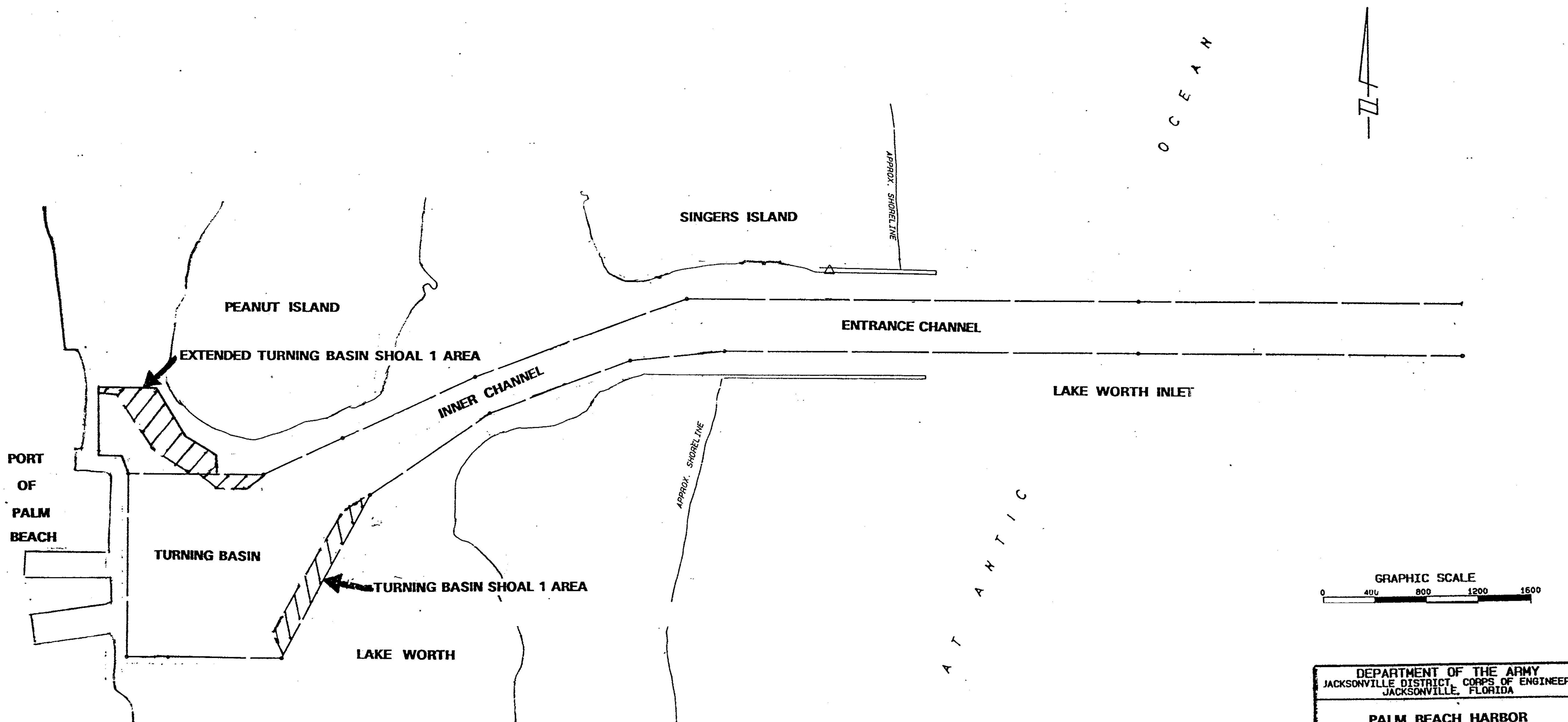
SITE IDENTIFICATION

Selection Criteria - To enable potential site identification, specific criteria was established with regard to size, shape, use, and boundary conditions. Potential sites less than 10 acres in size or with any dwelling were not considered for an upland disposal area. Wetlands or other environmentally sensitive areas were also avoided as potential sites. For any small site, shape would be a consideration to enable sufficient settling time



DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

FIGURE 1
LOCATION MAP
PALM BEACH HARBOR



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PALM BEACH HARBOR

FIGURE 2
LOCATION MAP
MAINTENANCE AREAS

TABLE 1
PALM BEACH HARBOR
HARBOR SECTIONS AND
SHOAL CHARACTERISTICS

SECTION NAME	DEPTH (FEET)	SECTION LENGTH (FEET)	ANNUAL SHOALING (CY)	DREDGE INTERVAL (YEARS)	TOTAL QUANTITY (CY)	SURFACE AREA (FEET ^ 2)	PROJECTED SHOALING (FEET)	MATERIAL TYPE
TURNING BASIN								
SHOAL 1	33	1,650	5,300	3	15,900	43,500	9.9	SAND & SILT
EXTENDED TURNING BASIN								
SHOAL 1	25	1,150	5,000	12	60,000	203,000	7.9	SAND & SILT

for the return water to meet required water quality standards. Property boundaries influenced site selection because severance damages are a consideration in real estate values. Severance damages are paid to aproperty owner when purchasing a portion of a parcel of land that devalues the remaining sections. In designating potential sites, utilization of the entire parcel was a major consideration to avoid any additional severance costs. With the criteria in place, the selection process went forward to identify the geographical boundaries as a means of limiting the scope of the search.

Geographical Boundaries - The identification of initial geographical boundaries usually involves a consideration for pipeline access to any potential site. The shoreline at the Atlantic Ocean forms the eastern limit. Equipment limitations relating to pumping dredged material to potential sites define the southern, western and northern boundaries. The detailed dredging analysis identifies a maximum pumping distance for this study as approximately 10 miles from the hydraulic dredge plant location. The pumping limit of 10 miles is based primarily on equipment limitations such as pipeline availability. Some respected experts in the dredging field consider only a 5 mile maximum pumping distance as reasonable based upon the availability of pipeline. For this study, however, the limit was extended to ensure all possible alternatives for upland locations in the vicinity of Palm Beach Harbor received full consideration. Geographical boundaries and equipment limitations greatly reduced the extent of potential site locations.

Site Selection - REDI maps with aerial photography dated 1992 of Palm Beach County available in the Jacksonville District, U.S. Army Corps of Engineers, Regulatory Division Office were of assistance in determining potential upland disposal site locations. These REDI maps were accessible for inspection in volumes covering the northern, central, and southern portions of Palm Beach County. Utilizing the previously mentioned selection criteria and geographical boundaries, the identification of 122 potential sites was possible in Palm Beach County.

Site Characteristics - The selected sites were then measured from copies of the REDI maps to determine size and perimeter. Site numbers and characteristics are provided in table 2 with most site locations being presented in figure 3. Exact site locations are not identified due to real estate requirements.

TABLE 2
PALM BEACH HARBOR
DISPOSAL AREA STUDY
SITE INFORMATION

SITE NUMBER	SITE SIZE (ACRES)	SITE NUMBER	SITE SIZE (ACRES)	SITE NUMBER	SITE SIZE (ACRES)	SITE NUMBER	SITE SIZE (ACRES)
PALM BEACH COUNTY, FL., NORTH VOLUME							
1	25	15	160	29	33	43	12
2	136	16	388	30	52	44	83
3	41	17	181	31	60	45	159
4	89	17A	11	32	35	46	315
5	110	18	126	33	28	47	267
6	112	19	25	34	96	48	147
7	350	20	272	35	78	49	57
8	232	21	523	36	44	50	19
8A	281	22	553	37	40	51	26
9	302	23	69	38	18	52	71
10	37	24	94	39	24	53	17
11	25	25	307	40	23	54	23
12	37	26	29	41	38	55	98
13	208	27	42	42	22	56	522
14	50	28	63	42A	12	57	68
						58	203
PALM BEACH COUNTY, FL., CENTRAL VOLUME							
59	47	74	12	89	221	104	38
60	27	75	22	90	45	105	14
61	15	76	316	91	53	106	13
62	153	77	39	92	47	107	148
63	117	78	49	93	35	108	27
64	60	79	51	94	26	109	22
65	155	80	14	95	140	110	169
66	86	81	24	96	93	111	24
67	54	82	19	97	27	112	14
68	94	83	121	98	13	113	12
69	54	84	28	99	131	114	20
70	108	85	101	100	186	115	16
71	89	86	19	101	13	116	20
72	275	87	33	102	12	117	17
73	19	88	65	103	152	118	14
						119	13

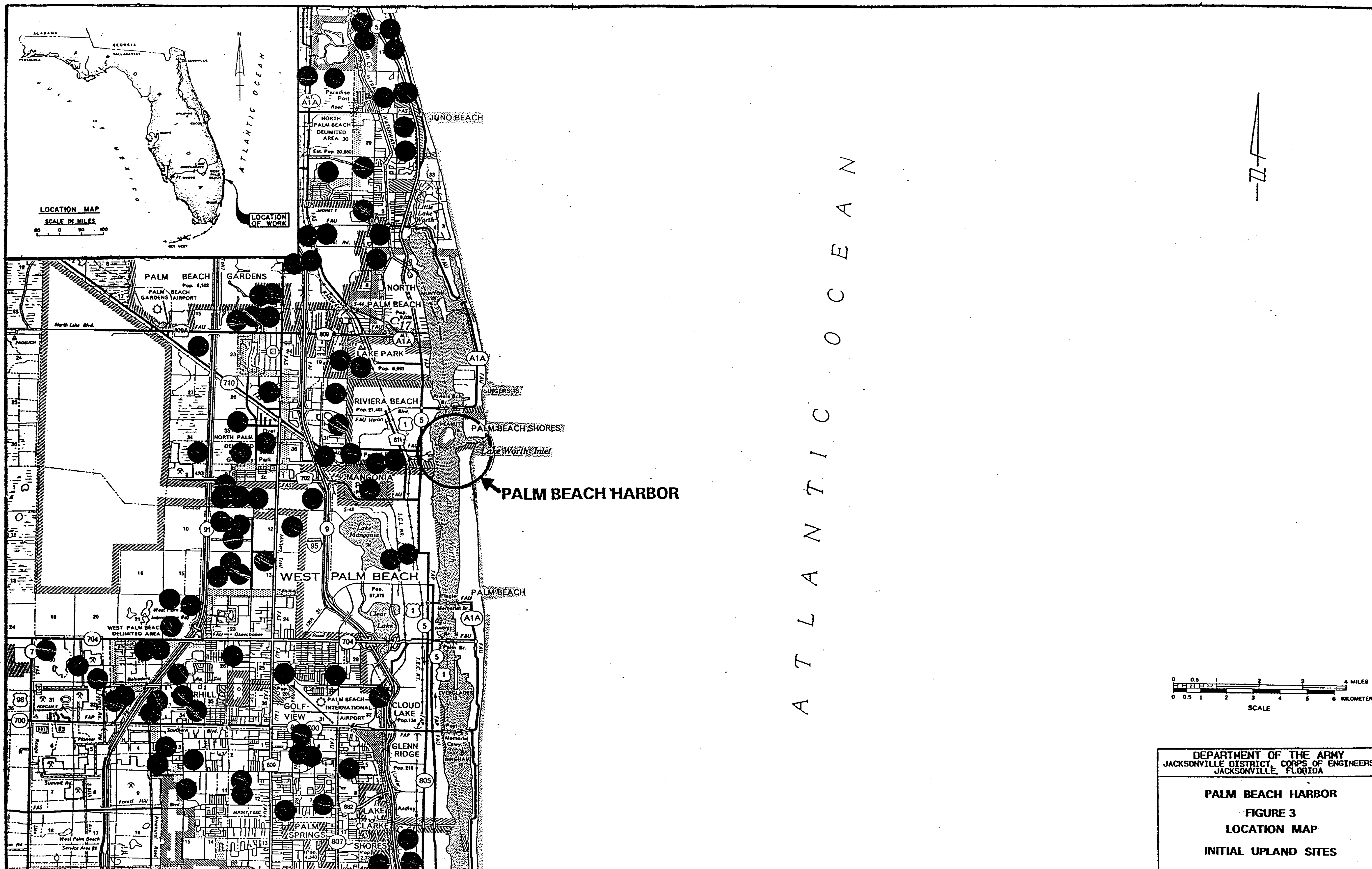
SITE VERIFICATION

Examination of aerial maps of each selected site enabled an environmental scientist to make initial observations concerning any significant environmental resources in the area. Any site with significant environmental resources was either dropped from consideration or redefined to avoid impacting those resources (see table 3). During initial site selection, the assumption was that each site remained as presented in the 1992 aerial maps and that pipeline access to each site would not prohibit site utilization. A site verification trip provided a more current identification and characterization of each site. The site inspection verified the land use and current conditions of the sites under consideration.

Changed Conditions - Site visits identified changes in site conditions that had taken place since the aerial photography was taken in 1992. Site visits to the potential sites revealed changes had taken place in one site. The southern part of site 38 has been developed into a self storage facility. However, this development has taken up only a small portion of site 38 with the remainder of this site still available for a disposal area. Visits to the remaining sites revealed no changes had occurred to make them unsuitable for disposal sites. The results of the site visits have verified that the potential sites are suitable for upland disposal areas.

Pipeline Access - An acceptable access route to the upland disposal site location is necessary. Access routes that must cross major highways, railroads, and other land parcels must take into account any environmental impacts and costs considerations to determine the practicality of such an action. Direct access to a site via an inland waterway is the most desired condition. Navigable waters of the United States do not require real estate easements. Small streams, canals, and drainage ditches can also provide access without an easement if they are attached to navigable waters. Access along highways and railroads is also possible and usually achieved by passing through culverts and under bridges. All potential sites have acceptable pipeline accessibility from adequate canals, drainage ditches, culverts, and bridges near the sites.

A potential site may be within the ten mile arc but a direct route to the site may not be available. In that case, the pipeline distance could exceed the ten mile limit and the site would be dropped from further consideration.



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PALM BEACH HARBOR

FIGURE 3

LOCATION MAP

INITIAL UPLAND SITES

TABLE 3
PALM BEACH HARBOR DISPOSAL AREA STUDY
INITIAL UPLAND SITES ELIMINATED

SITE NUMBER	SITE SIZE (ACRES)	REASON FOR ELIMINATION
PALM BEACH COUNTY, FL., NORTH VOLUME		
1	25	PIPELINE DISTANCE > 10 MILES
2	136	PIPELINE DISTANCE > 10 MILES
3	41	PIPELINE DISTANCE > 10 MILES
4	89	PIPELINE DISTANCE > 10 MILES
5	110	PIPELINE DISTANCE > 10 MILES
6	112	PIPELINE DISTANCE > 10 MILES
7	350	PIPELINE DISTANCE > 10 MILES
8	232	PIPELINE DISTANCE > 10 MILES
8A	281	PIPELINE DISTANCE > 10 MILES
13	208	ENVIRONMENTAL CONCERNS
14	50	ENVIRONMENTAL CONCERNS
15	160	ENVIRONMENTAL CONCERNS
17	181	ENVIRONMENTAL CONCERNS
20	272	PIPELINE DISTANCE > 10 MILES
21	523	PIPELINE DISTANCE > 10 MILES
22	553	PIPELINE DISTANCE > 10 MILES
23	60	ENVIRONMENTAL CONCERNS
24	94	ENVIRONMENTAL CONCERNS
25	307	PIPELINE DISTANCE > 10 MILES
26	29	ENVIRONMENTAL CONCERNS
27	42	ENVIRONMENTAL CONCERNS
29	33	ENVIRONMENTAL CONCERNS
34	96	ENVIRONMENTAL CONCERNS
36	44	ENVIRONMENTAL CONCERNS
41	38	ENVIRONMENTAL CONCERNS
46	315	PIPELINE DISTANCE > 10 MILES
47	267	PIPELINE DISTANCE > 10 MILES
55	98	PIPELINE DISTANCE > 10 MILES
56	522	PIPELINE DISTANCE > 10 MILES
57	68	PIPELINE DISTANCE > 10 MILES
58	203	PIPELINE DISTANCE > 10 MILES
PALM BEACH COUNTY,FL., CENTRAL VOLUME		
59	47	ENVIRONMENTAL CONCERNS
60	27	PIPELINE DISTANCE > 10 MILES
61	15	PIPELINE DISTANCE > 10 MILES
62	153	PIPELINE DISTANCE > 10 MILES
63	117	PIPELINE DISTANCE > 10 MILES
64	60	PIPELINE DISTANCE > 10 MILES
65	155	ENVIRONMENTAL CONCERNS
66	86	ENVIRONMENTAL CONCERNS
67	54	ENVIRONMENTAL CONCERNS
68	94	PIPELINE DISTANCE > 10 MILES
69	54	PIPELINE DISTANCE > 10 MILES
70	108	ENVIRONMENTAL CONCERNS
71	89	PIPELINE DISTANCE > 10 MILES
72	275	ENVIRONMENTAL CONCERNS
73	19	PIPELINE DISTANCE > 10 MILES
74	12	PIPELINE DISTANCE > 10 MILES
75	22	PIPELINE DISTANCE > 10 MILES
76	316	ENVIRONMENTAL CONCERNS

TABLE 3
PALM BEACH HARBOR DISPOSAL AREA STUDY
INITIAL UPLAND SITES ELIMINATED

SITE NUMBER	SITE SIZE (ACRES)	REASON FOR ELIMINATION
PALM BEACH COUNTY, FL., CENTRAL VOLUME(Cont'd)		
77	39	PIPELINE DISTANCE > 10 MILES
78	49	PIPELINE DISTANCE > 10 MILES
79	51	PIPELINE DISTANCE > 10 MILES
80	14	PIPELINE DISTANCE > 10 MILES
81	24	PIPELINE DISTANCE > 10 MILES
82	19	PIPELINE DISTANCE > 10 MILES
83	121	PIPELINE DISTANCE > 10 MILES
84	28	PIPELINE DISTANCE > 10 MILES
85	64	PIPELINE DISTANCE > 10 MILES
86	19	PIPELINE DISTANCE > 10 MILES
87	33	PIPELINE DISTANCE > 10 MILES
88	65	PIPELINE DISTANCE > 10 MILES
89	221	PIPELINE DISTANCE > 10 MILES
90	45	ENVIRONMENTAL CONCERNS
91	53	PIPELINE DISTANCE > 10 MILES
92	47	PIPELINE DISTANCE > 10 MILES
93	35	PIPELINE DISTANCE > 10 MILES
94	26	PIPELINE DISTANCE > 10 MILES
95	140	PIPELINE DISTANCE > 10 MILES
96	93	PIPELINE DISTANCE > 10 MILES
97	27	PIPELINE DISTANCE > 10 MILES
98	13	PIPELINE DISTANCE > 10 MILES
99	131	PIPELINE DISTANCE > 10 MILES
100	186	PIPELINE DISTANCE > 10 MILES
101	13	ENVIRONMENTAL CONCERNS
102	12	PIPELINE DISTANCE > 10 MILES
103	152	PIPELINE DISTANVE > 10 MILES
104	38	ENVIRONMENTAL CONCERNS
105	14	ENVIRONMENTAL CONCERNS
106	13	PIPELINE DISTANVE > 10 MILES
107	148	PIPELINE DISTANCE > 10 MILES
108	27	PIPELINE DISTANCE > 10 MILES
109	22	PIPELINE DISTANCE > 10 MILES
110	169	PIPELINE DISTANCE > 10 MILES
111	24	PIPELINE DISTANCE > 10 MILES
112	14	PIPELINE DISTANCE > 10 MILES
113	12	ENVIRONMENTAL CONCERNS
114	20	PIPELINE DISTANCE > 10 MILES
115	16	PIPELINE DISTANCE > 10 MILES
116	20	PIPELINE DISTANCE > 10 MILES
117	17	PIPELINE DISTANCE > 10 MILES
118	14	ENVIRONMENTAL CONCERNS
119	13	ENVIRONMENTAL CONCERNS

DETAILED SITE ANALYSIS

The detailed site analysis considered the specific characteristics of each site in order to determine preparation requirements and capacity for material disposal. Preparation requirements included such items as clearing and grubbing, dike construction, and weir installation, all of which directly influence costs. Quantification of the work items enabled the development of costs for each site. The total estimated cost of all the work items to prepare a site is then divided by the site capacity to provide a cost per cubic yard ($/cy). Combining that unit cost with the dredging and real estate costs provides a total cost per cubic yard to utilize each site for disposal.

SITE SPECIFICS

An accurate determination of conditions at each site is essential in developing the correct site preparation cost. Site capacity depends upon the amount of usable area and dike heights at the site. Dike heights need to be established and the site area cleared for utilization. Each component is directly related to the utilization cost of a potential site.

Site Capacity - The volume of material that can be placed within the diked area is defined as the site capacity. Site capacity has three components, usable area within the dikes, dike height, and bulking factor. The sites were first identified in the initial site analysis and further reviewed during a field visit. The usable area has an influence on determining the dike height. Further engineering studies would determine the maximum dike height for each site. Most of the potential sites have acreages which could economically and engineeringly support dike heights of at least 20 feet. A freeboard of two feet in the dike height was a factor in estimating the site capacity. For a dike height of 20 feet, the freeboard consideration would limit material placement to a height of 18 feet. Material used for dike construction normally comes from inside the perimeter of the disposal area. The assumption is that each site has suitable material for dike construction. The dike material from inside the disposal area provides additional space for dredged material disposal. The bulking factor varies according to dredged material characteristics. Sand has a bulking factor of 1 while silt can have a bulking factor of 1.5. Based on previous dredging experience and the nature of the dredged material in the harbor, the bulking factor should be approximately 1.3. Based upon the above information, the estimated capacity of each potential site was calculated and is provided in table 4.

TABLE 4
PALM BEACH HARBOR DISPOSAL AREA STUDY
SITE INFORMATION

SITE NUMBER	PERIMETER LENGTH (YARDS)	SITE SIZE (ACRES)	DIKE HEIGHT (FT)	DIKE X-SECTION (SF)	DIKE QUANTITY (CY)	BULKING FACTOR	CAPACITY DIKED AREA (CY)
9	6,913	302	40	5,600	4,301,400	1.3	14,242,000
10	1,875	37	30	3,300	687,500	1.3	1,285,700
11	2,238	25	30	3,300	820,600	1.3	868,700
12	2,248	37	30	3,300	824,300	1.3	1,285,700
16	5,748	388	40	5,600	3,576,500	1.3	18,297,700
17A	998	11	20	1,600	177,400	1.3	245,700
18	3,668	126	40	5,600	2,282,300	1.3	5,942,000
19	1,560	25	30	3,300	572,000	1.3	868,700
28	3,268	63	40	5,600	2,033,400	1.3	2,971,000
30	2,080	52	40	5,600	1,294,200	1.3	2,452,300
31	2,249	60	40	5,600	1,399,400	1.3	2,829,500
32	1,935	42	40	5,600	1,204,000	1.3	1,980,700
33	1,802	28	30	3,300	660,700	1.3	973,000
35	3,268	78	40	5,600	2,033,400	1.3	3,678,400
37	1,907	40	40	5,600	1,186,600	1.3	1,886,400
38	1,462	38	30	3,300	536,100	1.3	1,320,500
39	1,393	24	30	3,300	510,800	1.3	834,000
40	1,505	23	30	3,300	551,800	1.3	799,200
42	1,384	22	30	3,300	507,500	1.3	764,500
42A	1,244	12	20	1,600	221,200	1.3	268,100
43	2,678	64	40	5,600	1,666,300	1.3	3,018,200
44	2,965	83	40	5,600	1,844,900	1.3	3,914,200
45	5,786	159	40	5,600	3,600,200	1.3	7,498,300
48	3,426	147	40	5,600	2,131,700	1.3	6,932,400
49	2,393	57	40	5,600	1,489,000	1.3	2,688,100
50	1,173	19	20	1,600	208,500	1.3	424,400
51	1,752	26	30	3,300	642,400	1.3	903,500
52	2,383	71	40	5,600	1,482,800	1.3	3,348,300
53	1,399	17	20	1,600	248,700	1.3	379,800
54	2,134	23	30	3,300	782,500	1.3	799,200

Site Preparation - Preparation of a potential site for use as a disposal area involves planning and design for dike construction, installation of water control structures (weirs), provisions for returning water from the site, and clearing the site of trees and brush for efficient use. The number of weirs required for a disposal area depends upon disposal area and dredge size. For sites in this study, the area in each is sufficient to accommodate a 30 inch hydraulic dredge. To handle the discharge water from that dredge, each site would need six weirs at a cost of $75,000 per unit. Site clearing costs depend upon the amount and density of trees and bushes to be removed from an area. Aerial photography and site visit was valuable in determining this factor at each site. Table 5 provides the range of costs for clearing and grubbing. Site 32 is an example for estimating the clearing and grubbing cost. The site is in a medium clearing category that is estimated to cost $89,460 to clear and grub. The value is derived from the 42 acres site size multiplied by the $2,130 per acre clearing category. The estimated cost for dike construction is $1.90 per cubic yard with the quantity provided in table 4. Mobilization and demobilization costs for moving equipment to and from the construction site also depends primarily upon the quantity of material needed for dike construction. Table 6 provides the range of costs employed for mobilization and demobilization. To cover the cost of uncertainties in the estimate, a contingency item is estimated at 25 percent of construction costs. Costs for engineering and design (E&D) and construction management (CM) are a percent of the total estimated construction costs. The combined percentage is 15.

Site Cost Summary - The purpose of the detailed site analysis is to determine the site preparation costs for disposal of dredged material. Table 7 provides a site cost summary for each element of cost associated with a potential upland disposal site. The last column in that table provides a cost per cubic yard of dredged material placed in each site. That unit cost is determined by dividing the total cost by the site capacity. The site cost is only a portion of the entire cost for upland disposal. The remaining facets of dredging and real estate are discussed in the following text.

EXISTING DISPOSAL AREAS

At the present time there are no existing disposal areas. Peanut Island has been used as a disposal area for maintenance material from the turning basin. However, Peanut Island is no longer available for a disposal area because it has been determined to have value for wildlife and recreational purposes. Maintenance material from the entrance and inner channels has been placed on the beach area south of the south jetty since the excavated material has been good quality sand.

TABLE 5
PALM BEACH HARBOR DISPOSAL AREA STUDY
CLEARING AND GRUBBING COST RANGES

CLEARING CATEGORY	COST PER ACRE
Light (no trees)	$ 560
Light (with trees)	1,230
Light to Medium	1,450
Medium	1,680
Medium to Heavy	2,130
Heavy	2,460

TABLE 6
PALM BEACH HARBOR DISPOSAL AREA STUDY
MOBILIZATION AND DEMOBILIZATION COST RANGES

CUBIC YARDS	COSTS
30,000 to 311,000	$ 56,000
312,000 to 1,099,000	112,000
1,100,000 to 1,299,000	168,000
1,300,000 to 5,000,000	224,000

TABLE 7
PALM BEACH HARBOR DISPOSAL AREA STUDY
SITE PREPARATION COSTS

SITE NUMBER	SITE SIZE (ACRES)	DIKE QUANTITY (CY)	MOB & DEMOB ($)	DIKE CONSTR ($)	CLEARING & GRUBBING ($)	CONTROL STRUCT ($)	SUBTOTAL ($)	CONTING @ 25% ($)	E&D AND CM @ 15% ($)	TOTAL ($)	DIKED AREA CAPACITY (CY)	COST ($/CY)
9	302	4,301,400	224,000	8,172,660	643,300	450,000	9,489,960	2,372,490	1,423,494	13,285,944	14,242,000	0.93
10	37	687,500	112,000	1,306,250	78,800	450,000	1,947,050	486,763	292,058	2,725,870	1,285,700	2.12
11	25	820,600	112,000	1,559,140	53,300	450,000	2,174,440	543,610	326,166	3,044,216	868,700	3.50
12	37	824,300	112,000	1,566,170	62,200	450,000	2,190,370	547,593	328,556	3,066,518	1,285,700	2.39
16	388	3,576,500	224,000	6,795,350	826,400	450,000	8,295,750	2,073,938	1,244,363	11,614,050	18,297,700	0.63
17A	11	177,400	56,000	337,060	18,500	450,000	861,560	215,390	129,234	1,206,184	245,700	4.91
18	126	2,282,300	224,000	4,336,370	268,400	450,000	5,278,770	1,319,693	791,816	7,390,278	5,942,000	1.24
19	25	572,000	112,000	1,086,800	53,300	450,000	1,702,100	425,525	255,315	2,382,940	868,700	2.74
28	63	2,033,400	224,000	3,863,460	91,400	450,000	4,628,860	1,157,215	694,329	6,480,404	2,971,000	2.18
30	52	1,294,200	168,000	2,458,980	87,400	450,000	3,164,380	791,095	474,657	4,430,132	2,452,300	1.81
31	60	1,399,400	224,000	2,658,860	100,800	450,000	3,433,660	858,415	515,049	4,807,124	2,829,500	1.70
32	42	1,204,000	168,000	2,287,600	89,500	450,000	2,995,100	748,775	449,265	4,193,140	1,980,700	2.12
33	28	660,700	112,000	1,255,330	59,600	450,000	1,876,930	469,233	281,540	2,627,702	973,000	2.70
35	78	2,033,400	224,000	3,863,460	166,100	450,000	4,703,560	1,175,890	705,534	6,584,984	3,678,400	1.79
37	40	1,186,600	168,000	2,254,540	58,000	450,000	2,930,540	732,635	439,581	4,102,756	1,886,400	2.17
38	38	536,100	112,000	1,018,590	80,900	450,000	1,661,490	415,373	249,224	2,326,086	1,320,500	1.76
39	24	510,800	112,000	970,520	29,500	450,000	1,562,020	390,505	234,303	2,186,828	834,000	2.62
40	23	551,800	112,000	1,048,420	33,400	450,000	1,643,820	410,955	246,573	2,301,348	799,200	2.88
42	22	507,500	112,000	964,250	37,000	450,000	1,563,250	390,813	234,488	2,188,550	764,500	2.86
42A	12	221,200	56,000	420,280	20,200	450,000	946,480	236,620	141,972	1,325,072	268,100	4.94
43	64	1,666,300	224,000	3,165,970	136,300	450,000	3,976,270	994,068	596,441	5,566,778	3,018,200	1.84
44	83	1,844,900	224,000	3,505,310	139,400	450,000	4,318,710	1,079,678	647,807	6,046,194	3,914,200	1.54
45	159	3,600,200	224,000	6,840,380	230,600	450,000	7,744,980	1,936,245	1,161,747	10,842,972	7,498,300	1.45
48	147	2,131,700	224,000	4,050,230	213,200	450,000	4,937,430	1,234,358	740,615	6,912,402	6,932,400	1.00
49	57	1,489,000	224,000	2,829,100	82,700	450,000	3,585,800	896,450	537,870	5,020,120	2,688,100	1.87
50	19	208,500	56,000	396,150	23,400	450,000	925,550	231,388	138,833	1,295,770	424,400	3.05
51	26	642,400	112,000	1,220,560	37,700	450,000	1,820,260	455,065	273,039	2,548,364	903,500	2.82
52	71	1,482,800	224,000	2,817,320	87,300	450,000	3,578,620	894,655	536,793	5,010,068	3,348,300	1.50
53	17	248,700	56,000	472,530	24,700	450,000	1,003,230	250,808	150,485	1,404,522	379,800	3.70
54	23	782,500	112,000	1,486,750	28,300	450,000	2,077,050	519,263	311,558	2,907,870	799,200	3.64

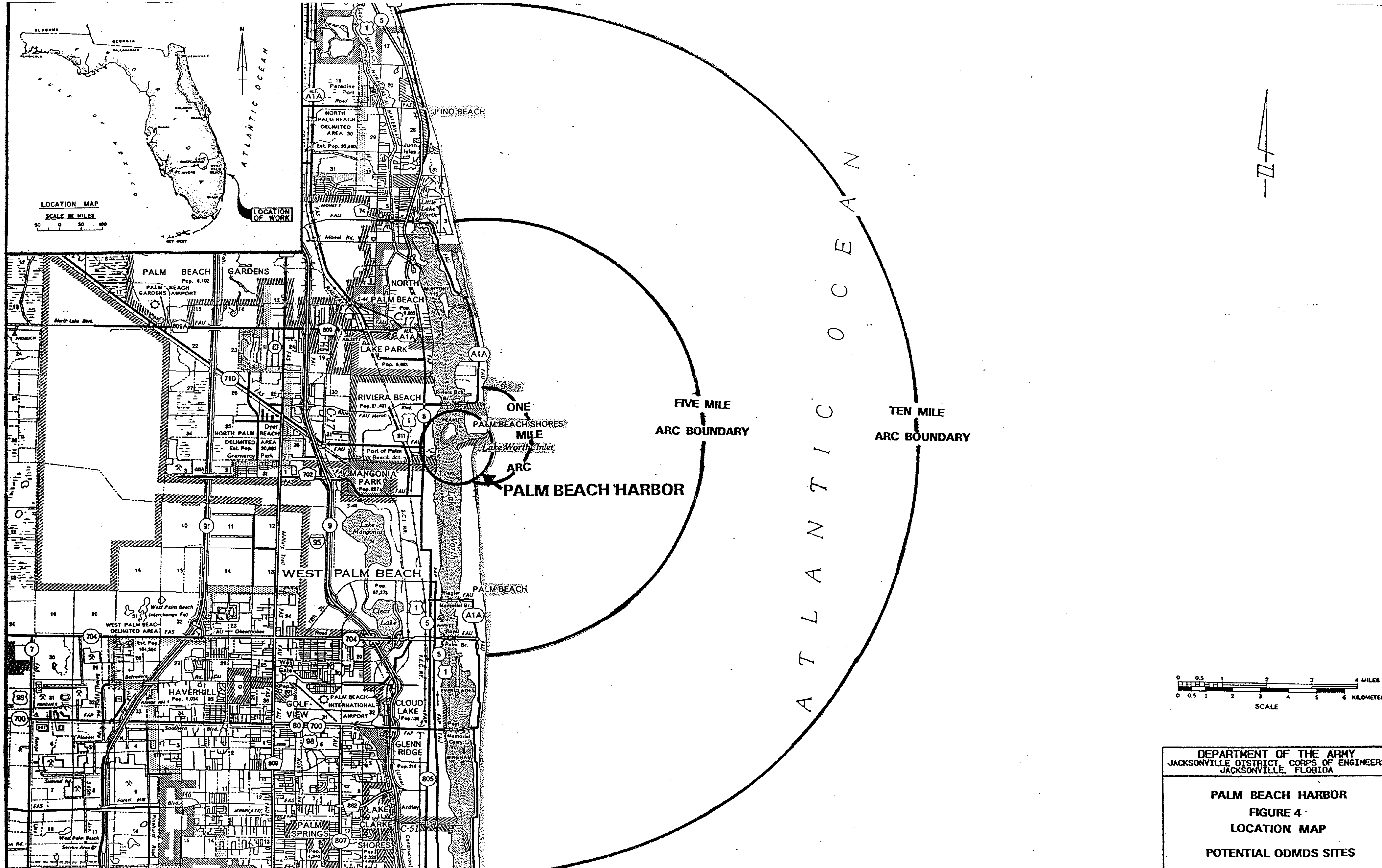
DETAILED DREDGING ANALYSIS

Dredging involves both the removal of material from the channel bottom and transportation to the designated disposal area. The analysis examined three methods of dredging. Clamshell dredging with barge transport and hopper dredging provide the most efficient methods to dispose of material in the offshore dredged material disposal site (ODMDS). Traditional hydraulic dredging with pipeline for transport to an upland site provides an efficient method for moving dredged material to upland disposal sites. As stated in the geographical boundaries section of this study, hydraulic dredging has a pumping limit of 10 miles which is based primarily on equipment limitations such as pipeline availability. Some respected experts in the dredging field consider a 5 mile maximum pumping distance as reasonable based upon the availability of pipeline. For this study, the limit was extended to ensure all possible alternatives for upland locations in the vicinity of Palm Beach Harbor received full consideration.

OCEAN DISPOSAL

The dredging analysis included two methods for ocean disposal of dredged material as mentioned earlier. Hopper dredging as well as clamshell dredging with barge transport are both applicable methods for ocean disposal. Currently, no usable ODMDS exists at Palm Beach Harbor. In order to determine cost for ocean disposal without a definite location for an ODMDS, cost estimates were computed for potential offshore sites in 1 mile increments from the Palm Beach Harbor entrance channel to 10 miles offshore. Figure 4 shows the location of the 1, 5, and 10 mile boundaries.

Hopper Dredge Estimates - The hopper dredge for estimating purposes has a carrying capacity of 3,600 cubic yards (cy). A hopper dredge hydraulically removes shoal material from the channel bottom and places it in a hopper on the dredge. When the hopper is full, the dredge proceeds to the ODMDS where the bottom of the hopper opens depositing the material on the ocean floor. The material classification which greatly influences dredging efficiency and therefore cost was discussed in the shoal characteristics section of this study. As stated in the same section, the project was broken into sections or cuts (see figure 2). A sample estimate to hopper dredge one of the Palm Beach Harbor cuts is provided in table 8. Note that the unit cost given at the top excludes any costs for mobilization, contingencies, engineering and design, as well as construction management. Table 9 provides the total dredging and transportation costs for each cut in the Palm Beach Harbor Federal Project. The costs for mobilization and demobilization are prorated over the project. Hopper dredge costs increase with with the distance to the ODMDS as shown in table 9.



DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

PALM BEACH HARBOR
FIGURE 4
LOCATION MAP
POTENTIAL ODMDS SITES

Mon 11 Jul 1994

TABLE 8
PALM BEACH HARBOR
DISPOSAL AREA STUDY
HOPPER DREDGE ESTIMATE

TIME 13:58:10

CHECKLIST FOR INPUT DATA.
Planning Est. 12 July 94

BID QUANTITY	159,500 C.Y.
UNIT COST...	$3.55 PER C.Y.
EXCAV. COST.	$566,225
TIME........	0.075 MONTHS

PG 1 OF 14: PROJECT TITLES

PROJECT -	Palm Beach Harbor DAS
LOCATION -	Ocean Disposal
INVIT # -	Turning Basin -> 10.0 miles
BID ITEM # -	2
FILENAME -	PBH401H
EST -	Al Fletcher
MIDPT DATE -	Oct-94
DESCRIPTION ENTERED? -	

PG 13 OF 14: MARKUPS USED

O.H. -	15.0%
PROFIT -	10.0%
BOND -	1.0%

PG 2 OF 14: EXCAVATION QTY'S

DREDGING AREA -	43,500 sf
REQ'D EXCAVATION -	15,950 cyds
% MUD -	50%
% SAND -	50%
% GRAVEL -	0%
PAY OVERDEPTH -	0 cyds
O.D. NOT DREDGED -	0 cyds
OVERDIG FOOTAGE -	1.00 ft
NONPAY YARDAGE -	16,100 cyds
GROSS YARDAGE -	175,600 cyds

PG 3 OF 14: LOCAL AREA FACTORS

FUEL COST -	$0.79 /gal
CFC RATE -	7.000%
USE MONTHS / YEAR -	10 mo/yr
MARINE INSUR -	1.5%
TAXES -	1.0%
PROVISIONS & SUPP -	$15 /man

PG 4 OF 14: DREDGE SELECTION (ALT-D)

DREDGE: SUGAR ISLAND

LOADS PER DAY -	5.67
CYCLE TIME -	216 min/load

PG'S 5-7 OF 14: PRODUCTION WORKSHEET

HOPPER CAPACITY -	3,600 cyds	DUMP/CONNECT TIME -	5 min
EFF. HOPPER CAP. -	1,500 cyds	JET PUMP AVAIL? -	YES
AVAIL DREDGING RATE -	2,100 cy/hr	TYPE OF DISPOSAL -	GRAVITY DUMP
AVAIL. DRAGHEADS -	2 ea	PUMPING RATE -	cy/hr
ACT. DRAGHDS USED -	1 ea	TRVL SPD TO DREDG -	11.7 mph
DRDGE RATE USED -	1,050 cy/hr	MAX TRVL SPD LIGHT -	13.8 mph
TURNS/CYCLE -	2 ea	EFFECTIVE TIME -	85.0%
MIN. PER TURN -	3 min	OPER WORK DAYS/MO -	30.42 days
DISPOSAL DIST -	11.1 mi	ADD. CLEANUP TIME -	10%
TRVL SPD TO DISP -	10.8 mph	SPECIAL COST -	$7,000 /mo
MAX TRVL SPD LOADED -	12.7 mph	SPECIAL COST -	$0 /job

PG'S 8-9 OF 14: PLANT OWN. & OPER.

DREDGE -	$361,328
PROPULSION TUG -	self prop.
SURVEY VESSEL -	$30,000
BOOSTER -	$0
CRANE BARGE -	$0
TENDER TUG -	$0
SHORE EQUIP -	$0

PG'S 10-12 OF 14: LABOR, 24 Jun 88

OVERTIME % -	28.00%
VACATION/HOLIDAY % -	8.64%
TAX & INSUR % -	30.61%
FRINGE BENEFITS -	$4.35 /hr
DREDGE CREW:	
SUGG. CREW SIZE -	14 ea
USED CREW SIZE -	14 ea
SHORE CREW:	
USED CREW SIZE -	0 ea
GOVERNMENT PERSON -	3 ea
FRE. PD TRAVEL -	28 days
RT TRAVEL COST -	$400

PG 14 OF 14: DREDGE OPER. ADJ. FACTORS

PUMP LOAD FACTOR -	50%
RPR & MAINT. ADJ -	1.00
JET PUMP % USAGE -	100%

TABLE 9
PALM BEACH HARBOR DISPOSAL AREA STUDY
HOPPER DREDGE AND OCEAN DISPOSAL COSTS

CUT NAME	SHOAL QUANTITY (CY)	MOB & DEMOB PER CUT	EXCAVATION COST PER CUT	SUBTOTAL COSTS PER CUT	CONT COSTS 25%	E&D AND CM 15%	HOPPER TOTAL $	DREDGING COSTS $/(CY)
1 MILE OFFSHORE								
TURNING BASIN	15,950	52,700	31,700	84,400	21,100	12,700	118,200	7.41
EXT TURNING BASIN	59,700	197,300	81,200	278,500	69,600	41,800	389,900	6.53
TOTALS – 1 MILE	75,650	250,000	112,900	362,900	90,700	54,500	508,100	
2 MILES OFFSHORE								
TURNING BASIN	15,950	52,700	34,000	86,700	21,700	13,000	121,400	7.61
EXT TURNING BASIN	59,700	197,300	91,300	288,600	72,200	43,300	404,100	6.77
TOTALS – 2 MILES	75,650	250,000	125,300	375,300	93,900	56,300	525,500	
3 MILES OFFSHORE								
TURNING BASIN	15,950	52,700	36,200	88,900	22,200	13,300	124,400	7.80
EXT TURNING BASIN	59,700	197,300	101,500	298,800	74,700	44,800	418,300	7.01
TOTALS – 3 MILES	75,650	250,000	137,700	387,700	96,900	58,100	542,700	
4 MILES OFFSHORE								
TURNING BASIN	15,950	52,700	39,200	91,900	23,000	13,800	128,700	8.07
EXT TURNING BASIN	59,700	197,300	111,600	308,900	77,200	46,300	432,400	7.24
TOTALS – 4 MILES	75,650	250,000	150,800	400,800	100,200	60,100	561,100	
5 MILES OFFSHORE								
TURNING BASIN	15,950	52,700	42,300	95,000	23,800	14,300	133,100	8.34
EXT TURNING BASIN	59,700	197,300	123,600	320,900	80,200	48,100	449,200	7.52
TOTALS – 5 MILES	75,650	250,000	165,900	415,900	104,000	62,400	582,300	
6 MILES OFFSHORE								
TURNING BASIN	15,950	52,700	44,700	97,400	24,400	14,600	136,400	8.55
EXT TURNING BASIN	59,700	197,300	134,300	331,600	82,900	49,700	464,200	7.78
TOTALS – 6 MILES	75,650	250,000	179,000	429,000	107,300	64,300	600,600	
7 MILES OFFSHORE								
TURNING BASIN	15,950	52,700	48,300	101,000	25,300	15,200	141,500	8.87
EXT TURNING BASIN	59,700	197,300	143,900	341,200	85,300	51,200	477,700	8.00
TOTALS – 7 MILES	75,650	250,000	192,200	442,200	110,600	66,400	619,200	
8 MILES OFFSHORE								
TURNING BASIN	15,950	52,700	50,600	103,300	25,800	15,500	144,600	9.07
EXT TURNING BASIN	59,700	197,300	156,400	353,700	88,400	53,100	495,200	8.29
TOTALS – 8 MILES	75,650	250,000	207,000	457,000	114,200	68,600	639,800	
9 MILES OFFSHORE								
TURNING BASIN	15,950	52,700	53,000	105,700	26,400	15,900	148,000	9.28
EXT TURNING BASIN	59,700	197,300	166,000	363,300	90,800	54,500	508,600	8.52
TOTALS – 9 MILES	75,650	250,000	219,000	469,000	117,200	70,400	656,600	
10 MILES OFFSHORE								
TURNING BASIN	15,950	52,700	56,600	109,300	27,300	16,400	153,000	9.59
EXT TURNING BASIN	59,700	197,300	177,300	374,600	93,700	56,200	524,500	8.79
TOTALS – 10 MILES	75,650	250,000	233,900	483,900	121,000	72,600	677,500	
20 MILES OFFSHORE								
TURNING BASIN	15,950	52,700	83,700	136,400	34,100	20,500	191,000	11.97
EXT TURNING BASIN	59,700	197,300	283,000	480,300	120,100	72,000	672,400	11.26
TOTALS – 20 MILES	75,650	250,000	366,700	616,700	154,200	92,500	863,400	

Clamshell Estimates - The clamshell dredging techniques are similar to the hopper dredge. The clamshell removes shoal material from the channel bottom which is deposited in an ocean going barge for transport to the ODMDS. One benefit of the clamshell operation is that with multiple barges the clamshell dredge can operate almost continuously. However, the additional equipment does cost more to mobilize to the dredging location. The clamshell dredge (26 cy) utilizes a 26 cy bucket to remove silty material and a 21 cy bucket to remove sandy material. The dredge is estimated to need two barges for transporting the material. The clamshell dredge works continuously. While one barge is enroute to the ODMDS, the clamshell is loading another barge. The number of barges influences the operating efficiency of the dredge. Table 10 provides a sample estimate summary similar to the hopper dredge estimate in table 8. Again, the mobilization and other costs absent in table 8 are also absent in the clamshell sample estimate. Table 11 provides the total dredging and transportation costs using a clamshell for each cut as shown in table 9. As with the hopper dredge costs, distance to the ODMDS is a factor influencing clamshell dredging costs.

UPLAND DISPOSAL

Upland disposal costs involved the traditional hydraulic dredging and transport to an upland site. As mentioned earlier, hydraulic dredging and material movement via pipeline has a 10 mile limit due to equipment limitations and dredging efficiencies. A pipeline access route was established to each potential upland site. The total cost for upland disposal includes dredging and transportation costs, site preparation cost, and site procurement cost. Further discussion of dredging and transportation costs is in the subsequent text.

Hydraulic Dredging - As stated throughout this report, hydraulic dredging is the traditional method for upland disposal and generally, the most economical for pumping distances less than 5 miles. This fact is possible because the dredge can work continuously without stopping to empty the hopper as with a hopper dredge or having to wait for a barge to return as with a clamshell dredge. A sample estimate for hydraulic dredging is given in table 12. The total cost is in table 13. The dredging costs shown in $ per cubic yard in table 13 reveal that potential disposal sites 9, 10, 11, 12, 16, 17A, 18, 19, 28, 30, 31, 39, 48, 50, 51, 52, 53, and 54 have significantly higher dredging costs than the rest of the potential sites. These sites were then dropped from further consideration. As described earlier, hydraulic dredging to a disposal site is restricted to a distance of approximately 10 miles. The mobilization cost for each maintenance event was prorated over the entire harbor. The assumption was made that maintenance of the turning basin areas would coincide with maintenance of the remainder of the harbor. Since the dredge and approximately 1.6 miles of pipe will be required to accomplish the beach placement only the mobilization costs for additional pipeline and booster pumps required for upland disposal where attributed to this portion of the study.

TABLE 10
PALM BEACH HARBOR
DISPOSAL AREA STUDY
MECHANICAL DREDGE ESTIMATE

CHECKLIST FOR INPUT DATA.

Palm Beach Harbor DAS

BID QUANTITY	15,942 C.Y.
UNIT COST...	$2.69 PER C.Y.
EXCAV. COST.	$42,884
TIME........	0.07 MONTHS

PG 1 OF 9: PROJECT TITLES

FILENAME -	PBH401M
PROJECT -	Palm Beach Harbor DAS
LOCATION -	Ocean Disposal
INVIT # -	Turning Basin -> 10.0 miles
DATE OF EST. -	12 July 94
EST. BY -	Al Fletcher
MOB. BID ITEM # -	0
EXCAV. BID ITEM # -	0
TYPE OF EST. -	Planning Estimate

PG 2 OF 9: EXCAVATION QTY'S

DREDGING AREA -	43,514 sf
REQ'D EXCAVATION -	15,942 cyds
PAY OVERDEPTH -	0 cyds
CONTRACT AMOUNT -	15,942 cyds
NOT DREDGED -	0 cyds
NONPAY YARDAGE -	1,600 cyds
GROSS YARDAGE -	17,542 cyds
NONPAY HEIGHT -	1.0 ft overdig.
TOTAL BANK HEIGHT -	10.9 ft

PG 3 OF 9: EXCAVATION PRODUCTION WORKSHEET

DREDGE SELECTED -	21 CY Clamshell Dredge
TYPE OF MATERIAL -	SAND
BUCKET SIZE -	16
BUCKET FILL FACTOR -	0.70
OPTIMUM BANK -	8
BANK FACTOR -	1.00

PG 4 OF 9: EXCAVATION PRODUCTION WORKSHEET

BUCKET CYCLE TIME -	55 Seconds
OTHER FACTOR -	1.00 >
CLEANUP -	10% More Time
TIME EFFICIENCY -	65.0% of EWT

PG 5 OF 9: HAULING PRODUCTION WORKSHEET

TUG DESCRIPTION -	3000 HP Diesel--Twin Screw
PREPARE SCOW TOW -	15 min
HAUL DIST -	11.1 mi
SPEED TO D/A -	5 mph
SPEED FROM D/A -	6 mph

PG 5 OF 9: HAULING PRODUCTION WORKSHEET

DUMP OR PUMPOUT -	20 min
DISENGAGE TOW -	10 min
TOW EFFICIENCY -	80 %
SCOW DESCRIPTION -	3000 CY Split Hull Scow
USEABLE VOLUME -	90 %
% SOLIDS -	80 %

PG 6 OF 9: EQUIPMENT MATCHING

# OF PIECES:	Used
DREDGES -	1
SCOWS PER DREDGE -	1
TOWING VESSELS -	1
SCOWS PER TOW -	1
ADDITIONAL SCOWS -	0
TOT SCOWS ON JOB -	2

PG 7 OF 9: SPECIAL LABOR & EQUIPMENT

QUARTERS ON DREDGE? -	NO
SURVEY BOAT? -	YES
CREW BOAT? -	NO

PG 8 OF 9: LOCAL AREA FACTORS

PRESENT YEAR -	1993
ECONOMIC INDEX -	4718
LAF -	0.840
INTEREST RATE -	7.000% /yr
TIME PERIOD -	July to December, 1994
PLANT AVAILABLE -	10 mos/yr
FUEL PRICE -	$0.79 /gal

PG 9 OF 9: OTHER ADJUSTMENTS

SPECIAL COST/MO -	$7,000 Turbidity Monitoring
SPECIAL COST LS -	$0 >
CONTRACTOR'S O.H. -	15.0%
CONTRACTOR'S PROFIT -	10.0%
CONTRACTOR'S BOND -	1.0%

TABLE 11
PALM BEACH HARBOR DISPOSAL AREA STUDY
MECHANICAL DREDGE AND OCEAN DISPOSAL COSTS

CUT NAME	SHOAL QUANTITY (CY)	MOB & DEMOB PER CUT	EXCAVATION COST PER CUT	SUBTOTAL COSTS PER CUT	CONT COSTS 25%	E&D AND CM 15%	TOTAL $	DREDGING COSTS $/(CY)
1 MILE OFFSHORE								
TURNING BASIN	15,950	52,700	33,600	86,300	21,600	12,900	120,800	7.57
EXT TURNING BASIN	59,700	197,300	118,200	315,500	78,900	47,300	441,700	7.40
TOTALS – 1 MILE	75,650	250,000	151,800	401,800	100,500	60,200	562,500	
2 MILES OFFSHORE								
TURNING BASIN	15,950	52,700	34,300	87,000	21,800	13,100	121,900	7.64
EXT TURNING BASIN	59,700	197,300	120,600	317,900	79,500	47,700	445,100	7.46
TOTALS – 2 MILES	75,650	250,000	154,900	404,900	101,300	60,800	567,000	
3 MILES OFFSHORE								
TURNING BASIN	15,950	52,700	34,900	87,600	21,900	13,100	122,600	7.69
EXT TURNING BASIN	59,700	197,300	123,000	320,300	80,100	48,000	448,400	7.51
TOTALS – 3 MILES	75,650	250,000	157,900	407,900	102,000	61,100	571,000	
4 MILES OFFSHORE								
TURNING BASIN	15,950	52,700	35,700	88,400	22,100	13,300	123,800	7.76
EXT TURNING BASIN	59,700	197,300	125,400	322,700	80,700	48,400	451,800	7.57
TOTALS – 4 MILES	75,650	250,000	161,100	411,100	102,800	61,700	575,600	
5 MILES OFFSHORE								
TURNING BASIN	15,950	52,700	36,300	89,000	22,300	13,400	124,700	7.82
EXT TURNING BASIN	59,700	197,300	127,800	325,100	81,300	48,800	455,200	7.62
TOTALS – 5 MILES	75,650	250,000	164,100	414,100	103,600	62,200	579,900	
6 MILES OFFSHORE								
TURNING BASIN	15,950	52,700	37,000	89,700	22,400	13,500	125,600	7.87
EXT TURNING BASIN	59,700	197,300	130,100	327,400	81,900	49,100	458,400	7.68
TOTALS – 6 MILES	75,650	250,000	167,100	417,100	104,300	62,600	584,000	
7 MILES OFFSHORE								
TURNING BASIN	15,950	52,700	37,600	90,300	22,600	13,500	126,400	7.92
EXT TURNING BASIN	59,700	197,300	132,500	329,800	82,500	49,500	461,800	7.74
TOTALS – 7 MILES	75,650	250,000	170,100	420,100	105,100	63,000	588,200	
8 MILES OFFSHORE								
TURNING BASIN	15,950	52,700	38,400	91,100	22,800	13,700	127,600	8.00
EXT TURNING BASIN	59,700	197,300	138,500	335,800	84,000	50,400	470,200	7.88
TOTALS – 8 MILES	75,650	250,000	176,900	426,900	106,800	64,100	597,800	
9 MILES OFFSHORE								
TURNING BASIN	15,950	52,700	39,100	91,800	23,000	13,800	128,600	8.06
EXT TURNING BASIN	59,700	197,300	148,700	346,000	86,500	51,900	484,400	8.11
TOTALS – 9 MILES	75,650	250,000	187,800	437,800	109,500	65,700	613,000	
10 MILES OFFSHORE								
TURNING BASIN	15,950	52,700	42,900	95,600	23,900	14,300	133,800	8.39
EXT TURNING BASIN	59,700	197,300	158,800	356,100	89,000	53,400	498,500	8.35
TOTALS – 10 MILES	75,650	250,000	201,700	451,700	112,900	67,700	632,300	
20 MILES OFFSHORE								
TURNING BASIN	15,950	52,700	67,800	120,500	30,100	18,100	168,700	10.58
EXT TURNING BASIN	59,700	197,300	259,100	456,400	114,100	68,500	639,000	10.70
TOTALS – 20 MILES	75,650	250,000	326,900	576,900	144,200	86,600	807,700	

TABLE 12
PALM BEACH HARBOR
DISPOSAL AREA STUDY
HYDRAULIC DREDGE ESTIMATE

CHECKLIST FOR INPUT DATA.

Palm Beach Harbor DAS

BID QUANTITY	15,942 C.Y.
UNIT COST...	$1.59 PER C.Y.
EXCAV. COST.	$25,348
TIME........	0.02 MONTHS

PG 1 OF 9: PROJECT TITLES

FILENAME -	PBH401P
PROJECT -	Palm Beach Harbor DAS
LOCATION -	Site 45
INVIT # -	Turning Basin
DATE OF EST. -	12 July 94
EST. BY -	Al Fletcher & Tim Murphy
MOB. BID ITEM # -	0
EXCAV. BID ITEM # -	0
TYPE OF EST. -	Planning Estimate

PG 2 OF 9: EXCAVATION QTY'S

DREDGING AREA -	43,514 sf
REQ'D EXCAVATION -	15,942 cyds
PAY OVERDEPTH -	0 cyds
CONTRACT AMOUNT -	15,942 cyds
NOT DREDGED -	0 cyds
NONPAY YARDAGE -	1,600 cyds
GROSS YARDAGE -	17,542 cyds
NONPAY HEIGHT -	1.0 ft overdig.
TOTAL BANK HEIGHT -	10.9 ft

PG 3 OF 9: MAXIMUM PIPELINE REQUIRED

FLOATING -	2,000 ft
SUBMERGED -	31,300 ft
SHORE -	1,000 ft
TOTAL -	34,300 ft
COST CATEGORY -	2 SAND
EQUIVALENT -	0 ft

PG 4 OF 9: MATERIAL FACTOR

DESCRIPTION	FACTOR	PERCENTAGE %
MUD & SILT	3	0
MUD & SILT	2.5	50
MUD & SILT	2	0
LOOSE SAND	1.1	0
LOOSE SAND	1	50
COMP. SAND	0.9	0
STIFF CLAY	0.6	0
COMP. SHELL	0.5	0
SOFT ROCK	0.4	0
BLAST. ROCK	0.25	0

RESULTANT
MATERIAL FACTOR - 1.43

PG 5 OF 9: DREDGE SELECTION

DREDGE SELECTED -	30" HYDRAULIC DREDGE
COMPUTED BANK FACTOR -	1.1
BANK FACTOR USED -	1.1 >
OTHER FACTOR -	1 >
CLEANUP -	10% More Time

PG 6 OF 9: HORSEPOWER CONSIDERATIONS

CHART H.P. -	9,000 hp
AVAILABLE H.P. -	9,000 hp
BOOSTER H.P. -	5,200 hp(ea)
LOSS PER BOOSTER -	15%

PG 7 OF 9: CHART PRODUCTION ANALYSIS

AVE. PIPELINE -	33,400 ft
BOOSTERS -	2
BOOSTER FACTOR -	0.70
% EFF WORK TIME (GROSS)-	65.0%
MAX. POSSIBLE -	63,526 ft
TOTAL HP AVAIL -	19,400 hp
% EFF WORK TIME (NET) -	45.5%
OPERATING TIME -	332 hours per month

PG 8 OF 9: GROSS PRODUCTION & LOCAL AREA FACTORS

PRODUCTION OVERRIDE -	NO
NET PRODUCTION -	2,134 net cy per hour
OPERATING TIME -	332 hours per month
BASED ON -	2 booster(s)
PAY PRODUCTION -	797,100 pay cy per month
PRESENT YEAR -	1993
ECONOMIC INDEX -	4718
LAF -	0.84
INTEREST RATE -	7.000% /yr
TIME PERIOD -	July to December, 1994
PLANT AVAILABLE -	9 mos/yr
FUEL PRICE -	$0.79 /gal

PG 9 OF 9: OTHER ADJUSTMENTS

SPECIAL COST/MO -	$7,000 Turbidity Monitoring
SPECIAL COST LS -	$0 >
CONTRACTOR'S O.H. -	15.0%
CONTRACTOR'S PROFIT -	10.0%
CONTRACTOR'S BOND -	1.0%

TABLE 13
PALM BEACH HARBOR DISPOSAL AREA STUDY
HYDRAULIC DREDGE AND UPLAND DISPOSAL COSTS

CUT NAME	SHOAL QUANTITY (CY)	MOB & DEMOB PER CUT	EXCAVATION COST PER CUT	SUBTOTAL COSTS PER CUT	CONT COSTS 25%	E&D AND CM 15%	TOTAL $	DREDGING COSTS $/(CY)
SITE 9								
TURNING BASIN	15,950	132,300	49,400	181,700	45,400	27,300	254,400	15.95
EXT TURNING BASIN	59,750	495,500	186,900	682,400	170,600	102,400	955,400	15.99
TOTALS – SITE 9	75,700	627,800	236,300	864,100	216,000	129,700	1,209,800	
SITE 10								
TURNING BASIN	15,950	108,700	39,200	147,900	37,000	22,200	207,100	12.98
EXT TURNING BASIN	59,750	407,100	170,100	577,200	144,300	86,600	808,100	13.52
TOTALS – SITE 10	75,700	515,800	209,300	725,100	181,300	108,800	1,015,200	
SITE 11								
TURNING BASIN	15,950	125,500	48,900	174,400	43,600	26,200	244,200	15.31
EXT TURNING BASIN	59,750	470,300	185,100	655,400	163,900	98,300	917,600	15.36
TOTALS – SITE 11	75,700	595,800	234,000	829,800	207,500	124,500	1,161,800	
SITE 12								
TURNING BASIN	15,950	127,600	49,100	176,700	44,200	26,500	247,400	15.51
EXT TURNING BASIN	59,750	478,200	185,700	663,900	166,000	99,600	929,500	15.56
TOTALS – SITE 12	75,700	605,800	234,800	840,600	210,200	126,100	1,176,900	
SITE 16								
TURNING BASIN	15,950	99,800	38,700	138,500	34,600	20,800	193,900	12.16
EXT TURNING BASIN	59,750	374,000	154,600	528,600	132,200	79,300	740,100	12.39
TOTALS – SITE 16	75,700	473,800	193,300	667,100	166,800	100,100	934,000	
SITE 17A								
TURNING BASIN	15,950	128,900	49,100	178,000	44,500	26,700	249,200	15.62
EXT TURNING BASIN	59,750	482,900	186,300	669,200	167,300	100,400	936,900	15.68
TOTALS – SITE 17A	75,700	611,800	235,400	847,200	211,800	127,100	1,186,100	
SITE 18								
TURNING BASIN	15,950	128,500	49,100	177,600	44,400	26,600	248,600	15.59
EXT TURNING BASIN	59,750	481,300	185,700	667,000	166,800	100,100	933,900	15.63
TOTALS – SITE 18	75,700	609,800	234,800	844,600	211,200	126,700	1,182,500	
SITE 19								
TURNING BASIN	15,950	109,900	39,400	149,300	37,300	22,400	209,000	13.10
EXT TURNING BASIN	59,750	411,900	170,100	582,000	145,500	87,300	814,800	13.64
TOTALS – SITE 19	75,700	521,800	209,500	731,300	182,800	109,700	1,023,800	
SITE 28								
TURNING BASIN	15,950	113,300	39,400	152,700	38,200	22,900	213,800	13.40
EXT TURNING BASIN	59,750	424,500	170,100	594,600	148,700	89,200	832,500	13.93
TOTALS – SITE 28	75,700	537,800	209,500	747,300	186,900	112,100	1,046,300	
SITE 30								
TURNING BASIN	15,950	98,100	38,600	136,700	34,200	20,500	191,400	12.00
EXT TURNING BASIN	59,750	367,700	145,100	512,800	128,200	76,900	717,900	12.02
TOTALS – SITE 30	75,700	465,800	183,700	649,500	162,400	97,400	909,300	
SITE 31								
TURNING BASIN	15,950	109,100	39,200	148,300	37,100	22,200	207,600	13.02
EXT TURNING BASIN	59,750	408,700	170,100	578,800	144,700	86,800	810,300	13.56
TOTALS – SITE 31	75,700	517,800	209,300	727,100	181,800	109,000	1,017,900	
SITE 32								
TURNING BASIN	15,950	73,000	37,600	110,600	27,700	16,600	154,900	9.71
EXT TURNING BASIN	59,750	273,300	128,400	401,700	100,400	60,300	562,400	9.41
TOTALS – SITE 32	75,700	346,300	166,000	512,300	128,100	76,900	717,300	
SITE 33								
TURNING BASIN	15,950	49,300	24,100	73,400	18,400	11,000	102,800	6.45
EXT TURNING BASIN	59,750	184,500	108,100	292,600	73,200	43,900	409,700	6.86
TOTALS – SITE 33	75,700	233,800	132,200	366,000	91,600	54,900	512,500	
SITE 35								
TURNING BASIN	15,950	46,700	23,900	70,600	17,700	10,600	98,900	6.20
EXT TURNING BASIN	59,750	175,100	95,500	270,600	67,700	40,600	378,900	6.34
TOTALS – SITE 35	75,700	221,800	119,400	341,200	85,400	51,200	477,800	
SITE 37								
TURNING BASIN	15,950	70,300	25,300	95,600	23,900	14,300	133,800	8.39
EXT TURNING BASIN	59,750	263,500	123,600	387,100	96,800	58,100	542,000	9.07
TOTALS – SITE 37	75,700	333,800	148,900	482,700	120,700	72,400	675,800	

TABLE 13
PALM BEACH HARBOR DISPOSAL AREA STUDY
HYDRAULIC DREDGE AND UPLAND DISPOSAL COSTS

CUT NAME	SHOAL QUANTITY (CY)	MOB & DEMOB PER CUT	EXCAVATION COST PER CUT	SUBTOTAL COSTS PER CUT	CONT COSTS 25%	E&D AND CM 15%	TOTAL $	DREDGING COSTS $/(CY)
SITE 38								
TURNING BASIN	15,950	73,800	37,800	111,600	27,900	16,700	156,200	9.79
EXT TURNING BASIN	59,750	276,500	128,400	404,900	101,200	60,700	566,800	9.49
TOTALS – SITE 38	75,700	350,300	166,200	516,500	129,100	77,400	723,000	
SITE 39								
TURNING BASIN	15,950	93,100	38,300	131,400	32,900	19,700	184,000	11.54
EXT TURNING BASIN	59,750	348,700	143,300	492,000	123,000	73,800	688,800	11.53
TOTALS – SITE 39	75,700	441,800	181,600	623,400	155,900	93,500	872,800	
SITE 40								
TURNING BASIN	15,950	76,800	38,100	114,900	28,700	17,200	160,800	10.08
EXT TURNING BASIN	59,750	287,500	129,000	416,500	104,100	62,500	583,100	9.76
TOTALS – SITE 40	75,700	364,300	167,100	531,400	132,800	79,700	743,900	
SITE 42								
TURNING BASIN	15,950	74,200	37,800	112,000	28,000	16,800	156,800	9.83
EXT TURNING BASIN	59,750	278,100	128,400	406,500	101,600	61,000	569,100	9.52
TOTALS – SITE 42	75,700	352,300	166,200	518,500	129,600	77,800	725,900	
SITE 42A								
TURNING BASIN	15,950	74,200	37,800	112,000	28,000	16,800	156,800	9.83
EXT TURNING BASIN	59,750	278,100	128,400	406,500	101,600	61,000	569,100	9.52
TOTALS – SITE 42A	75,700	352,300	166,200	518,500	129,600	77,800	725,900	
SITE 43								
TURNING BASIN	15,950	74,000	37,800	111,800	28,000	16,800	156,600	9.82
EXT TURNING BASIN	59,750	277,300	128,400	405,700	101,400	60,900	568,000	9.51
TOTALS – SITE 43	75,700	351,300	166,200	517,500	129,400	77,700	724,600	
SITE 44								
TURNING BASIN	15,950	77,200	38,100	115,300	28,800	17,300	161,400	10.12
EXT TURNING BASIN	59,750	289,100	129,000	418,100	104,500	62,700	585,300	9.80
TOTALS – SITE 44	75,700	366,300	167,100	533,400	133,300	80,000	746,700	
SITE 45								
TURNING BASIN	15,950	70,300	25,300	95,600	23,900	14,300	133,800	8.39
EXT TURNING BASIN	59,750	263,500	123,600	387,100	96,800	58,100	542,000	9.07
TOTALS – SITE 45	75,700	333,800	148,900	482,700	120,700	72,400	675,800	
SITE 48								
TURNING BASIN	15,950	100,700	38,700	139,400	34,900	20,900	195,200	12.24
EXT TURNING BASIN	59,750	377,100	154,600	531,700	132,900	79,800	744,400	12.46
TOTALS – SITE 48	75,700	477,800	193,300	671,100	167,800	100,700	939,600	
SITE 49								
TURNING BASIN	15,950	75,900	37,900	113,800	28,500	17,100	159,400	9.99
EXT TURNING BASIN	59,750	284,400	129,000	413,400	103,400	62,000	578,800	9.69
TOTALS – SITE 49	75,700	360,300	166,900	527,200	131,900	79,100	738,200	
SITE 50								
TURNING BASIN	15,950	131,400	49,300	180,700	45,200	27,100	253,000	15.86
EXT TURNING BASIN	59,750	492,400	186,900	679,300	169,800	101,900	951,000	15.92
TOTALS – SITE 50	75,700	623,800	236,200	860,000	215,000	129,000	1,204,000	
SITE 51								
TURNING BASIN	15,950	104,000	38,900	142,900	35,700	21,400	200,000	12.54
EXT TURNING BASIN	59,750	389,800	160,000	549,800	137,500	82,500	769,800	12.88
TOTALS – SITE 51	75,700	493,800	198,900	692,700	173,200	103,900	969,800	
SITE 52								
TURNING BASIN	15,950	108,300	39,200	147,500	36,900	22,100	206,500	12.95
EXT TURNING BASIN	59,750	405,500	169,500	575,000	143,800	86,300	805,100	13.47
TOTALS – SITE 52	75,700	513,800	208,700	722,500	180,700	108,400	1,011,600	
SITE 53								
TURNING BASIN	15,950	124,700	48,800	173,500	43,400	26,000	242,900	15.23
EXT TURNING BASIN	59,750	467,100	184,500	651,600	162,900	97,700	912,200	15.27
TOTALS – SITE 53	75,700	591,800	233,300	825,100	206,300	123,700	1,155,100	
SITE 54								
TURNING BASIN	15,950	95,600	38,400	134,000	33,500	20,100	187,600	11.76
EXT TURNING BASIN	59,750	358,200	143,900	502,100	125,500	75,300	702,900	11.76
TOTALS – SITE 54	75,700	453,800	182,300	636,100	159,000	95,400	890,500	

REAL ESTATE VALUES

The following evaluations involve an assessment of real estate values on the upland sites. The real estate analysis is last because of the field work involved in obtaining estimates for each site. Engineering and environmental investigations reduced the number of sites prior to initiating the real estate analysis. The real estate evaluations are in Appendix A and the results are in table 14. The estimated real estate values are for a fee simple purchase of the site. The values do not include any easements required for pipeline access to the site. Appendix A provides details concerning the methods used to obtain the real estate values as well as assumptions and limitations of the analysis.

COST COMPARISON

The estimated real estate costs were added to the previously calculated total costs for dredging and upland disposal for each site. Dredging costs for each of the ocean disposal methods provided a base condition for comparison with potential upland sites to determine at this level of detail what upland areas appear feasible for future consideration. The ocean disposal costs in tables 9 and 11 provide the base costs for comparison with total dredging and site preparation cost on a site by site basis. Table 15 uses site 45 as a sample of the comparison generated for each potential upland site. The most economical alternative is identified with an "*". The cost comparison for all potential sites produced no upland site that was as economical as offshore disposal.

SENSITIVITY ANALYSIS

The method of cost analysis lends itself to sensitivity of several cost elements. The real estate cost for each potential site was reduced by 50 percent. The results still indicated that no upland site was as economical as utilization of an ODMDS located up to 10 miles offshore. A series of cost estimates were compiled based upon hopper dredging and disposal in an ODMDS located 20 miles offshore. The results were identical to the previous sensitivity analysis performed for real estate costs.

TABLE 14
PALM BEACH HARBOR DISPOSAL AREA STUDY
REAL ESTATE VALUES

SITE NUMBER	SITE SIZE (ACRES)	DIKED AREA CAPACITY (CY)	TOTAL COMPENSATORY VALUE ($)	TOTAL COMPENSATORY VALUE ($/CY)
9	302	14,242,000	NA	0.00
10	37	1,285,700	NA	0.00
11	25	868,700	NA	0.00
12	37	1,285,700	NA	0.00
16	388	18,297,700	NA	0.00
17A	11	245,700	NA	0.00
18	126	5,942,000	NA	0.00
19	25	868,700	NA	0.00
28	63	2,971,000	NA	0.00
30	52	2,452,300	NA	0.00
31	60	2,829,500	NA	0.00
32	42	1,980,700	4,055,000	2.05
33	28	973,000	3,459,000	3.55
35	78	3,678,400	10,730,000	2.92
37	40	1,886,400	5,340,000	2.83
38	38	1,320,500	1,790,000	1.36
39	24	834,000	NA	0.00
40	23	799,200	9,330,000	11.67
42	22	764,500	1,691,000	2.21
42A	12	268,100	923,000	3.44
43	64	3,018,200	71,700	0.02
44	83	3,914,200	5,500,000	1.41
45	159	7,498,300	3,404,000	0.45
48	147	6,932,400	NA	0.00
49	57	2,688,100	5,341,000	1.99
50	19	424,400	NA	0.00
51	26	903,500	NA	0.00
52	71	3,348,300	NA	0.00
53	17	379,800	NA	0.00
54	23	799,200	NA	0.00

TABLE 15
PALM BEACH HARBOR DISPOSAL AREA STUDY
COST COMPARISON

		COSTS PER DREDGE AND DISPOSAL TYPE ($/CY)		
CUT NAME	QUANTITY PER CUT (CY)	CLAMSHELL TO OCEAN	HOPPER TO OCEAN	HYDRAULIC TO SITE 45
PALM BEACH HARBOR				
TURNING BASIN	15,950	$8.39 *	$9.59	$10.28
EXT TURNING BASIN	59,750	$8.35 *	$8.79	$10.96

* – Most Economical Dredging Method Per Cut

SUMMARY

The initial analysis involved 122 potential upland disposal sites located within a 10 mile arc of the Palm Beach Harbor Turning Basin. Environmental evaluations determined that 26 sites were unsuitable for disposal. After establishing pipeline access routes to each site, 66 sites were in excess of the 10 mile pipeline limit and removed from further consideration. An examination of hydraulic dredge and upland disposal costs of the remaining 30 potential disposal sites are summarized in table 16. From that table 18 sites have a cost for disposal of over $13.60 which is very high. Removing those sites from further consideration leaves 12 disposal areas which still exceed the cost for using either ODMDS site. Those 12 sites could be a consideration for disposal of material which is unsuitable for placement in the ODMDS.

During the course of this study, the preparation of over 80 cost estimates enabled a detailed cost comparison between 3 possible dredging techniques. This report shows only a sampling of those estimates. Detailed documentation on the estimates is available in the Jacksonville District Office.

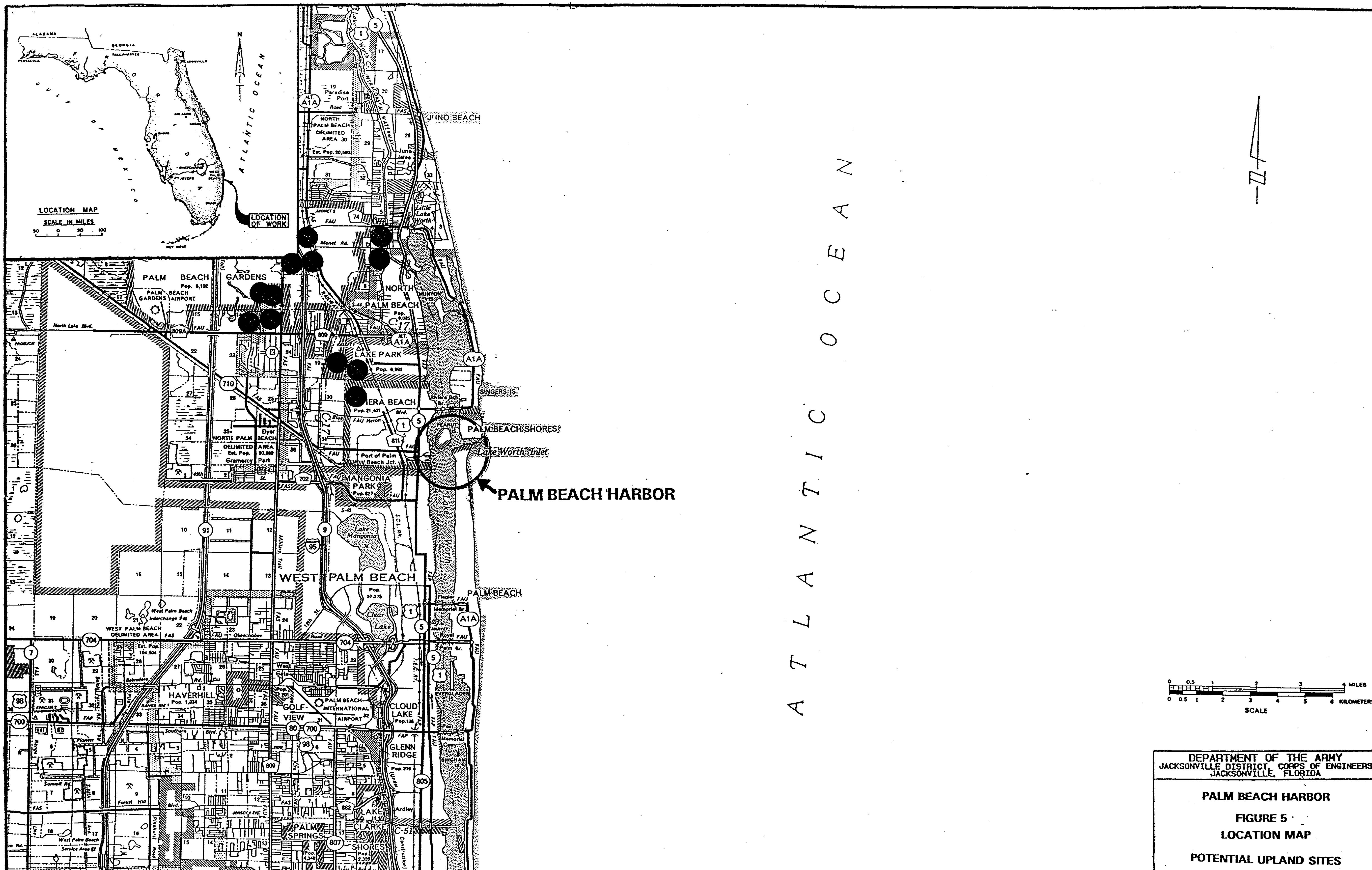
RESULTS

The results presented in tables 15 and 16 demonstrate the need for an Ocean Dredged Material Disposal Site (ODMDS) for the Palm Beach Harbor Federal Project. As shown by table 16, no upland disposal sites were found to be more economical than the use of the ODMDS. However, 12 potential upland sites do exist if the material that does not meet EPA criteria (see table 16).

TABLE 16
PALM BEACH HARBOR DISPOSAL AREA STUDY
FINAL COST COMPARISION

SITE NUMBER	CAPACITY	TURNING BASIN QUANTITY (CY)	TURNING BASIN COSTS ($/CY)	EXT TURNING BASIN QUANTITY (CY)	EXT TURNING BASIN COSTS ($/CY)	PROJECT COSTS ($)	NOTES
ODMDS @ 10 MILES WITH HOPPER DREDGE							
ODMDS	UNLIMITED	15,950	9.59	59,700	8.79	678,000	
ODMDS @ 10 MILES WITH CLAMSHELL DREDGE							
ODMDS	UNLIMITED	15,950	8.39	59,700	8.35	632,000	1
UPLAND DISPOSAL SITES WITH HYDRAULIC DREDGE							
9	14,242,000	15,950	16.38	59,700	16.43	1,242,000	2
10	1,285,700	15,950	14.61	59,700	15.16	1,138,000	2
11	868,700	15,950	18.32	59,700	18.37	1,389,000	2
12	1,285,700	15,950	17.42	59,700	17.46	1,320,000	2
16	18,297,700	15,950	12.31	59,700	12.53	945,000	2
17A	245,700	15,950	20.04	59,700	20.10	1,520,000	2
18	5,942,000	15,950	16.34	59,700	16.38	1,239,000	2
19	868,700	15,950	15.37	59,700	15.89	1,194,000	2
28	2,971,000	15,950	15.10	59,700	15.62	1,173,000	2
30	2,452,300	15,950	13.33	59,700	13.34	1,009,000	2
31	2,829,500	15,950	14.23	59,700	14.77	1,109,000	2
32	1,980,700	15,950	13.38	59,700	13.08	995,000	
33	973,000	15,950	12.22	59,700	12.63	949,000	
35	3,678,400	15,950	10.43	59,700	10.56	797,000	
37	1,886,400	15,950	12.92	59,700	13.59	1,017,000	
38	1,320,500	15,950	12.42	59,700	12.12	921,000	
39	834,000	15,950	13.67	59,700	13.66	1,034,000	2
40	799,200	15,950	24.14	59,700	23.82	1,807,000	
42	764,500	15,950	14.42	59,700	14.10	1,072,000	
42A	268,100	15,950	17.74	59,700	17.42	1,323,000	
43	3,018,200	15,950	11.20	59,700	10.89	829,000	
44	3,914,200	15,950	12.58	59,700	12.26	933,000	
45	7,498,300	15,950	9.81	59,700	10.48	782,000	
48	6,932,400	15,950	12.75	59,700	12.97	977,000	2
49	2,688,100	15,950	13.35	59,700	13.05	992,000	
50	424,400	15,950	18.43	59,700	18.48	1,397,000	2
51	903,500	15,950	14.88	59,700	15.21	1,145,000	2
52	3,348,300	15,950	13.96	59,700	14.49	1,087,000	2
53	379,800	15,950	18.44	59,700	18.48	1,397,000	2
54	799,200	15,950	14.92	59,700	14.92	1,129,000	2

NOTE:
1. The most economical alternative for project maintenance is an ODMDS located up to 10 miles offshore.
2. No real estate values included in project cost.


LOCATION MAP
SCALE IN MILES
LOCATION OF WORK
ATLANTIC OCEAN
PALM BEACH GARDENS
NORTH PALM BEACH
LAKE PARK
PALM BEACH SHORES
Lake Worth Inlet
PALM BEACH HARBOR
MANGONIA PARK
WEST PALM BEACH
PALM BEACH
HAVERHILL
GOLF-VIEW
CLOUD LAKE
GLENN RIDGE
LAKE CLARKE SHORES
PALM SPRINGS
JUNO BEACH
SINGERS IS.
SCALE
MILES
KILOMETERS
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
PALM BEACH HARBOR
FIGURE 5
LOCATION MAP
POTENTIAL UPLAND SITES

PALM BEACH HARBOR DISPOSAL AREA STUDY

REAL ESTATE SECTION

ATTACHMENT A

PALM BEACH HARBOR DISPOSAL AREA STUDY
REAL ESTATE SECTION FOR
POTENTIAL UPLAND DISPOSAL SITES

PURPOSE

The purpose of this study is to investigate potential upland disposal sites to be utilized in conjunction with the Palm Beach Harbor Dredging project. (Refer to Figure 3 for locations of potential sites.)

DESCRIPTION OF STUDY AND STUDY AREA

Twelve sites were selected as suitable for potential upland disposal sites. Each site was evaluated by the appraiser to arrive at an estimate of value for each disposal site. The estimates will enable a comparison of cost between the use of upland sites and the offshore disposal option.

The study area encompasses municipalities in Palm Beach County. The identified potential upland disposal sites are located in Palm Beach County. Potential disposal sites were located through the use of past studies, aerial photography, and geographical limitations. Each site is required to be open land with no dwellings, to meet minimum size requirement of 10 acres, and to be within the maximum pumping distance of approximately 10 miles from the dredge location. The geographical area is roughly bounded by the Atlantic Ocean to the east and a 10 mile arc from the Palm Beach Harbor Turning Basin formed the North, West, and South boundaries. These restrictions and boundaries have limited the scope of the study. The overall area is urbanized, with a mix of residential, commercial, agricultural, and industrial land use.

ESTIMATE OF VALUES

Each potential site was valued in fee simple based on recent tax assessment data and sales information. The indicated values are estimates for each potential site at the date of this study. A more detailed analysis would be necessary if consideration was given beyond the potential analysis stage. The Palm Beach Harbor Disposal Area Study Real Estate Values are provided in Table A-1.

TABLE A-1
PALM BEACH HARBOR
DISPOSAL AREA STUDY
REAL ESTATE VALUES

SITE NUMBER	SITE SIZE (ACRES)	TOTAL COMPENSATORY VALUE ($)
32	42	4,055,000
33	28	3,459,000
35	78	10,730,000
37	40	5,340,000
38	38	1,790,000
40	23	9,330,000
42	22	1,691,000
42A	12	923,000
43	64	71,700
44	83	5,500,000
45	159	3,404,000
49	57	5,341,000

The valuations as presented in this Real Estate Section are based upon information and conditions existing during the study period and are preliminary. A more detailed real estate study will be required to implement any upland site recommended in this report.necessary. Access routes that must cross major highways, railroads, and other land parcels must take into account any environmental impacts and costs considerations to determine the practicality of such an action. Direct access to a site via an inland waterway is the most desired condition. Navigable waters of the United States do not require real estate easements. Small streams, canals, and drainage ditches can also provide access without an easement if they are attached to navigable waters. Access along highways and railroads is also possible and usually achieved by passing through culverts and under bridges.

A potential site may be within the ten mile arc but a direct route to the site may not be available. In that case, the pipeline distance could exceed the ten mile limit and the site would be dropped from further consideration.

Appendix D

PORT EVERGLADES HARBOR DISPOSAL AREA STUDY

PORT EVERGLADES HARBOR

DISPOSAL AREA STUDY

PORT EVERGLADES HARBOR
DISPOSAL AREA STUDY

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PORT EVERGLADES HARBOR DISPOSAL AREA STUDY

INTRODUCTION

The Jacksonville District of the U.S. Army Corps of Engineers performed this study to determine the availability of upland sites in the vicinity of Port Everglades for disposal of dredged material. The purpose of the study was to determine the availability and feasibility of using upland sites in comparison to offshore dredged material disposal for Port Everglades Harbor. Upland disposal sites underwent an analysis of environmental, engineering, and economic criteria. The economic assessments included the cost to purchase the required land, construct the necessary features, and transport the dredged material to the site. The analysis involves environmental and economic impacts of offshore and upland disposal to obtain a cost comparison which would indicate the most feasible method of disposal. The analysis and evaluation presented in this study include information and conditions existing at the beginning of 1994. Further, more detailed study would be required to implement any upland site recommended in this report.

As this study is primarily for the disposal of dredged material from the Port Everglades Harbor Federal Project, the Federal navigation channel was the major concern. Any material dredged from local access channels and berthing areas was not a consideration at this time. The Intracoastal Waterway Jacksonville to Miami (IWW) was also excluded from this study as it is not part of the Port Everglades Harbor Federal Project. The IWW extends through the deep draft harbor project at Port Everglades and it provides a channel depth of 10 feet over a bottom width of 125 feet. Portions of the IWW and Port Everglades Harbor Federal projects overlap. The deeper depths of the Port Everglades Harbor are maintained in the overlap areas. The IWW has disposal sites for future maintenance work. The Dania Cutoff Canal is a local project located at the south end of Port Everglades. It provides access for small boats and commercial freighters west of the Intracoastal Waterway to Port Denison, a small commercial port. Recent dredging by local interests have provided depths of about 16 feet in the canal. Figure 1 is provided to show the location of Port Everglades Harbor. Figure 2 is provided to show the location of the maintenance areas (shoals).

INITIAL INVESTIGATIONS

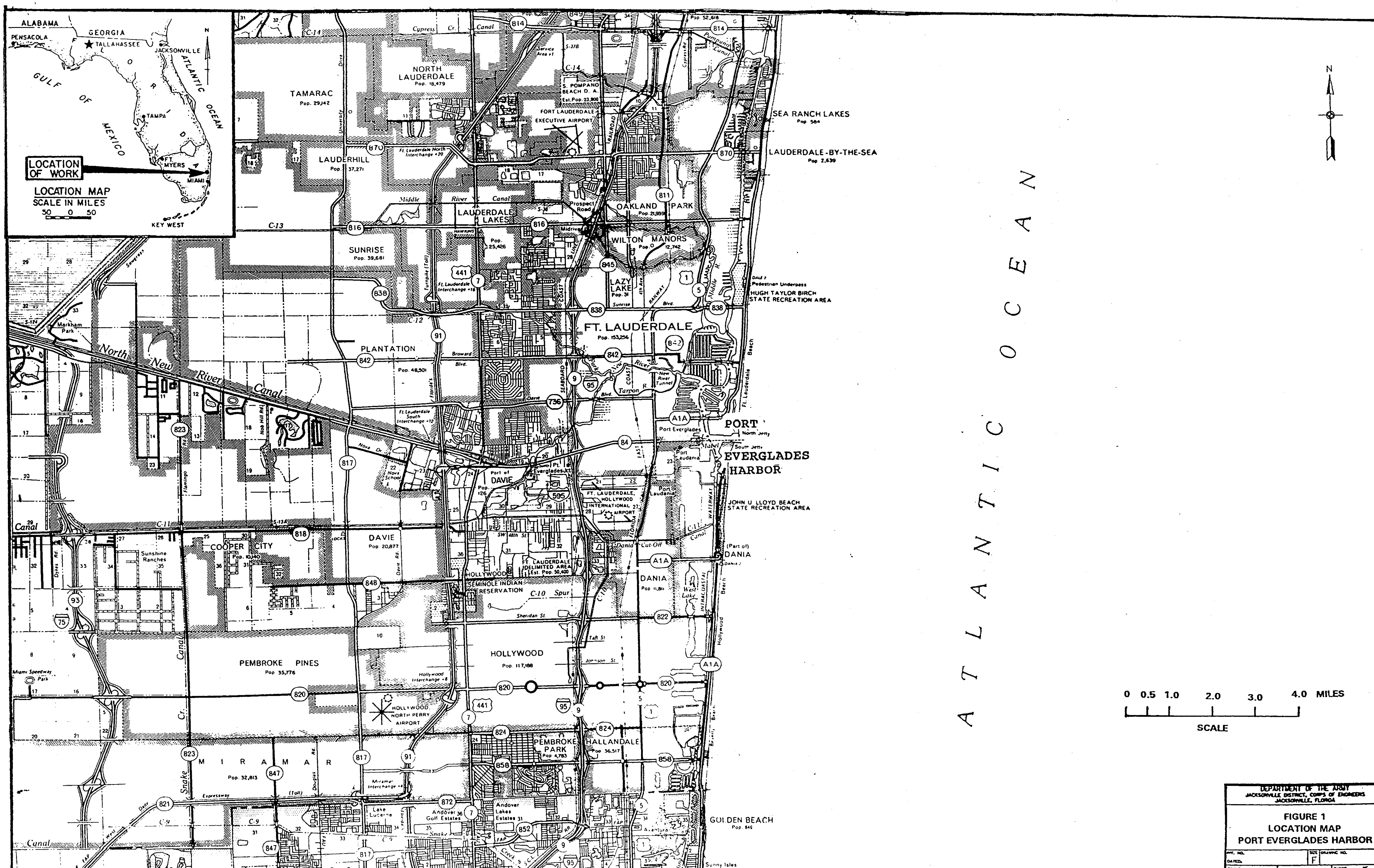
Initial investigations centered on obtaining and reviewing any previous disposal area studies for Port Everglades and other harbors. Recent aerial maps of Broward and Dade Counties were inspected to determine the availability of upland disposal areas within a ten mile arc from the Port Everglades Harbor Turning Basin. Prior studies and reports provided a methodology for an upland area evaluation which included environmental, engineering and economic considerations. Information in the Final Feasibility Report for the Navigation Study of Port Everglades Harbor and Mayport Carrier Homeporting Disposal Area Study was helpful in preparing for this analysis and understanding the problems associated with dredged material disposal.

SHOAL CHARACTERISTICS

The initial analysis involved a determination of dredged material quantity and classification as well as the dredging interval for the entrance channel and turning basin of the harbor. A dredging history on the Federally constructed entrance channel and main turning basin is available in the Jacksonville District Office. That history contains the quantity of material removed from the entrance channel and turning basin during each dredging event with a recorded time frame. Analysis of the data determined the annual shoaling rate and dredging interval of entrance channel and turning basin in the harbor. After determination of the annual shoaling rate and dredging interval, an analysis of the Port Everglades Harbor maintenance dredging history determined the location and average depth of shoals within the entrance channel and main turning basin. Shoal quantity, surface area, and depth are important factors related to dredging costs for shoal removal. The results of that analysis are presented in table 1.

SITE IDENTIFICATION

Selection Criteria - To enable potential site identification, specific criteria was established with regard to size, shape, use, and boundary conditions. Potential sites less than 10 acres in size or with any dwelling were not considered for an upland disposal area. Wetlands or other environmentally sensitive areas were also avoided as potential sites. For any small site, shape would be a consideration to enable sufficient settling time for the return water to meet required water quality standards. Property boundaries influenced site selection because severance damages are a consideration in real estate values. Severance damages are paid to a



DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

FIGURE 1
LOCATION MAP
PORT EVERGLADES HARBOR

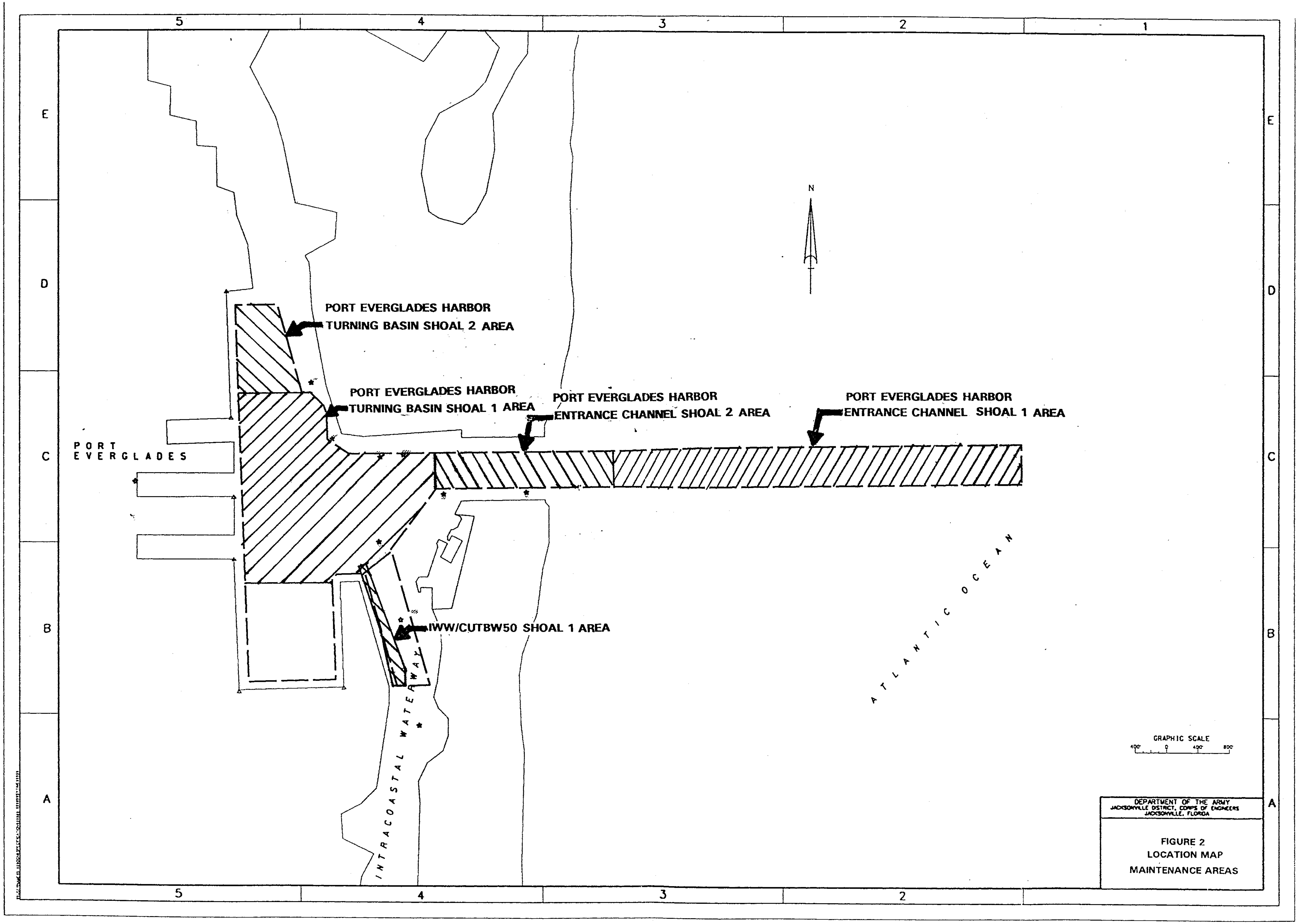


FIGURE 2
LOCATION MAP
MAINTENANCE AREAS

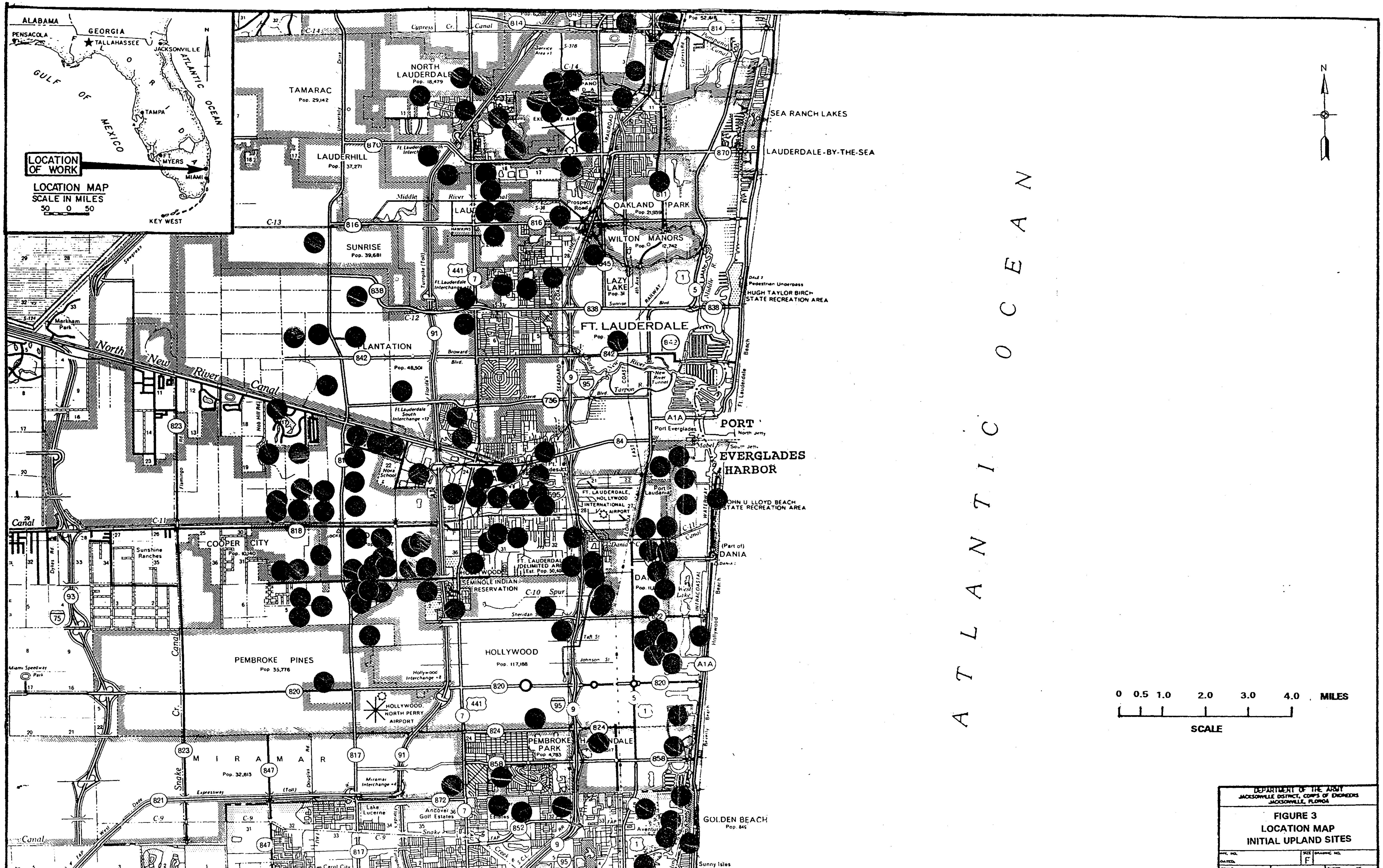


FIGURE 3
LOCATION MAP
INITIAL UPLAND SITES

property owner when purchasing a portion of a parcel of land that devalues the remaining sections. In designating potential sites, utilization of the entire parcel was a major consideration to avoid any additional severance costs. With the criteria in place, the selection process went forward to identify the geographical boundaries as a means of limiting the scope of the search.

Geographical Boundaries - The identification of initial geographical boundaries usually involves a consideration for pipeline access to any potential site. The shoreline at the Atlantic Ocean forms the eastern limit. Equipment limitations relating to pumping dredged material to potential sites define the southern, western and northern boundaries. The detailed dredging analysis identifies a maximum pumping distance for this study as approximately 10 miles from the hydraulic dredge plant location. The pumping limit of 10 miles is based primarily on equipment limitations such as pipeline availability. Some respected experts in the dredging field consider only a 5 mile maximum pumping distance as reasonable based upon the availability of pipeline. For this study, however, the limit was extended to ensure all possible alternatives for upland locations in the vicinity of Port Everglades Harbor received full consideration. Geographical boundaries and equipment limitations greatly reduced the extent of potential site locations.

Site Selection - REDI maps with aerial photography dated 1991-92 of Broward and Dade Counties available in the Jacksonville District, U.S. Army Corps of Engineers, Regulatory Division Office were of assistance in determining potential upland disposal site locations. These REDI maps were accessible for inspection in numbered volumes covering portions of Broward and Dade Counties. Utilizing the previously mentioned selection criteria and geographical boundaries, the identification of 153 potential sites was possible in Broward and Dade Counties.

Site Characteristics - The selected sites were then measured from copies of the REDI maps to determine size and perimeter. Site numbers and characteristics are provided in table 2 with most site locations being presented in figure 3. Exact site locations are not identified due to real estate requirements.

TABLE 2
PORT EVERGLADES HARBOR
DISPOSAL AREA STUDY
SITE INFORMATION

SITE NUMBER	SITE SIZE (ACRES)	SITE NUMBER	SITE SIZE (ACRES)	SITE NUMBER	SITE SIZE (ACRES)	SITE NUMBER	SITE SIZE (ACRES)
BROWARD COUNTY, FL., VOLUME 1							
1	17	2	19				
BROWARD COUNTY, FL., VOLUME 2							
3	12	12	10	21	10	30	34
4	14	13	11	22	22	31	21
5	11	14	10	23	10	32	623
6	39	15	36	24	19	33	12
7	42	16	22	25	13	34	41
8	79	17	22	26	50	35	16
9	36	18	14	27	13	36	22
10	16	19	15	28	110	37	14
11	10	20	37	29	33	38	13
						39	10
BROWARD COUNTY, FL., VOLUME 3							
40	29	59	60	78	13	97	26
41	16	60	107	79	29	98	19
42	33	61	129	80	27	99	12
43	34	62	19	81	83	100	14
44	25	63	11	82	66	101	30
45	106	64	35	83	29	102	57
46	17	65	25	84	13	103	11
47	33	66	104	85	11	104	10
48	16	67	18	86	41	105	22
49	14	68	12	87	15	106	11
50	18	69	15	88	13	107	12
51	60	70	25	89	11	108	13
52	35	71	18	90	14	109	21
53	282	72	25	91	20	110	31
54	13	73	17	92	26	111	101
55	12	74	45	93	14	112	62
56	27	75	32	94	30	113	68
57	18	76	11	95	41		
58	39	77	13	96	30		
BROWARD COUNTY, FL., VOLUME 4							
114	213	122	15	129	184	136	10
115	14	123	13	130	15	137	22
116	15	124	11	131	11	138	10
117	39	125	600	132	18	139	11
119	13	126	13	133	19	140	110
120	17	127	59	134	142	141	29
121	14	128	48	135	136	142	12
						143	28
DADE COUNTY, FL., VOLUME 1							
144	23	147	104	150	15	153	11
145	13	148	99	151	31	154	14
146	10	149	10	152	30		

SITE VERIFICATION

Examination of aerial maps of each selected site enabled an environmental scientist to make initial observations concerning any significant environmental resources in the area. Any site with significant environmental resources was either dropped from consideration or redefined to avoid impacting those resources (see table 3). During initial site selection, the assumption was that each site remained as presented in the 1991 or 1992 aerial maps and that pipeline access to each site would not prohibit site utilization. A site verification trip provided a more current identification and characterization of each site. The site inspection verified the land use and current conditions of the sites under consideration.

Changed Conditions - Site visits identified changes in site conditions that had taken place since the aerial photography was taken in 1991 and 1992. These changes made some sites unsuitable for potential disposal areas. Sites 120, 130, 134, 141 and 144 were being developed to construct residential housing, high rise condominiums, a shopping center and an Amtrak passenger parking lot. Several sites were found to have certain features making them unsuitable for disposal areas. Site 40 has an electrical substation, storage tanks and fire hydrants; site 58 has seven radio towers; site 59 has wetlands, power lines and garbage recycling plant; site 62 has unacceptable pipeline access; site 108 is suitable but not for sale; site 135 is being acquired by the state of Florida a nature preserve; site 138 is a former sanitary landfill site. Consequently, these sites received no further consideration in this study and were dropped from the list of potential disposal areas.

Pipeline Access - An acceptable access route to the upland disposal site location is necessary. Access routes that must cross major highways, railroads, and other land parcels must take into account any environmental impacts and costs considerations to determine the practicality of such an action. Direct access to a site via an inland waterway is the most desired condition. Navigable waters of the United States do not require real estate easements. Small streams, canals, and drainage ditches can also provide access without an easement if they are attached to navigable waters. Access along highways and railroads is also possible and usually achieved by passing through culverts and under bridges. Site 62 was eliminated because of its access route crossed the busy traffic interchange of Eller Drive and U.S. Highway 1.

A potential site may be within the ten mile arc but a direct route to the site may not be available. In that case, the pipeline distance could exceed the ten mile limit and the site would be dropped from further consideration.

TABLE 3
PORT EVERGLADES HARBOR DISPOSAL AREA STUDY
INITIAL UPLAND SITES ELIMINATED

SITE NUMBER	SITE SIZE (ACRES)	REASON FOR ELIMINATION
BROWARD COUNTY, FL., VOLUME 1		
1	17	ENVIRONMENTAL CONCERNS
2	19	ENVIRONMENTAL CONCERNS
BROWARD COUNTY, FL., VOLUME 2		
3	12	ENVIRONMENTAL CONCERNS
4	14	ENVIRONMENTAL CONCERNS
5	11	PIPELINE DISTANCE > 10 MILES
6	39	ENVIRONMENTAL CONCERNS
7	42	ENVIRONMENTAL CONCERNS
8	79	ENVIRONMENTAL CONCERNS
9	36	ENVIRONMENTAL CONCERNS
10	16	PIPELINE DISTANCE > 10 MILES
11	10	ENVIRONMENTAL CONCERNS
12	10	ENVIRONMENTAL CONCERNS
13	11	ENVIRONMENTAL CONCERNS
14	10	ENVIRONMENTAL CONCERNS
15	36	PIPELINE DISTANCE > 10 MILES
16	22	PIPELINE DISTANCE > 10 MILES
17	22	PIPELINE DISTANCES > 10 MILES
18	14	PIPELINE DISTANCE > 10 MILES
19	15	ENVIRONMENTAL CONCERNS
20	37	ENVIRONMENTAL CONCERNS
21	10	PIPELINE DISTANCES > 10 MILES
22	22	ENVIRONMENTAL CONCERNS
23	10	PIPELINE DISTANCE > 10 MILES
24	19	ENVIRONMENTAL CONCERNS
26	50	ENVIRONMENTAL CONCERNS
27	13	PIPELINE DISTANCE > 10 MILES
29	33	ENVIRONMENTAL CONCERNS
31	21	ENVIRONMENTAL CONCERNS
32	623	PIPELINE DISTANCE > 10 MILES
33	12	ENVIRONMENTAL CONCERNS
34	41	ENVIRONMENTAL CONCERNS
35	16	PIPELINE DISTANCE > 10 MILES
36	22	PIPELINE DISTANCE > 10 MILES
37	14	PIPELINE DISTANCE > 10 MILES
39	10	PIPELINE DISTANCE > 10 MILES
BROWARD COUNTY, FL., VOLUME 3		
40	29	SITE HAS AN ELECTRICAL SUBSTATION
41	16	ENVIRONMENTAL CONCERNS
42	33	ENVIRONMENTAL CONCERNS
43	34	ENVIRONMENTAL CONCERNS
44	25	ENVIRONMENTAL CONCERNS
45	106	ENVIRONMENTAL CONCERNS
46	17	PIPELINE DISTANCE > 10 MILES
47	33	ENVIRONMENTAL CONCERNS
48	16	SITE SIZE AND SHAPE
49	14	ENVIRONMENTAL CONCERNS
50	18	ENVIRONMENTAL CONCERNS
51	60	ENVIRONMENTAL CONCERNS
52	35	PIPELINE DISTANCE > 10 MILES

TABLE 3
PORT EVERGLADES HARBOR DISPOSAL AREA STUDY
INITIAL UPLAND SITES ELIMINATED

SITE NUMBER	SITE SIZE (ACRES)	REASON FOR ELIMINATION
BROWARD COUNTY, FL., VOLUME 3 (Cont'd)		
53	282	PIPELINE DISTANCE > 10 MILES
54	13	ENVIRONMENTAL CONCERNS
55	12	ENVIRONMENTAL CONCERNS
57	18	ENVIRONMENTAL CONCERNS
58	39	SITE HAS RADIO TOWERS
59	60	SITE HAS WETLANDS, POWERLINES AND LARGE GARBAGE RECOVERY MOUND
60	107	ENVIRONMENTAL CONCERNS
61	129	ENVIRONMENTAL CONCERNS
62	19	PIPELINE ACCESS
63	11	ENVIRONMENTAL CONCERNS
65	25	ENVIRONMENTAL CONCERNS
67	18	ENVIRONMENTAL CONCERNS
68	12	ENVIRONMENTAL CONCERNS
71	18	ENVIRONMENTAL CONCERNS
73	17	DEVELOPMENT IN PROGRESS
74	45	ENVIRONMENTAL CONCERNS
75	32	ENVIRONMENTAL CONCERNS
78	13	PIPELINE DISTANCE > 10 MILES
79	29	ENVIRONMENTAL CONCERNS
80	27	ENVIRONMENTAL CONCERNS
81	83	PIPELINE DISTANCE > 10 MILES
82	66	ENVIRONMENTAL CONCERNS
83	29	ENVIRONMENTAL CONCERNS
84	13	PIPELINE DISTANCE > 10 MILES
85	11	PIPELINE DISTANCE > 10 MILES
86	41	PIPELINE DISTANVE > 10 MILES
87	15	ENVIRONMENTAL CONCERNS
88	13	ENVIRONMENTAL CONCERNS
89	11	ENVIRONMENTAL CONCERNS
90	14	PIPELINE DISTANCE > 10 MILES
91	20	PIPELINE DISTANCE > 10 MILES
92	26	PIPELINE DISTANCE > 10 MILES
93	14	PIPELINE DISTANCE > 10 MILES
94	30	ENVIRONMENTAL CONCERNS
96	30	ENVIRONMENTAL CONCERNS
97	26	ENVIRONMENTAL CONCERNS
98	19	ENVIRONMENTAL CONCERNS
99	12	PIPELINE DISTANCE > 10 MILES
100	14	PIPELINE DISTANCE > 10 MILES
101	30	ENVIRONMENTAL CONCERNS
102	57	ENVIRONMENTAL CONCERNS
103	11	ENVIRONMENTAL CONCERNS
104	10	ENVIRONMENTAL CONCERNS
107	12	ENVIRONMENTAL CONCERNS
108	13	OWNER UNWILLING TO SELL PROPERTY
111	101	ENVIRONMENTAL CONCERNS
112	62	ENVIRONMENTAL CONCERNS
113	68	ENVIRONMENTAL CONCERNS

TABLE 3
PORT EVERGLADES HARBOR DISPOSAL AREA STUDY
INITIAL UPLAND SITES ELIMINATED

SITE NUMBER	SITE SIZE (ACRES)	REASON FOR ELIMINATION
BROWARD COUNTY, FL., VOLUME 4		
114	213	ENVIRONMENTAL CONCERNS
115	14	ENVIRONMENTAL CONCERNS
119	13	ENVIRONMENTAL CONCERNS
120	17	DEVELOPMENT IN PROGRESS
121	14	ENVIRONMENTAL CONCERNS
122	15	ENVIRONMENTAL CONCERNS
123	13	ENVIRONMENTAL CONCERNS
124	11	ENVIRONMENTAL CONCERNS
125	600	PIPELINE DISTANCE > 10 MILES
126	13	PIPELINE DISTANCE > 10 MILES
127	59	ENVIRONMENTAL CONCERNS
128	48	ENVIRONMENTAL CONCERNS
129	184	PIPELINE DISTANCE > 10 MILES
130	15	DEVELOPMENT IN PROGRESS
131	11	ENVIRONMENTAL CONCERNS
132	18	ENVIRONMENTAL CONCERNS
133	19	ENVIRONMENTAL CONCERNS
134	142	DEVELOPMENT IN PROGRESS
135	136	ENVIRONMENTAL CONCERNS
136	10	ENVIRONMENTAL CONCERNS
137	22	PIPELINE DISTANCE > 10 MILES
138	10	ENVIRONMENTAL CONCERNS
139	11	ENVIRONMENTAL CONCERNS
141	29	DEVELOPMENT IN PROGRESS
142	12	PIPELINE DISTANCE > 10 MILES
143	28	PIPELINE DISTANCE > 10 MILES
DADE COUNTY, FL., VOLUME 1		
144	13	DEVELOPMENT IN PROGRESS
145	13	ENVIRONMENTAL CONCERNS
146	10	ENVIRONMENTAL CONCERNS
148	99	ENVIRONMENTAL CONCERNS
149	10	ENVIRONMENTAL CONCERNS
150	15	PIPELINE DISTANCE > 10 MILES
151	31	PIPELINE DISTANCE > 10 MILES
152	30	ENVIRONMENTAL CONCERNS
153	11	ENVIRONMENTAL CONCERNS

DETAILED SITE ANALYSIS

The detailed site analysis considered the specific characteristics of each site in order to determine preparation requirements and capacity for material disposal. Preparation requirements included such items as clearing and grubbing, dike construction, and weir installation, all of which directly influence costs. Quantification of the work items enabled the development of costs for each site. The total estimated cost of all the work items to prepare a site is then divided by the site capacity to provide a cost per cubic yard ($/cy). Combining that unit cost with the dredging and real estate costs provides a total cost per cubic yard to utilize each site for disposal.

SITE SPECIFICS

An accurate determination of conditions at each site is essential in developing the correct site preparation cost. Site capacity depends upon the amount of usable area and dike heights at the site. Dike heights need to be established and the site area cleared for utilization. Each component is directly related to the utilization cost of a potential site.

Site Capacity - The volume of material that can be placed within the diked area is defined as the site capacity. Site capacity has three components, usable area within the dikes, dike height, and bulking factor. The sites were first identified in the initial site analysis and further reviewed during a field visit. The usable area has an influence on determining the dike height. Further engineering studies would determine the maximum dike height for each site. The vast majority of potential sites have acreages which could economically and engineeringly support dike heights of at least 20 feet. A freeboard of two feet in the dike height was a factor in estimating the site capacity. For a dike height of 20 feet, the freeboard consideration would limit material placement to a height of 18 feet. Material used for dike construction normally comes from inside the perimeter of the disposal area. The assumption is that each site has suitable material for dike construction. The dike material from inside the disposal area provides additional space for dredged material disposal. The bulking factor varies according to dredged material characteristics. Sand has a bulking factor of 1 while silt can have a bulking factor of 1.5. Based on previous dredging experience and the nature of the dredged material in the harbor, the bulking factor should be approximately 1.3. Based upon the above information, the estimated capacity of each potential site was calculated and is provided in table 4.

TABLE 4
PORT EVERGLADES HARBOR DISPOSAL AREA STUDY
SITE INFORMATION

SITE NUMBER	PERIMETER LENGTH (YARDS)	SITE SIZE (ACRES)	DIKE HEIGHT (FT)	DIKE X-SECTION (SF)	DIKE QUANTITY (CY)	BULKING FACTOR	CAPACITY DIKED AREA (CY)
BROWARD COUNTY, FL, VOLUME 2							
25	1,321	13	20	1,600	234,800	1.3	290,400
28	3,525	110	40	5,600	2,193,300	1.3	5,187,500
30	1,643	34	30	3,300	602,400	1.3	1,181,500
38	1,381	13	20	1,600	245,500	1.3	290,400
BROWARD COUNTY,FL, VOLUME 3							
56	1,536	27	30	3,300	563,200	1.3	938,200
64	1,841	35	30	3,300	675,000	1.3	1,216,200
66	3,908	104	40	5,600	2,431,600	1.3	4,904,500
69	1,226	15	20	1,600	218,000	1.3	335,100
70	1,807	25	30	3,300	662,600	1.3	868,700
72	1,081	25	30	3,300	396,400	1.3	868,700
76	1,017	11	20	1,600	180,800	1.3	245,700
77	1,047	13	20	1,600	186,100	1.3	290,400
95	2,433	41	40	5,600	1,513,900	1.3	1,933,500
105	2,027	22	30	3,300	743,200	1.3	764,500
106	975	11	20	1,600	173,300	1.3	245,700
109	1,304	21	30	3,300	478,100	1.3	729,700
110	1,644	31	30	3,300	602,800	1.3	1,077,200
BROWARD COUNTY,FL, VOLUME 4							
116	1,306	15	20	1,600	232,200	1.3	335,100
117	2,872	39	30	3,300	1,053,100	1.3	1,355,200
140	6,057	110	40	5,600	3,768,800	1.3	5,187,500
DADE COUNTY,FL, VOLUME 1							
147	3,419	104	40	5,600	2,127,400	1.3	4,904,500
154	1,236	14	20	1,600	219,700	1.3	312,700

Site Preparation - Preparation of a potential site for use as a disposal area involves planning and design for dike construction, installation of water control structures (weirs), provisions for returning water from the site, and clearing the site of trees and brush for efficient use. The number of weirs required for a disposal area depends upon disposal area and dredge size. For sites in this study, the area in each is sufficient to accommodate a 30 inch hydraulic dredge. To handle the discharge water from that dredge, each site would need six weirs at a cost of $75,000 per unit. Site clearing costs depend upon the amount and density of trees and bushes to be removed from an area. Aerial photography was valuable in determining this factor at each site. Table 5 provides the range of costs for clearing and grubbing. Site 66 is an example for estimating the clearing and grubbing cost. The site is a lightly covered (no trees) that is estimated to cost $58,200 to clear and grub. The value is derived from the 104 acres site size multiplied by the $560 per acre clearing category. The estimated cost for dike construction is $1.90 per cubic yard with the quantity provided in table 4. Mobilization and demobilization costs for moving equipment to and from the construction site also depends primarily upon the quantity of material needed for dike construction. Table 6 provides the range of costs employed for mobilization and demobilization. To cover the cost of uncertainties in the estimate, a contingency item is estimated at 25 percent of construction costs. Costs for engineering and design (E&D) and construction management (CM) are a percent of the total estimated construction costs. The combined percentage is 15.

Site Cost Summary - The purpose of the detailed site analysis is to determine the site preparation costs for disposal of dredged material. Table 7 provides a site cost summary for each element of cost associated with a potential upland disposal site. The last column in that table provides a cost per cubic yard of dredged material placed in each site. That unit cost is determined by dividing the total cost by the site capacity. The site cost is only a portion of the entire cost for upland disposal. The remaining facets of dredging and real estate are discussed in the following text.

EXISTING DISPOSAL AREAS

Sites 64 and 66 are two existing disposal areas located near Port Everglades Harbor. These sites do not have dikes. Dikes would have to be constructed around the sites for disposal of dredged material. At the present time, dredged material placed in these sites from prior maintenance dredging is at street level.

TABLE 5
PORT EVERGLADES HARBOR DISPOSAL AREA STUDY
CLEARING AND GRUBBING COST RANGES

CLEARING CATEGORY	COST PER ACRE
Light (no trees)	$ 560
Light (with trees)	1,230
Light to Medium	1,450
Medium	1,680
Medium to Heavy	2,130
Heavy	2,460

TABLE 6
PORT EVERGLADES HARBOR DISPOSAL AREA STUDY
MOBILIZATION AND DEMOBILIZATION COST RANGES

CUBIC YARDS	COSTS
30,000 to 311,000	$ 56,000
312,000 to 1,099,000	112,000
1,100,000 to 1,299,000	168,000
1,300,000 to 5,000,000	224,000

TABLE 7
PORT EVERGLADES HARBOR DISPOSAL AREA STUDY
SITE PREPARATION COSTS

SITE NUMBER	SITE SIZE (ACRES)	DIKE QUANTITY (CY)	MOB & DEMOB ($)	DIKE CONSTR ($)	CLEARING & GRUBBING ($)	CONTROL STRUCT ($)	SUBTOTAL ($)	CONTING @ 25% ($)	E&D AND CM @ 15% ($)	TOTAL ($)	DIKED AREA CAPACITY (CY)	COST ($/CY)
BROWARD COUNTY, FL, VOLUME 2												
25	13	234,800	56,000	446,120	16,000	450,000	968,120	242,030	145,218	1,355,368	290,400	4.67
28	110	2,193,300	224,000	4,167,270	135,300	450,000	4,976,570	1,244,143	746,486	6,967,198	5,187,500	1.34
30	34	602,400	112,000	1,144,560	41,800	450,000	1,748,360	437,090	262,254	2,447,704	1,181,500	2.07
38	13	245,500	56,000	466,450	16,000	450,000	988,450	247,113	148,268	1,383,830	290,400	4.77
BROWARD COUNTY,FL, VOLUME 3												
56	27	563,200	112,000	1,070,080	33,200	450,000	1,665,280	416,320	249,792	2,331,392	938,200	2.48
64	35	675,000	112,000	1,282,500	43,100	450,000	1,887,600	471,900	283,140	2,642,640	1,216,200	2.17
66	104	2,431,600	224,000	4,620,040	58,200	450,000	5,352,240	1,338,060	802,836	7,493,136	4,904,500	1.53
69	15	218,000	56,000	414,200	8,400	450,000	928,600	232,150	139,290	1,300,040	335,100	3.88
70	25	662,600	112,000	1,258,940	30,800	450,000	1,851,740	462,935	277,761	2,592,436	868,700	2.98
72	25	396,400	112,000	753,160	30,800	450,000	1,345,960	336,490	201,894	1,884,344	868,700	2.17
76	11	180,800	56,000	343,520	13,500	450,000	863,020	215,755	129,453	1,208,228	245,700	4.92
77	13	186,100	56,000	353,590	7,300	450,000	866,890	216,723	130,034	1,213,646	290,400	4.18
95	41	1,513,900	224,000	2,876,410	23,000	450,000	3,573,410	893,353	536,012	5,002,774	1,933,500	2.59
105	22	743,200	112,000	1,412,080	27,100	450,000	2,001,180	500,295	300,177	2,801,652	764,500	3.66
106	11	173,300	56,000	329,270	13,500	450,000	848,770	212,193	127,316	1,188,278	245,700	4.84
109	21	478,100	112,000	908,390	11,800	450,000	1,482,190	370,548	222,329	2,075,066	729,700	2.84
110	31	602,800	112,000	1,145,320	38,100	450,000	1,745,420	436,355	261,813	2,443,588	1,077,200	2.27
BROWARD COUNTY,FL, VOLUME 4												
116	15	232,200	56,000	441,180	18,500	450,000	965,680	241,420	144,852	1,351,952	335,100	4.03
117	39	1,053,100	112,000	2,000,890	56,600	450,000	2,619,490	654,873	392,924	3,667,286	1,355,200	2.71
140	110	3,768,800	224,000	7,160,720	190,400	450,000	8,025,120	2,006,280	1,203,768	11,235,168	5,187,500	2.17
DADE COUNTY,FL, VOLUME 1												
147	104	2,127,400	224,000	4,042,060	127,900	450,000	4,843,960	1,210,990	726,594	6,781,544	4,904,500	1.38
154	14	219,700	56,000	417,430	17,200	450,000	940,630	235,158	141,095	1,316,882	312,700	4.21

DETAILED DREDGING ANALYSIS

Dredging involves both the removal of material from the channel bottom and transportation to the designated disposal area. The analysis examined three methods of dredging. Hopper dredging and clamshell dredging with barge transport provide the most efficient methods to dispose of material in the offshore dredged material disposal site (ODMDS). The traditional hydraulic dredging with pipeline for pumping material to an upland site provides an efficient method for moving dredged material to upland disposal sites. As stated in the geographical boundaries section of this study, hydraulic dredging has a pumping limit of 10 miles which is based primarily on equipment limitations such as pipeline availability. Some respected experts in the dredging field consider only a 5 mile maximum pumping distance as reasonable based upon the availability of pipeline. For this study, however, the limit was extended to ensure all possible alternatives for upland locations in the vicinity of Port Everglades Harbor received full consideration.

OCEAN DISPOSAL

The dredging analysis included two methods for ocean disposal of dredged material as mentioned earlier. Hopper dredging and transport as well as clamshell dredging with barge transport are both applicable methods for ocean disposal. Currently, no usable ODMDS exists at Port Everglades Harbor. In order to determine cost for ocean disposal without a definite location for a ODMDS, cost estimates were computed for offshore disposal sites in 1 mile increments from Port Everglades Harbor entrance channel to a distance of 10 miles offshore. Figure 4 shows the location of the 1, 5, and 10 mile boundaries.

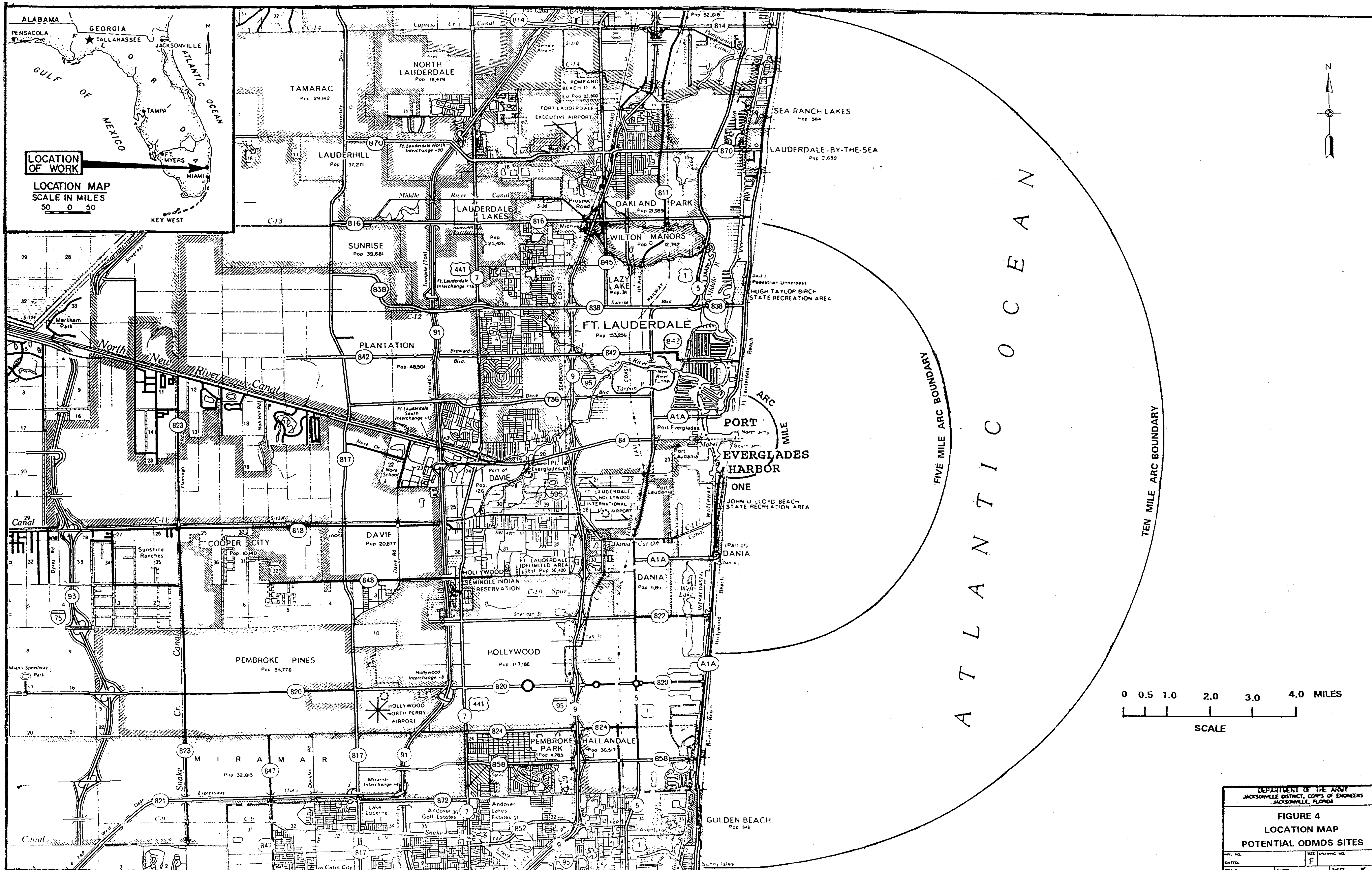
Hopper Dredge Estimates - The hopper dredge for estimating purposes has a carrying capacity of 3,600 cubic yard (cy). A hopper dredge hydraulically removes shoal material from the channel bottom and places it in a hopper on the dredge. As soon as the hopper is full, the dredge proceeds to the ODMDS where the bottom of the hopper opens and the material is deposited on the ocean floor. The material classification which greatly influences dredging efficiency and therefore costs was discussed earlier in the shoal characteristics section of this study. As stated in the same section, the Federal project was broken into sections or cuts identical to normal operations in the harbor (see figure 2). A sample estimate to hopper dredge one of the Port Everglades Harbor cuts is provided in table 8. Note that the unit cost given at the top excludes any costs related to mobilization, contingencies, engineering and design, as well as construction management. Table 9 provides the total dredging and transportation costs for each cut in the Port Everglades Harbor Federal Project. The costs for mobilization and demobilization are prorated over the project. As shown in table 9, hopper dredge costs increase with increases in the distance to the ODMDS.

Clamshell Estimates - The clamshell dredging techniques are similar to the hopper dredge. The clamshell removes shoal material from the channel bottom which is deposited in an ocean going barge for transport to the ODMDS. One benefit of the clamshell operation is that with multiple barges the clamshell dredge can operate almost continuously. However, the additional equipment does cost more to mobilize to the dredging location. The clamshell dredge (26 cy) utilizes a 26 cy bucket to remove silty material and a 21 cy bucket to remove sandy material. The dredge is estimated to need two barges for transporting the material. The clamshell dredge works continuously. While one barge is enroute to the ODMDS, the clamshell is loading another barge. The number of barges influences the operating efficiency of the dredge. Two barges are within reason to be available for such an operation. Table 10 provides a sample estimate summary which is similar to the hopper dredge estimate in table 8. Again, the mobilization and other costs absent in table 8 are also absent in the clamshell sample estimate. Table 11 provides the total dredging and transportation costs using a clamshell for each cut as shown in table 9. As with the hopper dredge costs, distance to the ODMDS is a factor influencing clamshell dredging costs.

UPLAND DISPOSAL

Upland disposal costs involved the traditional hydraulic dredging and transport to an upland site. As mentioned earlier, hydraulic dredging and material movement via pipeline has a 10 mile limit due to equipment limitations and dredging efficiencies. A pipeline access route was established to each potential upland site. The total cost for upland disposal includes dredging and transportation costs, site preparation cost, and site procurement cost. Further discussion of dredging and transportation costs is in the subsequent text.

Hydraulic Dredging - As stated throughout this report, hydraulic dredging is the traditional method for upland disposal and generally, the most economical for pumping distances less than 5 miles. This fact is possible because the dredge can work continuously without stopping to empty the hopper as with a hopper dredge or having to wait for a barge to return as with a clamshell dredge. A sample estimate for hydraulic dredging is given in table 12. The total cost is in table 13. As described earlier, hydraulic dredging to a disposal site is restricted to a distance of approximately 10 miles. The mobilization cost for each maintenance event was prorated over the entire harbor. The assumption was made that the entire harbor will be maintained during each maintenance event with the possibility of utilizing more than one site.



DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

FIGURE 4
LOCATION MAP
POTENTIAL ODMDS SITES

TABLE 1
PORT EVERGLADES HARBOR
HARBOR SECTIONS AND
SHOAL CHARACTERISTICS

SECTION NAME	DEPTH (FEET)	SECTION LENGTH (FEET)	ANNUAL SHOALING (CY)	DREDGE INTERVAL (YEARS)	TOTAL QUANTITY (CY)	SURFACE AREA (FEET ^ 2)	PROJECTED SHOALING (FEET)	MATERIAL TYPE
ENTRANCE CHANNEL								
SHOAL 1	45	5,100	1,800	20	36,000	130,000	7.3	SAND
	46	5,100	2,300	20	45,220	130,000	9.4	SAND
	47	5,100	2,900	20	58,180	130,000	12.1	SAND
SHOAL 2	42	2,350	2,000	20	39,640	300,000	3.6	SAND
	43	2,350	2,700	20	53,140	300,000	4.8	SAND
	44	2,350	3,500	20	70,200	300,000	6.3	SAND
TURNING BASIN								
SHOAL 1	42	2,550	5,500	20	110,000	280,000	10.7	SAND
	43	2,550	6,700	20	134,820	280,000	13.0	SAND
	44	2,550	8,100	20	162,580	280,000	15.7	SAND
SHOAL 2	31	875	800	20	16,780	503,554	0.9	SAND
	32	875	2,000	20	39,240	503,554	2.1	SAND
	33	875	3,400	20	68,480	503,554	3.7	SAND
IWW/CUT BW50								
SHOAL 1	36	1,700	1,200	20	23,400	227,383	2.8	SAND
	37	1,700	1,300	20	26,680	227,383	3.2	SAND
	38	1,700	1,500	20	30,240	227,383	3.6	SAND

Fri 08 Apr 1994

TABLE 8
PORT EVERGLADES HARBOR
DISPOSAL AREA STUDY
HOPPER DREDGE ESTIMATE

TIME 09:58:34

CHECKLIST FOR INPUT DATA.
Planning Est. 08 Apr 94

BID QUANTITY	58,180 C.Y.
UNIT COST...	$1.34 PER C.Y.
EXCAV. COST.	$77,961
TIME........	0.1 MONTHS

PG 1 OF 14: PROJECT TITLES

PROJECT -	Port Everglades Harbor Study
LOCATION -	Ocean Disposal-Mile 5
INVIT # -	Entrance Channel - Shoal 1
BID ITEM # -	0
FILENAME -	PEHS_HOP
EST -	B J Harrison
MIDPT DATE -	Jan-94
DESCRIPTION ENTERED? -	

PG 13 OF 14: MARKUPS USED

O.H. -	15.0%
PROFIT -	10.0%
BOND -	1.0%

PG 2 OF 14: EXCAVATION QTY'S

DREDGING AREA -	130,000 sf
REQ'D EXCAVATION -	58,180 cyds
% MUD -	20%
% SAND -	80%
% GRAVEL -	0%
PAY OVERDEPTH -	0 cyds
O.D. NOT DREDGED -	0 cyds
OVERDIG FOOTAGE -	1.00 ft
NONPAY YARDAGE -	4,800 cyds
GROSS YARDAGE -	62,980 cyds

PG 3 OF 14: LOCAL AREA FACTORS

FUEL COST -	$0.79 /gal
CFC RATE -	5.625%
USE MONTHS / YEAR -	10 mo/yr
MARINE INSUR -	1.5%
TAXES -	1.0%
PROVISIONS & SUPP -	$15 /man

PG 4 OF 14: DREDGE SELECTION (ALT-D)

DREDGE: SUGAR ISLAND

LOADS PER DAY -	10.29
CYCLE TIME -	119 min/load

PG'S 5-7 OF 14: PRODUCTION WORKSHEET

HOPPER CAPACITY -	3,600 cyds	DUMP/CONNECT TIME -	5 min
EFF. HOPPER CAP. -	2,160 cyds	JET PUMP AVAIL? -	YES
AVAIL DREDGING RATE -	2,100 cy/hr	TYPE OF DISPOSAL -	GRAVITY DUMP
AVAIL. DRAGHEADS -	2 ea	PUMPING RATE -	cy/hr
ACT. DRAGHDS USED -	2 ea	TRVL SPD TO DREDG -	11.7 mph
DRDGE RATE USED -	2,250 cy/hr	MAX TRVL SPD LIGHT -	13.8 mph
TURNS/CYCLE -	2 ea	EFFECTIVE TIME -	85.0%
MIN. PER TURN -	3 min	OPER WORK DAYS/MO -	30.42 days
DISPOSAL DIST -	4.7 mi	ADD. CLEANUP TIME -	15%
TRVL SPD TO DISP -	10.8 mph	SPECIAL COST -	$7,000 /mo
MAX TRVL SPD LOADED -	12.7 mph	SPECIAL COST -	$0 /job

PG'S 8-9 OF 14: PLANT OWN. & OPER.

DREDGE -	$382,835
PROPULSION TUG -	self prop.
SURVEY VESSEL -	$30,000
BOOSTER -	$0
CRANE BARGE -	$0
TENDER TUG -	$0
SHORE EQUIP -	$0

PG 14 OF 14: DREDGE OPER. ADJ. FACTORS

PUMP LOAD FACTOR -	50%
RPR & MAINT. ADJ -	1.00
JET PUMP % USAGE -	100%

PG'S 10-12 OF 14: LABOR, 24 Jun 88

OVERTIME % -	28.00%
VACATION/HOLIDAY % -	8.64%
TAX & INSUR % -	30.61%
FRINGE BENEFITS -	$4.35 /hr
DREDGE CREW:	
SUGG. CREW SIZE -	14 ea
USED CREW SIZE -	14 ea
SHORE CREW:	
USED CREW SIZE -	0 ea
GOVERNMENT PERSON -	3 ea
FRE. PD TRAVEL -	28 days
RT TRAVEL COST -	$400

TABLE 9
PORT EVERGLADES HARBOR DISPOSAL AREA STUDY
HOPPER DREDGE AND OCEAN DISPOSAL COSTS

CUT NAME	SHOAL QUANTITY (CY)	MOB & DEMOB PER CUT	EXCAVATION COST PER CUT	SUBTOTAL COSTS PER CUT	CONT COSTS 25%	E&D AND CM 15%	HOPPER TOTAL $	DREDGING COSTS $/(CY)
1 MILE OFFSHORE								
ENTRANCE CH – 1	58,180	37,300	55,300	92,600	23,200	13,900	129,700	2.23
ENTRANCE CH – 2	70,200	45,000	70,900	115,900	29,000	17,400	162,300	2.31
TURNING BASIN – 1	162,580	104,300	172,300	276,600	69,200	41,500	387,300	2.38
TURNING BASIN – 2	68,480	43,900	93,800	137,700	34,400	20,700	192,800	2.82
IWW/CUT BW50	30,240	19,400	39,300	58,700	14,700	8,800	82,200	2.72
TOTALS – 1 MILE	389,680	250,000	431,600	681,500	170,500	102,300	954,300	
2 MILES OFFSHORE								
ENTRANCE CH – 1	58,180	37,300	62,800	100,100	25,000	15,000	140,100	2.41
ENTRANCE CH – 2	70,200	45,000	78,600	123,600	30,900	18,500	173,000	2.46
TURNING BASIN – 1	162,580	104,300	187,000	291,300	72,800	43,700	407,800	2.51
TURNING BASIN – 2	68,480	43,900	101,400	145,300	36,300	21,800	203,400	2.97
IWW/CUT BW50	30,240	19,400	46,600	66,000	16,500	9,900	92,400	3.06
TOTALS – 2 MILES	389,680	250,000	476,400	726,300	181,500	108,900	1,016,700	
3 MILES OFFSHORE								
ENTRANCE CH – 1	58,180	37,300	70,400	107,700	26,900	16,200	150,800	2.59
ENTRANCE CH – 2	70,200	45,000	93,400	138,400	34,600	20,800	193,800	2.76
TURNING BASIN – 1	162,580	104,300	203,200	307,500	76,900	46,100	430,500	2.65
TURNING BASIN – 2	68,480	43,900	108,900	152,800	38,200	22,900	213,900	3.12
IWW/CUT BW50	30,240	19,400	46,600	66,000	16,500	9,900	92,400	3.06
TOTALS – 3 MILES	389,680	250,000	522,500	772,400	193,100	115,900	1,081,400	
4 MILES OFFSHORE								
ENTRANCE CH – 1	58,180	37,300	78,000	115,300	28,800	17,300	161,400	2.77
ENTRANCE CH – 2	70,200	45,000	101,100	146,100	36,500	21,900	204,500	2.91
TURNING BASIN – 1	162,580	104,300	232,500	336,800	84,200	50,500	471,500	2.90
TURNING BASIN – 2	68,480	43,900	116,400	160,300	40,100	24,000	224,400	3.28
IWW/CUT BW50	30,240	19,400	54,100	73,500	18,400	11,000	102,900	3.40
TOTALS – 4 MILES	389,680	250,000	582,100	832,000	208,000	124,700	1,164,700	
5 MILES OFFSHORE								
ENTRANCE CH – 1	58,180	37,300	78,000	115,300	28,800	17,300	161,400	2.77
ENTRANCE CH – 2	70,200	45,000	115,800	160,800	40,200	24,100	225,100	3.21
TURNING BASIN – 1	162,580	104,300	247,100	351,400	87,900	52,700	492,000	3.03
TURNING BASIN – 2	68,480	43,900	131,500	175,400	43,900	26,300	245,600	3.59
IWW/CUT BW50	30,240	19,400	54,100	73,500	18,400	11,000	102,900	3.40
TOTALS – 5 MILES	389,680	250,000	626,500	876,400	219,200	131,400	1,227,000	
6 MILES OFFSHORE								
ENTRANCE CH – 1	58,180	37,300	92,500	129,800	32,500	19,500	181,800	3.12
ENTRANCE CH – 2	70,200	45,000	123,600	168,600	42,200	25,300	236,100	3.36
TURNING BASIN – 1	162,580	104,300	269,900	374,200	93,600	56,100	523,900	3.22
TURNING BASIN – 2	68,480	43,900	139,000	182,900	45,700	27,400	256,000	3.74
IWW/CUT BW50	30,240	19,400	61,700	81,100	20,300	12,200	113,600	3.76
TOTALS – 6 MILES	389,680	250,000	686,700	936,600	234,300	140,500	1,311,400	
7 MILES OFFSHORE								
ENTRANCE CH – 1	58,180	37,300	100,100	137,400	34,400	20,600	192,400	3.31
ENTRANCE CH – 2	70,200	45,000	131,300	176,300	44,100	26,400	246,800	3.52
TURNING BASIN – 1	162,580	104,300	284,500	388,800	97,200	58,300	544,300	3.35
TURNING BASIN – 2	68,480	43,900	154,100	198,000	49,500	29,700	277,200	4.05
IWW/CUT BW50	30,240	19,400	61,700	81,100	20,300	12,200	113,600	3.76
TOTALS – 7 MILES	389,680	250,000	731,700	981,600	245,500	147,200	1,374,300	
8 MILES OFFSHORE								
ENTRANCE CH – 1	58,180	37,300	107,600	144,900	36,200	21,700	202,800	3.49
ENTRANCE CH – 2	70,200	45,000	138,300	183,300	45,800	27,500	256,600	3.66
TURNING BASIN – 1	162,580	104,300	307,300	411,600	102,900	61,700	576,200	3.54
TURNING BASIN – 2	68,480	43,900	160,900	204,800	51,200	30,700	286,700	4.19
IWW/CUT BW50	30,240	19,400	69,300	88,700	22,200	13,300	124,200	4.11
TOTALS – 8 MILES	389,680	250,000	783,400	1,033,300	258,300	154,900	1,446,500	
9 MILES OFFSHORE								
ENTRANCE CH – 1	58,180	37,300	115,200	152,500	38,100	22,900	213,500	3.67
ENTRANCE CH – 2	70,200	45,000	153,700	198,700	49,700	29,800	278,200	3.96
TURNING BASIN – 1	162,580	104,300	330,000	434,300	108,600	65,100	608,000	3.74
TURNING BASIN – 2	68,480	43,900	168,500	212,400	53,100	31,900	297,400	4.34
IWW/CUT BW50	30,240	19,400	69,300	88,700	22,200	13,300	124,200	4.11
TOTALS – 9 MILES	389,680	250,000	836,700	1,086,600	271,700	163,000	1,521,300	
10 MILES OFFSHORE								
ENTRANCE CH – 1	58,180	37,300	122,800	160,100	40,000	24,000	224,100	3.85
ENTRANCE CH – 2	70,200	45,000	160,800	205,800	51,500	30,900	288,200	4.11
TURNING BASIN – 1	162,580	104,300	344,700	449,000	112,300	67,400	628,700	3.87
TURNING BASIN – 2	68,480	43,900	176,000	219,900	55,000	33,000	307,900	4.50
IWW/CUT BW50	30,240	19,400	76,500	95,900	24,000	14,400	134,300	4.44
TOTALS – 10 MILES	389,680	250,000	880,800	1,130,700	282,800	169,700	1,583,200	

TABLE 10
PORT EVERGLADES HARBOR
DISPOSAL AREA STUDY
MECHANICAL DREDGE ESTIMATE

CHECKLIST FOR INPUT DATA.

Port Everglades Habor Study

BID QUANTITY	58,180 C.Y.
UNIT COST...	$2.09 PER C.Y.
EXCAV. COST.	$121,596
TIME........	0.17 MONTHS

PG 1 OF 9: PROJECT TITLES

FILENAME -	PEHSMEC
PROJECT -	Port Everglades Habor Study
LOCATION -	Ocean Disposal-5.0 Mile
INVIT # -	Entrance Channel-Shoal 1
DATE OF EST. -	07 Apr 94
EST. BY -	B J Harrison
MOB. BID ITEM # -	1
EXCAV. BID ITEM # -	2
TYPE OF EST. -	Planning Estimate

PG 2 OF 9: EXCAVATION QTY'S

DREDGING AREA -	130,000 sf
REQ'D EXCAVATION -	58,180 cyds
PAY OVERDEPTH -	0 cyds
CONTRACT AMOUNT -	58,180 cyds
NOT DREDGED -	0 cyds
NONPAY YARDAGE -	4,800 cyds
GROSS YARDAGE -	62,980 cyds
NONPAY HEIGHT -	1.0 ft overdig.
TOTAL BANK HEIGHT -	13.1 ft

PG 3 OF 9: EXCAVATION PRODUCTION WORKSHEET

DREDGE SELECTED -	26 CY Clamshell Dredge
TYPE OF MATERIAL -	SAND
BUCKET SIZE -	21
BUCKET FILL FACTOR -	0.70
OPTIMUM BANK -	9
BANK FACTOR -	1.00

PG 4 OF 9: EXCAVATION PRODUCTION WORKSHEET

BUCKET CYCLE TIME -	55 Seconds
OTHER FACTOR -	1.00 >
CLEANUP -	15% More Time
TIME EFFICIENCY -	60.0% of EWT

PG 5 OF 9: HAULING PRODUCTION WORKSHEET

TUG DESCRIPTION -	3000 HP Diesel--Twin Screw
PREPARE SCOW TOW -	15 min
HAUL DIST -	4.7 mi
SPEED TO D/A -	5 mph
SPEED FROM D/A -	6 mph

PG 5 OF 9: HAULING PRODUCTION WORKSHEET

DUMP OR PUMPOUT -	20 min
DISENGAGE TOW -	10 min
TOW EFFICIENCY -	80 %
SCOW DESCRIPTION -	3000 CY Split Hull Scow
USEABLE VOLUME -	90 %
% SOLIDS -	80 %

PG 6 OF 9: EQUIPMENT MATCHING

# OF PIECES:	Used
DREDGES -	1
SCOWS PER DREDGE -	1
TOWING VESSELS -	1
SCOWS PER TOW -	1
ADDITIONAL SCOWS -	0
TOT SCOWS ON JOB -	2

PG 7 OF 9: SPECIAL LABOR & EQUIPMENT

QUARTERS ON DREDGE? -	NO
SURVEY BOAT? -	YES
CREW BOAT? -	NO

PG 8 OF 9: LOCAL AREA FACTORS

PRESENT YEAR -	1993
ECONOMIC INDEX -	4718
LAF -	0.840
INTEREST RATE -	5.625% /yr
TIME PERIOD -	June to December, 1993
PLANT AVAILABLE -	10 mos/yr
FUEL PRICE -	$0.79 /gal

PG 9 OF 9: OTHER ADJUSTMENTS

SPECIAL COST/MO -	$7,000 Turbidity Monitoring
SPECIAL COST LS -	$0 >
CONTRACTOR'S O.H. -	15.0%
CONTRACTOR'S PROFIT -	10.0%
CONTRACTOR'S BOND -	1.0%

TABLE 11
PORT EVERGLADES HARBOR DISPOSAL AREA STUDY
MECHANICAL DREDGE AND OCEAN DISPOSAL COSTS

CUT NAME	SHOAL QUANTITY (CY)	MOB & DEMOB PER CUT	EXCAVATION COST PER CUT	SUBTOTAL COSTS PER CUT	CONT COSTS 25%	E&D AND CM 15%	TOTAL $	DREDGING COSTS $/(CY)
1 MILE OFFSHORE								
ENTRANCE CH – 1	58,180	37,300	112,800	150,100	37,500	22,500	210,100	3.61
ENTRANCE CH – 2	70,200	45,000	179,000	224,000	56,000	33,600	313,600	4.47
TURNING BASIN – 1	162,580	104,300	318,700	423,000	105,800	63,500	592,300	3.64
TURNING BASIN – 2	68,480	43,900	302,000	345,900	86,500	51,900	484,300	7.07
IWW/CUT BW50	30,240	19,400	137,600	157,000	39,300	23,600	219,900	7.27
TOTALS – 1 MILE	389,680	250,000	1,050,100	1,300,000	325,100	195,100	1,820,200	
2 MILES OFFSHORE								
ENTRANCE CH – 1	58,180	37,300	115,200	152,500	38,100	22,900	213,500	3.67
ENTRANCE CH – 2	70,200	45,000	181,800	226,800	56,700	34,000	317,500	4.52
TURNING BASIN – 1	162,580	104,300	323,500	427,800	107,000	64,200	599,000	3.68
TURNING BASIN – 2	68,480	43,900	304,700	348,600	87,200	52,300	488,100	7.13
IWW/CUT BW50	30,240	19,400	138,800	158,200	39,600	23,700	221,500	7.32
TOTALS – 2 MILES	389,680	250,000	1,064,000	1,313,900	328,600	197,100	1,839,600	
3 MILES OFFSHORE								
ENTRANCE CH – 1	58,180	37,300	117,500	154,800	38,700	23,200	216,700	3.72
ENTRANCE CH – 2	70,200	45,000	184,600	229,600	57,400	34,400	321,400	4.58
TURNING BASIN – 1	162,580	104,300	330,000	434,300	108,600	65,100	608,000	3.74
TURNING BASIN – 2	68,480	43,900	308,200	352,100	88,000	52,800	492,900	7.20
IWW/CUT BW50	30,240	19,400	140,300	159,700	39,900	24,000	223,600	7.39
TOTALS – 3 MILES	389,680	250,000	1,080,600	1,330,500	332,600	199,500	1,862,600	
4 MILES OFFSHORE								
ENTRANCE CH – 1	58,180	37,300	119,300	156,600	39,200	23,500	219,300	3.77
ENTRANCE CH – 2	70,200	45,000	187,400	232,400	58,100	34,900	325,400	4.64
TURNING BASIN – 1	162,580	104,300	336,500	440,800	110,200	66,100	617,100	3.80
TURNING BASIN – 2	68,480	43,900	311,600	355,500	88,900	53,300	497,700	7.27
IWW/CUT BW50	30,240	19,400	141,500	160,900	40,200	24,100	225,200	7.45
TOTALS – 4 MILES	389,680	250,000	1,096,300	1,346,200	336,600	201,900	1,884,700	
5 MILES OFFSHORE								
ENTRANCE CH – 1	58,180	37,300	121,600	158,900	39,700	23,800	222,400	3.82
ENTRANCE CH – 2	70,200	45,000	190,200	235,200	58,800	35,300	329,300	4.69
TURNING BASIN – 1	162,580	104,300	343,000	447,300	111,800	67,100	626,200	3.85
TURNING BASIN – 2	68,480	43,900	314,300	358,200	89,600	53,700	501,500	7.32
IWW/CUT BW50	30,240	19,400	143,000	162,400	40,600	24,400	227,400	7.52
TOTALS – 5 MILES	389,680	250,000	1,112,100	1,362,000	340,500	204,300	1,906,800	
6 MILES OFFSHORE								
ENTRANCE CH – 1	58,180	37,300	123,900	161,200	40,300	24,200	225,700	3.88
ENTRANCE CH – 2	70,200	45,000	193,100	238,100	59,500	35,700	333,300	4.75
TURNING BASIN – 1	162,580	104,300	349,500	453,800	113,500	68,100	635,400	3.91
TURNING BASIN – 2	68,480	43,900	317,700	361,600	90,400	54,200	506,200	7.39
IWW/CUT BW50	30,240	19,400	144,500	163,900	41,000	24,600	229,500	7.59
TOTALS – 6 MILES	389,680	250,000	1,128,700	1,378,600	344,700	206,800	1,930,100	
7 MILES OFFSHORE								
ENTRANCE CH – 1	58,180	37,300	126,300	163,600	40,900	24,500	229,000	3.94
ENTRANCE CH – 2	70,200	45,000	195,900	240,900	60,200	36,100	337,200	4.80
TURNING BASIN – 1	162,580	104,300	364,200	468,500	117,100	70,300	655,900	4.03
TURNING BASIN – 2	68,480	43,900	320,500	364,400	91,100	54,700	510,200	7.45
IWW/CUT BW50	30,240	19,400	145,800	165,200	41,300	24,800	231,300	7.65
TOTALS – 7 MILES	389,680	250,000	1,152,700	1,402,600	350,600	210,400	1,963,600	
8 MILES OFFSHORE								
ENTRANCE CH – 1	58,180	37,300	133,800	171,100	42,800	25,700	239,600	4.12
ENTRANCE CH – 2	70,200	45,000	198,700	243,700	60,900	36,600	341,200	4.86
TURNING BASIN – 1	162,580	104,300	390,200	494,500	123,600	74,200	692,300	4.26
TURNING BASIN – 2	68,480	43,900	323,900	367,800	92,000	55,200	515,000	7.52
IWW/CUT BW50	30,240	19,400	147,300	166,700	41,700	25,000	233,400	7.72
TOTALS – 8 MILES	389,680	250,000	1,193,900	1,443,800	361,000	216,700	2,021,500	
9 MILES OFFSHORE								
ENTRANCE CH – 1	58,180	37,300	144,300	181,600	45,400	27,200	254,200	4.37
ENTRANCE CH – 2	70,200	45,000	201,500	246,500	61,600	37,000	345,100	4.92
TURNING BASIN – 1	162,580	104,300	416,200	520,500	130,100	78,100	728,700	4.48
TURNING BASIN – 2	68,480	43,900	327,300	371,200	92,800	55,700	519,700	7.59
IWW/CUT BW50	30,240	19,400	146,100	165,500	41,400	24,800	231,700	7.66
TOTALS – 9 MILES	389,680	250,000	1,235,400	1,485,300	371,300	222,800	2,079,400	
10 MILES OFFSHORE								
ENTRANCE CH – 1	58,180	37,300	147,800	185,100	46,300	27,800	259,200	4.46
ENTRANCE CH – 2	70,200	45,000	214,100	259,100	64,800	38,900	362,800	5.17
TURNING BASIN – 1	162,580	104,300	440,600	544,900	136,200	81,700	762,800	4.69
TURNING BASIN – 2	68,480	43,900	330,100	374,000	93,500	56,100	523,600	7.65
IWW/CUT BW50	30,240	19,400	147,600	167,000	41,800	25,100	233,900	7.73
TOTALS – 10 MILES	389,680	250,000	1,280,200	1,530,100	382,600	229,600	2,142,300	

TABLE 12
PORT EVERGLADES HARBOR
DISPOSAL AREA STUDY
HYDRAULIC DREDGE ESTIMATE

Fri 08 Apr 1994

TIME 13:49:46

CHECKLIST FOR INPUT DATA.

Port Everglades Harbor Study 4/94

BID QUANTITY	58,180 C.Y.
UNIT COST...	$1.81 PER C.Y.
EXCAV. COST.	$105,306
TIME........	0.12 MONTHS

PG 1 OF 9: PROJECT TITLES

FILENAME	PEHS_PI
PROJECT	Port Everglades Harbor Study 4/94
LOCATION	Site 66
INVIT #	Entrance Channel - Shoal 1
DATE OF EST.	08 Apr 94
EST. BY	B J Harrison
MOB. BID ITEM #	0
EXCAV. BID ITEM #	0
TYPE OF EST.	Planning Estimate

PG 2 OF 9: EXCAVATION QTY'S

DREDGING AREA	130,000 sf
REQ'D EXCAVATION	58,180 cyds
PAY OVERDEPTH	0 cyds
CONTRACT AMOUNT	58,180 cyds
NOT DREDGED	0 cyds
NONPAY YARDAGE	4,800 cyds
GROSS YARDAGE	62,980 cyds
NONPAY HEIGHT	1.0 ft overdig.
TOTAL BANK HEIGHT	13.1 ft

PG 3 OF 9: MAXIMUM PIPELINE REQUIRED

FLOATING	2,000 ft
SUBMERGED	17,050 ft
SHORE	1,000 ft
TOTAL	20,050 ft
COST CATEGORY	2 SAND
EQUIVALENT	0 ft

PG 4 OF 9: MATERIAL FACTOR

DESCRIPTION	FACTOR	PERCENTAGE %
MUD & SILT	3	0
MUD & SILT	2.5	20
MUD & SILT	2	0
LOOSE SAND	1.1	0
LOOSE SAND	1	80
COMP. SAND	0.9	0
STIFF CLAY	0.6	0
COMP. SHELL	0.5	0
SOFT ROCK	0.4	0
BLAST. ROCK	0.25	0

RESULTANT
MATERIAL FACTOR - 1.14

PG 5 OF 9: DREDGE SELECTION

DREDGE SELECTED	30" HYDRAULIC DREDGE
COMPUTED BANK FACTOR	1.1
BANK FACTOR USED	1.1 >
OTHER FACTOR	1 >
CLEANUP	15% More Time

PG 6 OF 9: HORSEPOWER CONSIDERATIONS

CHART H.P.	9,000 hp
AVAILABLE H.P.	9,000 hp
BOOSTER H.P.	5,200 hp(ea)
LOSS PER BOOSTER	15%

PG 7 OF 9: CHART PRODUCTION ANALYSIS

AVE. PIPELINE	17,500 ft
BOOSTERS	0
BOOSTER FACTOR	1.00
% EFF WORK TIME (GROSS)	50.0%
MAX. POSSIBLE	29,410 ft
TOTAL HP AVAIL	9,000 hp
% EFF WORK TIME (NET)	50.0%
OPERATING TIME	365 hours per month

PG 8 OF 9: GROSS PRODUCTION & LOCAL AREA FACTORS

PRODUCTION OVERRIDE	NO
NET PRODUCTION	1,492 net cy per hour
OPERATING TIME	365 hours per month
BASED ON	0 booster(s)
PAY PRODUCTION	484,833 pay cy per month
PRESENT YEAR	1993
ECONOMIC INDEX	4718
LAF	0.84
INTEREST RATE	5.625% /yr
TIME PERIOD	June to December, 1993
PLANT AVAILABLE	9 mos/yr
FUEL PRICE	$0.79 /gal

PG 9 OF 9: OTHER ADJUSTMENTS

SPECIAL COST/MO	$7,000 Turbidity Monitoring
SPECIAL COST LS	$0 >
CONTRACTOR'S O.H.	15.0%
CONTRACTOR'S PROFIT	10.0%
CONTRACTOR'S BOND	1.0%

TABLE 13
PORT EVERGLADES HARBOR DISPOSAL AREA STUDY
HYDRAULIC DREDGE AND UPLAND DISPOSAL COSTS

CUT NAME	SHOAL QUANTITY (CY)	MOB & DEMOB PER CUT	EXCAVATION COST PER CUT	SUBTOTAL COSTS PER CUT	CONT COSTS 25%	E&D AND CM 15%	TOTAL $	DREDGING COSTS $/(CY)
SITE 25								
ENTRANCE CH – 1	58,180	188,900	247,300	436,200	109,100	65,400	610,700	10.50
ENTRANCE CH – 2	70,200	228,000	327,800	555,800	139,000	83,400	778,200	11.09
TURNING BASIN – 1	162,580	528,000	570,700	1,098,700	274,700	164,800	1,538,200	9.46
TURNING BASIN – 2	68,480	222,400	419,100	641,500	160,400	96,200	898,100	13.11
IWW/CUT BW50	30,240	98,200	209,300	307,500	76,900	46,100	430,500	14.24
TOTALS – SITE 25	389,680	1,265,500	1,774,200	3,039,700	760,100	455,900	4,255,700	
SITE 28								
ENTRANCE CH – 1	58,180	186,700	234,500	421,200	105,300	63,200	589,700	10.14
ENTRANCE CH – 2	70,200	225,300	313,800	539,100	134,800	80,900	754,800	10.75
TURNING BASIN – 1	162,580	521,700	544,600	1,066,300	266,600	159,900	1,492,800	9.18
TURNING BASIN – 2	68,480	219,800	394,400	614,200	153,600	92,100	859,900	12.56
IWW/CUT BW50	30,240	97,000	200,800	297,800	74,500	44,700	417,000	13.79
TOTALS – SITE 28	389,680	1,250,500	1,688,100	2,938,600	734,800	440,800	4,114,200	
SITE 30								
ENTRANCE CH – 1	58,180	172,100	201,300	373,400	93,400	56,000	522,800	8.99
ENTRANCE CH – 2	70,200	207,600	275,200	482,800	120,700	72,400	675,900	9.63
TURNING BASIN – 1	162,580	480,800	479,600	960,400	240,100	144,100	1,344,600	8.27
TURNING BASIN – 2	68,480	202,500	354,000	556,500	139,100	83,500	779,100	11.38
IWW/CUT BW50	30,240	89,400	174,800	264,200	66,100	39,600	369,900	12.23
TOTALS – SITE 30	389,680	1,152,500	1,484,900	2,637,300	659,400	395,600	3,692,300	
SITE 38								
ENTRANCE CH – 1	58,180	184,600	222,200	406,800	101,700	61,000	569,500	9.79
ENTRANCE CH – 2	70,200	222,800	301,200	524,000	131,000	78,600	733,600	10.45
TURNING BASIN – 1	162,580	515,900	518,600	1,034,500	258,600	155,200	1,448,300	8.91
TURNING BASIN – 2	68,480	217,300	381,400	598,700	149,700	89,800	838,200	12.24
IWW/CUT BW50	30,240	96,000	188,400	284,400	71,100	42,700	398,200	13.17
TOTALS – SITE 38	389,680	1,236,500	1,611,800	2,848,400	712,100	427,300	3,987,800	
SITE 56								
ENTRANCE CH – 1	58,180	N/A						
ENTRANCE CH – 2	70,200	N/A						
TURNING BASIN – 1	162,580	N/A						
TURNING BASIN – 2	68,480	218,500	514,300	732,800	183,200	109,900	1,025,900	14.98
IWW/CUT BW50	30,240	N/A						
TOTALS – SITE 56	389,680	1,243,500	514,300	732,800	183,200	109,900	1,025,900	
SITE 64								
ENTRANCE CH – 1	58,180	120,700	105,900	226,600	56,700	34,000	317,300	5.45
ENTRANCE CH – 2	70,200	145,600	127,800	273,400	68,400	41,000	382,800	5.45
TURNING BASIN – 1	162,580	337,300	209,700	547,000	136,800	82,100	765,900	4.71
TURNING BASIN – 2	68,480	142,100	176,700	318,800	79,700	47,800	446,300	6.52
IWW/CUT BW50	30,240	62,700	73,500	136,200	34,100	20,400	190,700	6.31
TOTALS – SITE 64	389,680	808,500	693,600	1,502,000	375,700	225,300	2,103,000	
SITE 66								
ENTRANCE CH – 1	58,180	119,500	105,300	224,800	56,200	33,700	314,700	5.41
ENTRANCE CH – 2	70,200	144,200	127,100	271,300	67,800	40,700	379,800	5.41
TURNING BASIN – 1	162,580	334,000	208,100	542,100	135,500	81,300	758,900	4.67
TURNING BASIN – 2	68,480	140,700	176,000	316,700	79,200	47,500	443,400	6.47
IWW/CUT BW50	30,240	62,100	73,200	135,300	33,800	20,300	189,400	6.26
TOTALS – SITE 66	389,680	800,500	689,700	1,490,200	372,500	223,500	2,086,200	
SITE 69								
ENTRANCE CH – 1	58,180	N/A						
ENTRANCE CH – 2	70,200	196,100	262,500	458,600	114,700	68,800	642,100	9.15
TURNING BASIN – 1	162,580	454,300	465,000	919,300	229,800	137,900	1,287,000	7.92
TURNING BASIN – 2	68,480	191,300	380,100	571,400	142,900	85,700	800,000	11.68
IWW/CUT BW50	30,240	84,500	160,300	244,800	61,200	36,700	342,700	11.33
TOTALS – SITE 69	389,680	1,088,800	1,267,900	2,194,100	548,600	329,100	3,071,800	
SITE 70								
ENTRANCE CH – 1	58,180	N/A						
ENTRANCE CH – 2	70,200	222,500	333,500	556,000	139,000	83,400	778,400	11.09
TURNING BASIN – 1	162,580	515,300	559,300	1,074,600	268,700	161,200	1,504,500	9.25
TURNING BASIN – 2	68,480	217,000	380,700	597,700	149,400	89,700	836,800	12.22
IWW/CUT BW50	30,240	95,800	161,200	257,000	64,300	38,600	359,900	11.90
TOTALS – SITE 70	389,680	1,235,000	1,434,700	2,485,300	621,400	372,900	3,479,600	
SITE 72								
ENTRANCE CH – 1	58,180	172,300	200,700	373,000	93,300	56,000	522,300	8.98
ENTRANCE CH – 2	70,200	207,900	314,500	522,400	130,600	78,400	731,400	10.42
TURNING BASIN – 1	162,580	481,400	544,600	1,026,000	256,500	153,900	1,436,400	8.84
TURNING BASIN – 2	68,480	202,800	446,500	649,300	162,300	97,400	909,000	13.27
IWW/CUT BW50	30,240	89,500	175,700	265,200	66,300	39,800	371,300	12.28
TOTALS – SITE 72	389,680	1,153,800	1,682,000	2,835,900	709,000	425,500	3,970,400	
SITE 76								
ENTRANCE CH – 1	58,180	N/A						
ENTRANCE CH – 2	70,200	227,000	359,400	586,400	146,600	88,000	821,000	11.70
TURNING BASIN – 1	162,580	525,600	634,100	1,159,700	289,900	174,000	1,623,600	9.99
TURNING BASIN – 2	68,480	221,400	513,600	735,000	183,800	110,300	1,029,100	15.03
IWW/CUT BW50	30,240	97,800	209,300	307,100	76,800	46,100	430,000	14.22
TOTALS – SITE 76	389,680	1,259,800	1,716,400	2,788,200	697,100	418,400	3,903,700	

TABLE 13
PORT EVERGLADES HARBOR DISPOSAL AREA STUDY
HYDRAULIC DREDGE AND UPLAND DISPOSAL COSTS

CUT NAME	SHOAL QUANTITY (CY)	MOB & DEMOB PER CUT	EXCAVATION COST PER CUT	SUBTOTAL COSTS PER CUT	CONT COSTS 25%	E&D AND CM 15%	TOTAL $	DREDGING COSTS $/(CY)
SITE 77								
ENTRANCE CH – 1	58,180	N/A						
ENTRANCE CH – 2	70,200	N/A						
TURNING BASIN – 1	162,580	N/A						
TURNING BASIN – 2	68,480	N/A						
IWW/CUT BW50	30,240	98,400	247,700	346,100	86,500	51,900	484,500	16.02
TOTALS – SITE 77	389,680	1,267,500	247,700	346,100	86,500	51,900	484,500	
SITE 95								
ENTRANCE CH – 1	58,180	N/A						
ENTRANCE CH – 2	70,200	N/A						
TURNING BASIN – 1	162,580	N/A						
TURNING BASIN – 2	68,480	N/A						
IWW/CUT BW50	30,240	97,300	235,600	332,900	83,200	49,900	466,000	15.41
TOTALS – SITE 95	389,680	1,253,500	235,600	332,900	83,200	49,900	466,000	
SITE 105								
ENTRANCE CH – 1	58,180	141,000	131,500	272,500	68,100	40,900	381,500	6.56
ENTRANCE CH – 2	70,200	170,100	178,300	348,400	87,100	52,300	487,800	6.95
TURNING BASIN – 1	162,580	394,100	302,400	696,500	174,100	104,500	975,100	6.00
TURNING BASIN – 2	68,480	166,000	245,200	411,200	102,800	61,700	575,700	8.41
IWW/CUT BW50	30,240	73,300	95,900	169,200	42,300	25,400	236,900	7.83
TOTALS – SITE 105	389,680	944,500	953,300	1,897,800	474,400	284,800	2,657,000	
SITE 106								
ENTRANCE CH – 1	58,180	158,900	161,700	320,600	80,200	48,100	448,900	7.72
ENTRANCE CH – 2	70,200	191,800	222,500	414,300	103,600	62,100	580,000	8.26
TURNING BASIN – 1	162,580	444,100	375,600	819,700	204,900	123,000	1,147,600	7.06
TURNING BASIN – 2	68,480	187,100	315,700	502,800	125,700	75,400	703,900	10.28
IWW/CUT BW50	30,240	82,600	119,400	202,000	50,500	30,300	282,800	9.35
TOTALS – SITE 106	389,680	1,064,500	1,194,900	2,259,400	564,900	338,900	3,163,200	
SITE 109								
ENTRANCE CH – 1	58,180	140,700	131,500	272,200	68,100	40,800	381,100	6.55
ENTRANCE CH – 2	70,200	169,800	178,300	348,100	87,000	52,200	487,300	6.94
TURNING BASIN – 1	162,580	393,200	302,400	695,600	173,900	104,300	973,800	5.99
TURNING BASIN – 2	68,480	165,600	244,500	410,100	102,500	61,500	574,100	8.38
IWW/CUT BW50	30,240	73,100	95,600	168,700	42,200	25,300	236,200	7.81
TOTALS – SITE 109	389,680	942,500	952,300	1,894,700	473,700	284,100	2,652,500	
SITE 110								
ENTRANCE CH – 1	58,180	141,000	131,500	272,500	68,100	40,900	381,500	6.56
ENTRANCE CH – 2	70,200	170,100	178,300	348,400	87,100	52,300	487,800	6.95
TURNING BASIN – 1	162,580	394,100	302,400	696,500	174,100	104,500	975,100	6.00
TURNING BASIN – 2	68,480	166,000	245,200	411,200	102,800	61,700	575,700	8.41
IWW/CUT BW50	30,240	73,300	95,900	169,200	42,300	25,400	236,900	7.83
TOTALS – SITE 110	389,680	944,500	953,300	1,897,800	474,400	284,800	2,657,000	
SITE 116								
ENTRANCE CH – 1	58,180	161,300	174,000	335,300	83,800	50,300	469,400	8.07
ENTRANCE CH – 2	70,200	194,600	234,500	429,100	107,300	64,400	600,800	8.56
TURNING BASIN – 1	162,580	450,800	398,300	849,100	212,300	127,400	1,188,800	7.31
TURNING BASIN – 2	68,480	189,900	328,700	518,600	129,700	77,800	726,100	10.60
IWW/CUT BW50	30,240	83,800	130,600	214,400	53,600	32,200	300,200	9.93
TOTALS – SITE 116	389,680	1,080,500	1,266,100	2,346,500	586,700	352,100	3,285,300	
SITE 117								
ENTRANCE CH – 1	58,180	163,700	175,100	338,800	84,700	50,800	474,300	8.15
ENTRANCE CH – 2	70,200	197,500	236,600	434,100	108,500	65,100	607,700	8.66
TURNING BASIN – 1	162,580	457,500	422,700	880,200	220,100	132,000	1,232,300	7.58
TURNING BASIN – 2	68,480	192,700	341,000	533,700	133,400	80,100	747,200	10.91
IWW/CUT BW50	30,240	85,100	131,800	216,900	54,200	32,500	303,600	10.04
TOTALS – SITE 117	389,680	1,096,500	1,307,200	2,403,700	600,900	360,500	3,365,100	
SITE 140								
ENTRANCE CH – 1	58,180	171,500	201,300	372,800	93,200	55,900	521,900	8.97
ENTRANCE CH – 2	70,200	206,900	274,500	481,400	120,400	72,200	674,000	9.60
TURNING BASIN – 1	162,580	479,200	478,000	957,200	239,300	143,600	1,340,100	8.24
TURNING BASIN – 2	68,480	201,800	392,400	594,200	148,600	89,100	831,900	12.15
IWW/CUT BW50	30,240	89,100	160,900	250,000	62,500	37,500	350,000	11.57
TOTALS – SITE 140	389,680	1,148,500	1,507,100	2,655,600	664,000	398,300	3,717,900	
SITE 147								
ENTRANCE CH – 1	58,180	N/A						
ENTRANCE CH – 2	70,200	197,500	372,800	570,300	142,600	85,500	798,400	11.37
TURNING BASIN – 1	162,580	457,500	648,700	1,106,200	276,600	165,900	1,548,700	9.53
TURNING BASIN – 2	68,480	192,700	527,300	720,000	180,000	108,000	1,008,000	14.72
IWW/CUT BW50	30,240	85,100	221,700	306,800	76,700	46,000	429,500	14.20
TOTALS – SITE 147	389,680	1,275,800	1,770,500	2,703,300	675,900	405,400	3,784,600	
SITE 154								
ENTRANCE CH – 1	58,180	N/A						
ENTRANCE CH – 2	70,200	N/A						
TURNING BASIN – 1	162,580	N/A						
TURNING BASIN – 2	68,480	N/A						
IWW/CUT BW50	30,240	89,100	234,700	323,800	81,000	48,600	453,400	14.99
TOTALS – SITE 154	389,680	1,245,300	234,700	323,800	81,000	48,600	453,400	

REAL ESTATE VALUES

The following evaluations involve an assessment of real estate values on the upland sites. The real estate analysis is last because of the field work involved in obtaining estimates for each site. Engineering and environmental investigations reduced the number of sites prior to initiating the real estate analysis. During the real estate analysis, sites 40, 58, 59, 62, 108, 120, 130, 134, 135, 138, 141, and 144 were found to be unsuitable. Consequently, these sites were dropped from further consideration. The real estate evaluations are in Appendix A and the results are in table 14. The estimated real estate values are for a fee simple purchase of the site with any severance damage caused by the purchase and utilization of the site. The values do not include any easements required for pipeline access to the site. Appendix A provides details concerning the methods used to obtain the real estate values as well as assumptions and limitations of the analysis.

COST COMPARISON

The estimated real estate costs were added to the previously calculated total costs for dredging and upland disposal for each site. Dredging costs for each of the ocean disposal methods provided a base condition for comparison with potential upland sites to determine at this level of detail what upland areas appear feasible for future consideration. The ocean disposal costs in tables 9 and 11 provide the base costs for comparison with total dredging and site preparation cost on a site by site basis. Table 15 uses site 66 as a sample of the comparison generated for each potential upland site. The most economical alternative is identified with an "*". The cost comparison for all potential sites produced no upland site that was as economical as offshore disposal.

SENSITIVITY ANALYSIS

The method of cost analysis lends itself to sensitivity of several cost elements. The mobilization and demobilization cost for the hydraulic dredge can be equal or greater than the actual excavation cost. A sensitivity analysis was performed by reducing the cost for mobilization and demobilization by 50 percent. The results still indicated that no upland site was as economical as utilization of an ODMDS located up to 10 miles offshore. The same results were produced when the real estate cost for each potential site was reduced by 50 percent. A series of cost estimates were compiled based upon hopper dredging and disposal in an ODMDS located 20 miles offshore. The results were identical to the previous sensitivity analyses performed for real estate and mobilization costs.

TABLE 14
PORT EVERGLADES HARBOR DISPOSAL AREA STUDY
REAL ESTATE VALUES

SITE NUMBER	SITE SIZE (ACRES)	DIKED AREA CAPACITY (CY)	TOTAL COMPENSATORY VALUE ($)	TOTAL COMPENSATORY VALUE ($/CY)
BROWARD COUNTY, FL, VOLUME 2				
25	13	290,400	1,690,000	5.82
28	110	5,187,500	9,350,000	1.80
30	34	1,181,500	1,170,000	0.99
38	13	290,400	1,690,000	5.82
BROWARD COUNTY,FL, VOLUME 3				
56	27	938,200	4,752,000	5.07
64	35	1,216,200	3,150,000	2.59
66	104	4,904,500	10,965,000	2.24
69	15	335,100	1,350,000	4.03
70	25	868,700	2,250,000	2.59
72	25	868,700	3,250,000	3.74
76	11	245,700	990,000	4.03
77	13	290,400	1,170,000	4.03
95	41	1,933,500	3,690,000	1.91
105	22	764,500	1,980,000	2.59
106	11	245,700	4,290,000	17.46
109	21	729,700	2,835,000	3.89
110	31	1,077,200	4,030,000	3.74
BROWARD COUNTY,FL, VOLUME 4				
116	15	335,100	1,350,000	4.03
117	39	1,355,200	3,510,000	2.59
140	110	5,187,500	14,850,000	2.86
DADE COUNTY,FL, VOLUME 1				
147	104	4,904,500	14,040,000	2.86
154	14	312,700	1,820,000	5.82

TABLE 15
PORT EVERGLADES HARBOR DISPOSAL AREA STUDY
COST COMPARISON

CUT NAME	QUANTITY PER CUT (CY)	COSTS PER DREDGE AND DISPOSAL TYPE ($/CY)		
		CLAMSHELL TO OCEAN	HOPPER TO OCEAN	HYDRAULIC TO SITE 66
PORT EVERGLADES HARBOR – ENTRANCE CHANNEL				
SHOAL 1	58,180	$4.46	$3.85 *	$9.18
SHOAL 2	70,200	$5.17	$4.11 *	$9.18
PORT EVERGLADES HARBOR – TURNING BASIN				
SHOAL 1	162,580	$4.69	$3.87 *	$8.44
SHOAL 2	68,480	$7.65	$4.50 *	$10.24
PORT EVERGLADES HARBOR – IWW/CUT BW50				
SHOAL 1	30,240	$7.73	$4.44 *	$10.03

* – Most Economical Dredging Method Per Cut

SUMMARY

The initial analysis involved 153 potential upland disposal sites located within a 10 mile arc of the Port Everglades Harbor Turning Basin. Environmental evaluations determined that 83 sites were unsuitable for disposal. An examination of aerial maps and a field trip revealed development on six sites making them unsuitable for further consideration. One site was inaccessible by pipeline due to having to cross the traffic interchange at Eller Drive and U.S. Highway 1. After establishing a pipeline access route to the site, thirty-six sites were in excess of the 10 mile pipeline limit and removed from further consideration. One site had a shape that not conducive to dike construction and would not allow the outflow water to meet water quality standards. This site was removed from further consideration. Also, four other sites were unsuitable for the following reasons: the first site had an electrical substation and fire hydrants; second site had powerlines; third site had seven radio towers; fourth site owner unwilling to sell property. Table 16 contains the 22 sites (see figure 5 for general locations) considered suitable for disposal of the material from Port Everglades Harbor Entrance Channel and Turning Basin.

During the course of this study, the preparation of over 210 cost estimates enabled a detailed cost comparison between 3 possible dredging techniques. This report shows only a sampling of those estimates. Detailed documentation on the estimates is available in the Jacksonville District Office.

RESULTS

The results presented in tables 15 and 16 demonstrate the need for an Ocean Dredged Material Disposal Site (ODMDS) for the Port Everglades Harbor Federal Project. As shown by table 16, no upland disposal sites were found to be more economical than the use of the ODMDS. However, potential upland sites do exist if the material does not meet EPA criteria (see table 16).

TABLE 16
PORT EVERGLADES HARBOR DISPOSAL AREA STUDY
FINAL COST COMPARISION

		ENTRANCE CHANNEL				TURNING BASIN							
		SHOAL 1		SHOAL 2		SHOAL 1		SHOAL 2		IWW/CUT BW50		PROJECT	
SITE NUMBER	CAPACITY	QUANTITY (CY)	COSTS ($/CY)	QUANTITY (CY)	COSTS ($/CY)	QUANTITY (CY)	COSTS ($/CY)	QUANTITY (CY)	COSTS ($/CY)	QUANTITY (CY)	COSTS ($/CY)	COSTS ($)	NOTES
ODMDS @ 10 MILES WITH HOPPER DREDGE													
ODMDS	UNLIMITED	58,180	3.85	70,200	4.11	162,580	3.87	68,480	4.50	30,240	4.44	1,584,000	1
ODMDS @ 10 MILES WITH CLAMSHELL DREDGE													
ODMDS	UNLIMITED	58,180	4.46	70,200	5.17	162,580	4.69	68,480	7.65	30,240	7.73	2,143,000	
UPLAND DISPOSAL SITES WITH HYDRAULIC DREDGE													
25	290,400	58,180	20.99	70,200	21.58	162,580	19.95	68,480	23.60	30,240	24.73	8,344,000	
28	5,187,500	58,180	13.28	70,200	13.89	162,580	12.32	68,480	15.70	30,240	16.93	5,338,000	
30	1,181,500	58,180	12.05	70,200	12.69	162,580	11.33	68,480	14.44	30,240	15.29	4,885,000	
38	290,400	58,180	20.38	70,200	21.04	162,580	19.50	68,480	22.83	30,240	23.76	8,115,000	
56	938,200	58,180	NA	70,200	NA	162,580	NA	68,480	22.53	30,240	NA	1,543,000	2
64	1,216,200	58,180	10.21	70,200	10.21	162,580	9.47	68,480	11.28	30,240	11.07	3,958,000	2
66	4,904,500	58,180	9.18	70,200	9.18	162,580	8.44	68,480	10.24	30,240	10.03	3,555,000	2
69	335,100	58,180	20.91	70,200	17.06	162,580	15.83	68,480	19.59	30,240	19.24	6,911,000	2
70	868,700	58,180	NA	70,200	16.66	162,580	14.82	68,480	17.79	30,240	17.47	5,326,000	2
72	868,700	58,180	14.89	70,200	16.33	162,580	14.75	68,480	19.18	30,240	18.19	6,274,000	2
76	245,700	58,180	NA	70,200	20.65	162,580	18.94	68,480	23.98	30,240	23.17	6,872,000	2
77	290,400	58,180	20.21	70,200	NA	162,580	NA	68,480	NA	30,240	24.23	1,909,000	2
95	1,933,500	58,180	NA	70,200	NA	162,580	NA	68,480	NA	30,240	19.91	602,000	2
105	764,500	58,180	12.81	70,200	13.20	162,580	12.25	68,480	14.66	30,240	14.08	5,093,000	2
106	245,700	58,180	30.02	70,200	30.56	162,580	29.36	68,480	32.58	30,240	31.65	11,853,000	2
109	729,700	58,180	13.28	70,200	13.67	162,580	12.72	68,480	15.11	30,240	14.54	5,275,000	2
110	1,077,200	58,180	12.57	70,200	12.96	162,580	12.01	68,480	14.42	30,240	13.84	5,000,000	2
116	335,100	58,180	16.13	70,200	16.62	162,580	15.37	68,480	18.66	30,240	17.99	6,426,000	2
117	1,355,200	58,180	13.45	70,200	13.96	162,580	12.88	68,480	16.21	30,240	15.34	5,430,000	2
140	5,187,500	58,180	14.00	70,200	14.63	162,580	13.27	68,480	17.18	30,240	16.60	5,677,000	2
147	4,904,500	58,180	NA	70,200	15.61	162,580	13.77	68,480	18.96	30,240	18.44	5,191,000	2
154	312,700	58,180	NA	70,200	NA	162,580	NA	68,480	NA	30,240	25.02	757,000	2

NOTES:
1. The most economical alternative for project maintenance is an ODMDS located up to 10 miles offshore.
2. The entire project can not be maintained using only this site. Additional sites would have to be utilized.

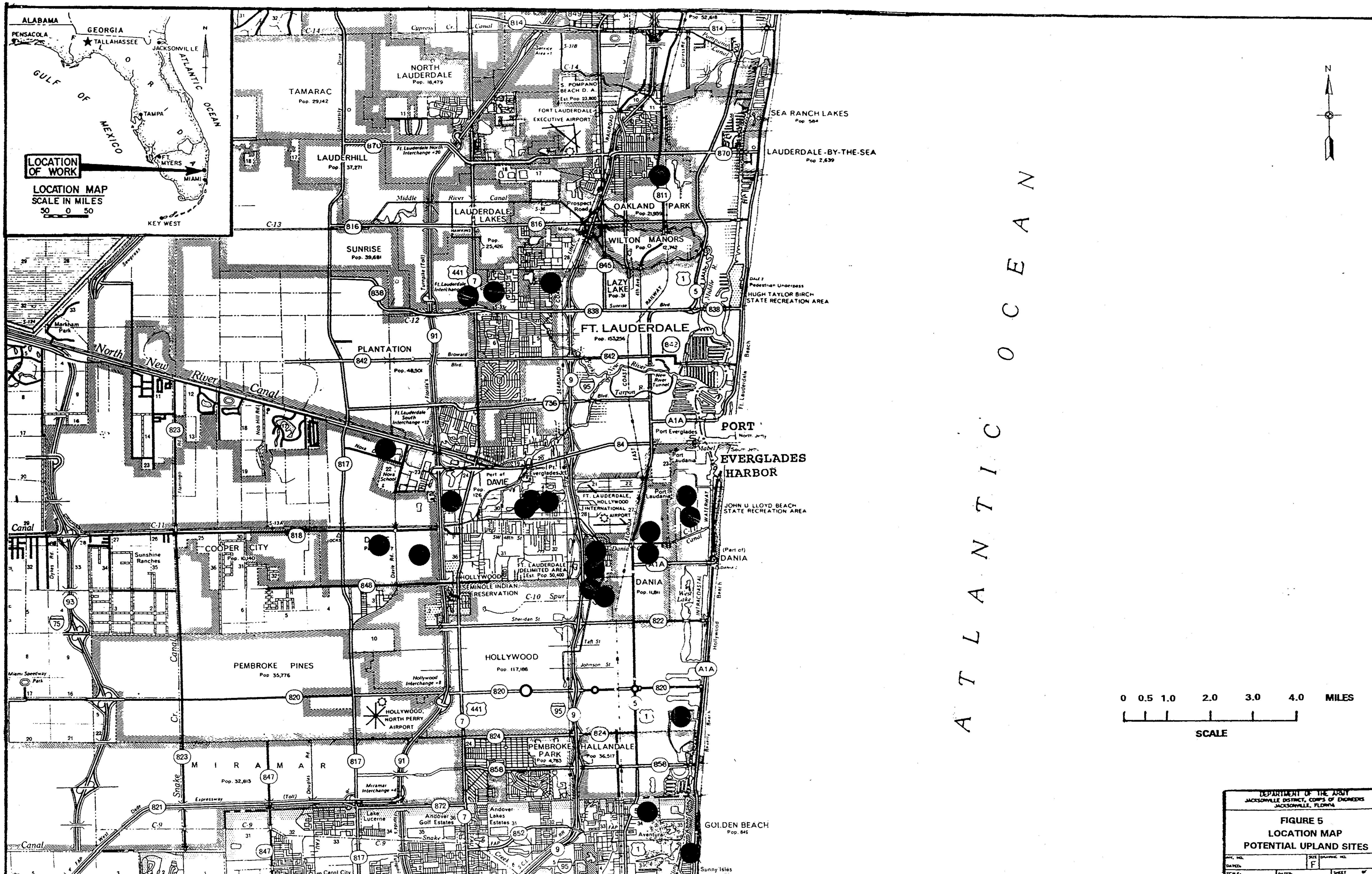


FIGURE 5
LOCATION MAP
POTENTIAL UPLAND SITES

PORT EVERGLADES HARBOR DISPOSAL AREA STUDY

REAL ESTATE SECTION

ATTACHMENT A

PROJECT: Port Everglades Harbor Disposal Area Site Study (DAS)

PURPOSE AND FUNCTION OF THE REPORT

This report is in response to CESAJ-PD-PN memorandum dated 29 March 1994, requesting preliminary real estate values for 36 potential upland disposal sites to be utilized in conjunction with the Port Everglades Harbor Dredging project.

Twenty-two sites were selected as suitable upland disposal sites. Each site will be briefly outlined in an attempt to summarize important considerations to arrive at an estimate of value for each disposal site. The estimate will enable a comparison of cost between the use of upland sites and the offshore disposal option.

DATE OF INSPECTION AND REPORT

On 6-8 April 1994, the potential site areas were examined, evaluated, and inspected by Mr. Joseph M. Gentile, Civil Engineer CESAJ-PD-PN, and the appraiser. The date of this report is 8 April 1994.

ASSUMPTIONS AND LIMITING CONDITIONS

The estimates of value for the project area, as shown and contained in this report, were made subject to the following assumptions and limiting conditions

1. The land estimates provided by the appraiser in this report should be used only for planning purposes. Due to budget and time restrictions, the scope of the study is limited. Additionally, requirements of the Project are subject to change, which in turn could alter the values presented. Should the study reach a feasibility stage these values should be refined. A tract appraisal will be required for acquisition.

2. It is assumed that use of the subject sites as disposal sites would be approved by appropriate officials and all necessary permits and zoning variances could be secured.

3. Due to the passage of the State of Florida Growth Management Act, the reader must be cautioned that unimproved land may be subject to transitional land use plans or to mitigation. Due to the frequent changes, the effects of these conditions usually cannot be determined and changes in value may occur.

4. It is assumed that there are no hidden or unapparent conditions of the property, subsoil, or structures that render it more or less valuable. No responsibility is

5. Information, estimates and opinions furnished to the appraiser and contained in the report were obtained from sources considered reliable and believed to be true and correct. However, no responsibility for accuracy of such items furnished the appraiser can be assumed by the appraiser.

6. The appraiser assumes no responsibility for matters of a legal nature affecting the property appraised or the title thereto, nor does the appraiser render any opinion as to the title, which is assumed to be good and marketable. The property is appraised as if under responsible ownership.

7. Possession of this report, or a copy thereof, does not carry with it the right of publication, nor may it be used by anyone but the Government or its designee.

8. The maps, sketches, and aerial photographs used to assemble this report are not certified to be accurate, but are merely used to give the appraiser an indication of the general project area; therefore they will remain on file in CESAJ-RE-S.

9. Unless otherwise stated in this report, the existence of hazardous material, which may or may not be present on the property, was not observed by the appraiser. The appraiser has no knowledge of the existence of such materials on or in the property. The appraiser, however, is not qualified to detect such substances. The presence of substances such as asbestos, urea-formaldehyde foam insulation, or other potentially hazardous materials may affect the value of the property. The value estimate is predicated on the assumption that there is no such material on or in the property that would cause a loss in value. No responsibility is assumed for any such conditions, or for any expertise or engineering knowledge required to discover them.

10. The value conclusions expressed in this report are based on data found in Broward and Dade County's public records. Not all data has been verified.

11. There is no indication of mineral or petroleum activity in the area at this time. It is assumed that the value of subsurface rights is included in the sales price of the comparable sales.

12. To my knowledge, there are no cemeteries, cultural resources, or historical markers located on the subject sites.

13. It is assumed that the sites consist of vacant land only and that there are no improvements or structures which will be affected by the Project. It is also assumed that no damages resulting from the use of these sites as disposal sites would occur to surrounding properties.

14. The appraiser is relying on inspection of the subject site, tax records and/or other suitable information for descriptions of subject property. Legal descriptions were not provided and it was impractical to contact all the owners involved. Owner contact is not a requirement for gross appraisals as per Real Estate Policy Guidance Letter No. 3, dated 31 May 1991.

15. As per Real Estate Policy Guidance Letter No. 7, dated 5 October 1993, Reconnaissance scope estimates or initial cost estimates that are utilized for preliminary planning purposes do not require compliance with the Uniform Standards of Proffessional Appraisal Practice.

ESTATES APPRAISED

The estate appraised in each of the subject parcels is the fee simple title to each tract, subject, however, to existing easements for public utilities, railroads and pipelines. However, this is a preliminary value to be used for Project Planning purposes.

OWNERSHIPS

The estimated number of ownerships, based on personal cursory research of tax records with the Broward and Dade counties Property Appraisal office, is provided in Table I.

REGION AND AREA DATA

Port Everglades Harbor, initially named Hollywood Harbor, was originally constructed in 1925-1928, under agreement between the cities of Hollywood and Fort Lauderdale, Florida. Port Everglades is located in the southeastern portion of Broward County at the adjoining city limits of Fort Lauderdale, Hollywood, and Dania, 24 miles north of Miami and 323 miles south of Jacksonville. The total jurisdictional area of the port is approximately 2,100 acres of which 910 acres are owned by the Port Authority. Port Everglades is the state of Florida's deepest harbor and it is also the largest seaport in acreage on Florida's lower east coast.

The River and Harbor Act of 1930 authorized Federal maintenance of the locally constructed project. Subsequently, modifications authorized by Congress were constructed, such as the Southport navigation improvements which include the channel and turning notch. These improvements are eligible for inclusion into the Federal project at Port Everglades. The Federal government proposes to assume maintenance responsibilities on these navigation works. Acquisition of upland areas is being considered so that these will be available within economical dredging distances when disposal of shoal material from maintenance is necessary. This is an alternative to an Offshore Dredging Material Dump Site (ODMDS). The cost estimates provided in this report will enable a comparison of cost between the use of upland sites and the Offshore Dredging Material Dump Site.

Port Everglades Harbor Project encompasses municipalities in Broward, Dade, and Palm Beach County. The subject sites are located in Broward and Dade counties. Broward County encompasses 1,211 square miles. Its county seat is Fort Lauderdale, with a 1992 population of 1,294,000. Dade County encompasses 1,955 square miles. Its county seat is Miami, with a 1992 population of 1,982,901. The counties' major industries are services, trade and government. Broward County, particularly west Broward, capitalizes on its position as a central distribution point for all of South Florida. Broward's housing market benefitted greatly from Hurricane Andrew, as many Dade residents opted to move north and build mostly in the area of southwest Broward, near the confluence of Interstates 75 and 595. In Dade County, Andrew ended what had been a tough recession (10% unemployment) creating some 30,000 construction jobs and 10,000 manufacturing jobs.

Potential disposal sites are located through the use of past studies, aerial photography, and geographical limitations. Each site must be open land with no dwellings, meet minimum size requirement of 10 acres, and be within limitations imposed by the geographical area. The limitations are generally related to pipeline access to the site. The maximum pumping distance is assumed to be approximately 10 - 15 miles from the hydraulic dredge or a pump-out plant location. The geographical area is roughly bounded by the Atlantic Ocean to the east, NE 191 Street to the south, Pine Island to the west, and NE 7th Street to the north. These restrictions and boundaries have limited the scope of the study. The overall area is urbanized, with a mix of residential, commercial, agricultural, and industrial land use.

The Corps of Engineers narrows down a list of "potential" upland sites to only those best suited for specific project requirements. As previously mentioned, the study area is subject to change.

DESCRIPTION OF THE SUBJECT

Acquisition of upland sites has been proposed as a possible alternative to offshore disposal. The subject sites under consideration consist mostly of unimproved vacant land, with some open areas. Except for some fencing, there were no improvements detected during the inspection of the sites. The location, zoning, and brief description of each site is found in the following Table I:

PROJECT: Port Everglades Harbor Disposal Area Site Study (DAS)

TABLE III. ESTIMATE OF REAL ESTATE LAND COSTS

Site	Use	Size (Acres)	Estimated Value per Acre	Total estimated Value
25	C	13	$ 130,000	$1,690,000
28	I	110	85,000	9,350,000
30	I	34	90,000	1,170,000
38	C	13	130,000	1,690,000
56	I	27	176,000	4,752,000
64	I	35	90,000	3,150,000
66	I	104	85,000	10,965,000[2]
69	I	15	90,000	1,350,000
70	I	25	90,000	2,250,000
72	C	25	130,000	3,250,000
76	I	11	90,000	990,000
77	AG	13	90,000	1,170,000
95	AG	41	90,000	3,690,000
105	AG	22	90,000	1,980,000
106	C	11	130,000	4,290,000
109	R	21	135,000	2,835,000
110	C	31	130,000	4,030,000
116	I	15	90,000	1,350,000
117	R,I	39	90,000	3,510,000
140	R	110	135,000	14,850,000
147	R	104	135,000	14,040,000
154	C	14	130,000	1,820,000
Estimated cost				$ 94,000,000 (R)
Contingencies (25%)				$ 24,000,000 (R)
Total estimated cost				$118,000,000 (R)

25 April 1994

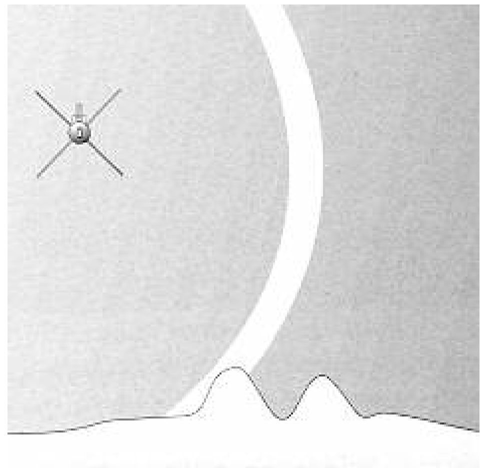
ROSA G. CIENFUEGOS, Appraiser

[2]Included in total estimated value, is the amount of $2,125,000 in severance damage to the NE 100 ± acres of the parent tract, estimated at 25% of land value.

Appendix E

SIDESCAN SONAR SURVEY RESULTS AT THE CANDIDATE ODMDS FOR PORT EVERGLADES AND PALM BEACH, FLORIDA

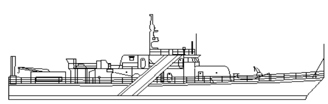
SIDESCAN SONAR SURVEY RESULTS AT THE CANDIDATE OCEAN DREDGED MATERIAL DISPOSAL SITES FOR PORT EVERGLADES AND PALM BEACH, FLORIDA



Prepared for:

U.S. Army Corps of Engineers
Jacksonville District

Under Interagency Agreement #RW96945795



By:

U.S. Environmental Protection Agency
Region 4
Wetlands, Coastal and NonPoint Source Branch

May 2000

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Appendices

SIDESCAN SONAR SURVEY RESULTS AT THE CANDIDATE OCEAN DREDGED MATERIAL DISPOSAL SITES FOR PORT EVERGLADES AND PALM BEACH, FLORIDA

1.0 INTRODUCTION

The U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers have the responsibility under Section 102 of the Marine Protection, Research and Sanctuaries Act (MPRSA), for the management and monitoring of Ocean Dredged Material Disposal Sites (ODMDSs). EPA has the responsibility under the MPRSA for designation of sites for dredged material disposal. The Corps of Engineers Jacksonville District has requested that EPA Region 4 designate disposal sites off shore Palm Beach, Florida and Port Everglades, Florida for the disposal of dredged material.

To date, EPA and the COE have identified four candidate sites for Palm Beach and three for Port Everglades. In accordance with 40 CFR §228.4 of the Ocean Dumping regulations site designations will be made based on environmental studies of each site. Various surveys have been conducted in the past in the vicinity of these candidate site. These surveys along with this effort and a literature search will be used to characterize the candidate sites and adjacent regions to support dredged material disposal site designations offshore Port Everglades and Palm Beach, Florida.

This report details the results of sidescan sonar survey of the candidate sites for Ocean Dredged Material Disposal Sites (ODMDSs) offshore Port Everglades and Palm Beach, Florida conducted in 1998. The survey was conducted by EPA Region 4 personnel aboard the OSV Peter W. Anderson from August 18, 1998 to August 23, 1998.

2.0 METHODS

Sidescan sonar data was collected along north/south transects for each survey area utilizing a Klein™ 595 system. Only 100kHz frequency data was collected. Cable length (3,000ft) prohibited the collection of the 500 kHz frequency. Transects completed are shown in Appendix A. Transect spacing was set at 250 meters for the primary survey areas and at greater distances for the secondary areas. The system range was set at 250 meters to provide 100 percent overlap in the primary survey areas. Operating parameters for each survey area is given in Table 1.

Table 1: Survey Operating Parameters

Survey Area	Transect Spacing (m)	Range (m)	% Overlap	Speed (knots)
PE-A, PB-A	250	250	100	3
PB-B, PE-B	300	250	67	3
PE-C, PE-D, PB-C, PB-D	750-1000	250	0	3

Operating parameters are selected based on guidance provided in “Side Scan Sonar Record Interpretation” (Klein Associates) and “Sound Underwater Images, A Guide to the Generation and Interpretation of Side Scan Sonar Data” (Fish, 1990) and desired resolution of 1 meter for the primary survey areas and 2 meters for the secondary survey areas. Shorter transect spacing was selected for the survey areas encompassing the preferred candidate sites to provide greater resolution. Larger transect spacing was selected for the candidate sites less likely to be selected. Even a larger transect spacing was selected for the secondary survey areas since these areas are outside the expected zone of impact from disposal. Grab sampling from a previous survey was used to ground-truthing the general characteristics of the bottom. Benthic photography was unsuccessfully attempted.

Data was recorded both in analog format on thermal paper and digitally on optical disks utilizing the EOSCAN™ software onboard the OSV Anderson. Frequent system crashes caused data gaps in the digital data. However, full coverage was recorded on the thermal paper.

3.0 RESULTS AND DISCUSSION

3.1 Port Everglades 4 Mile Candidate Site

The sidescan mosaic of the survey area (Figure 1) shows a composite of the survey lanes. Gaps in the data are due to technical difficulties in recording the sidescan data electronically (see Section 2.0). 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 sizes was approximately 0.18mm 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 low relief areas are shown in Figure 2 and their acoustic images are shown in Appendix B.

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. The location of these targets are shown in Figure 3. They are divided into large and small targets. The acoustic images for most of these targets are

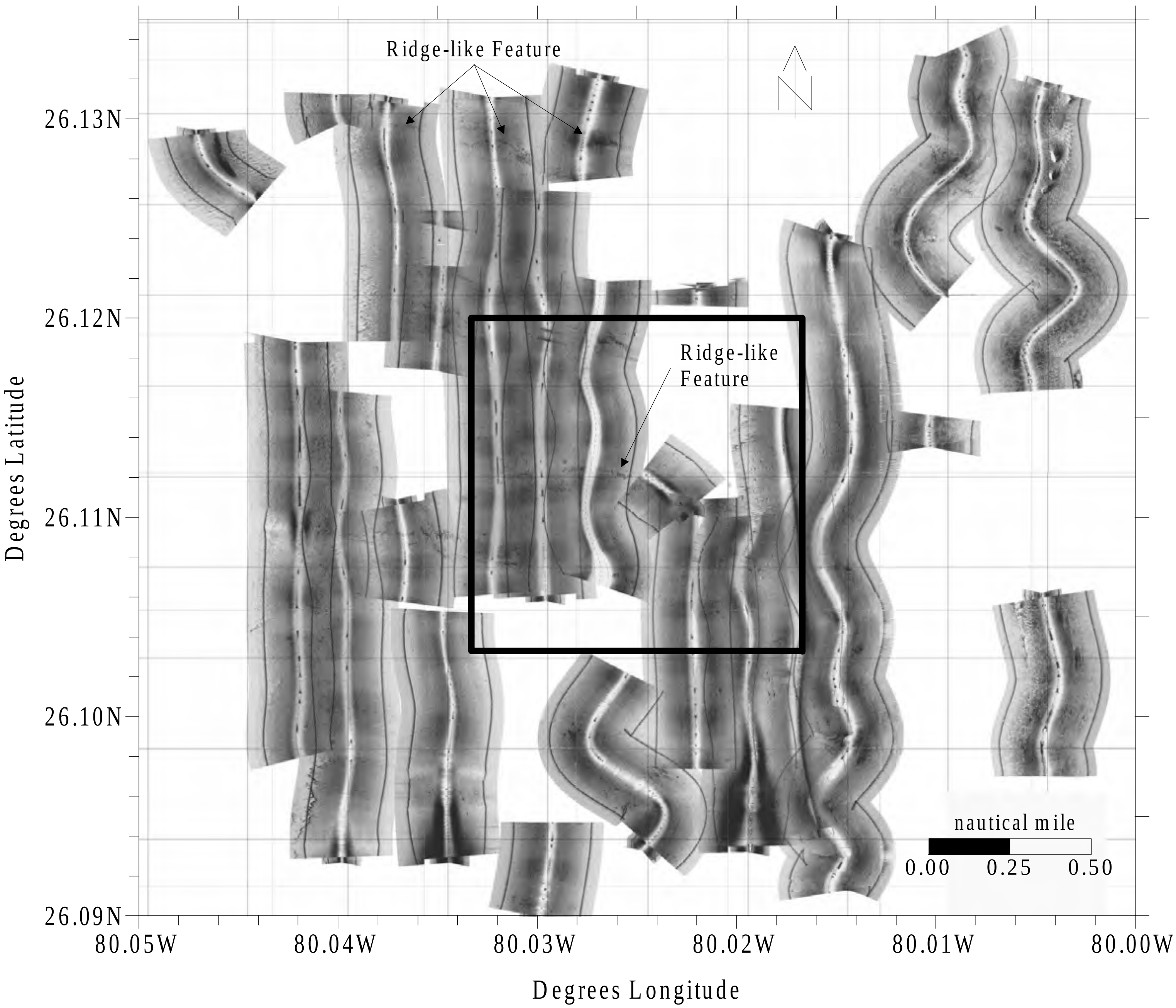

Figure 1: Sidescan Mosaic for the Port Everglades 4 Mile Site

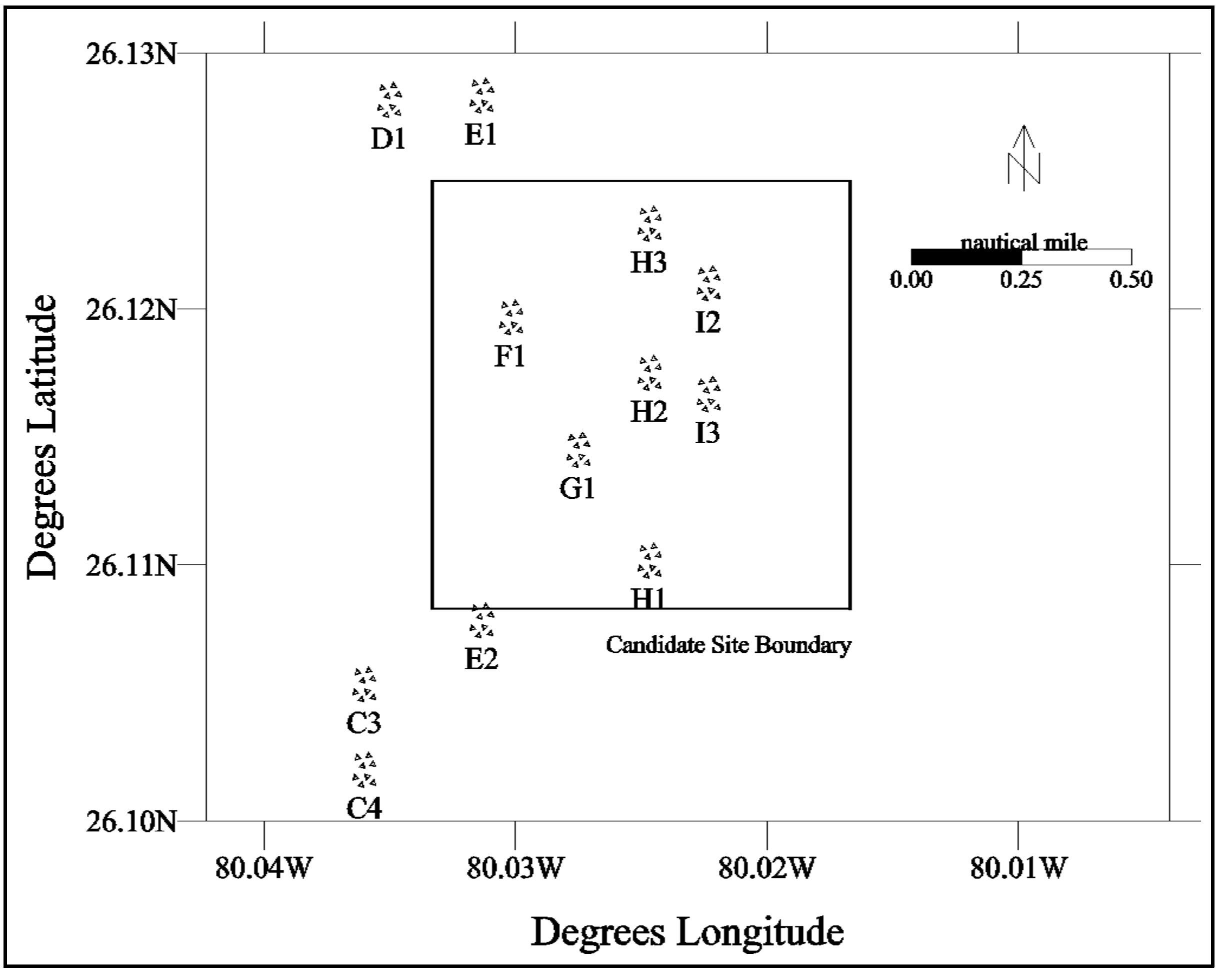

Figure 2: Areas of Scattered Low Relief In and Near the Port Everglades 4 Mile Candidate Site. Labels correspond to acoustic images presented in Appendix B.

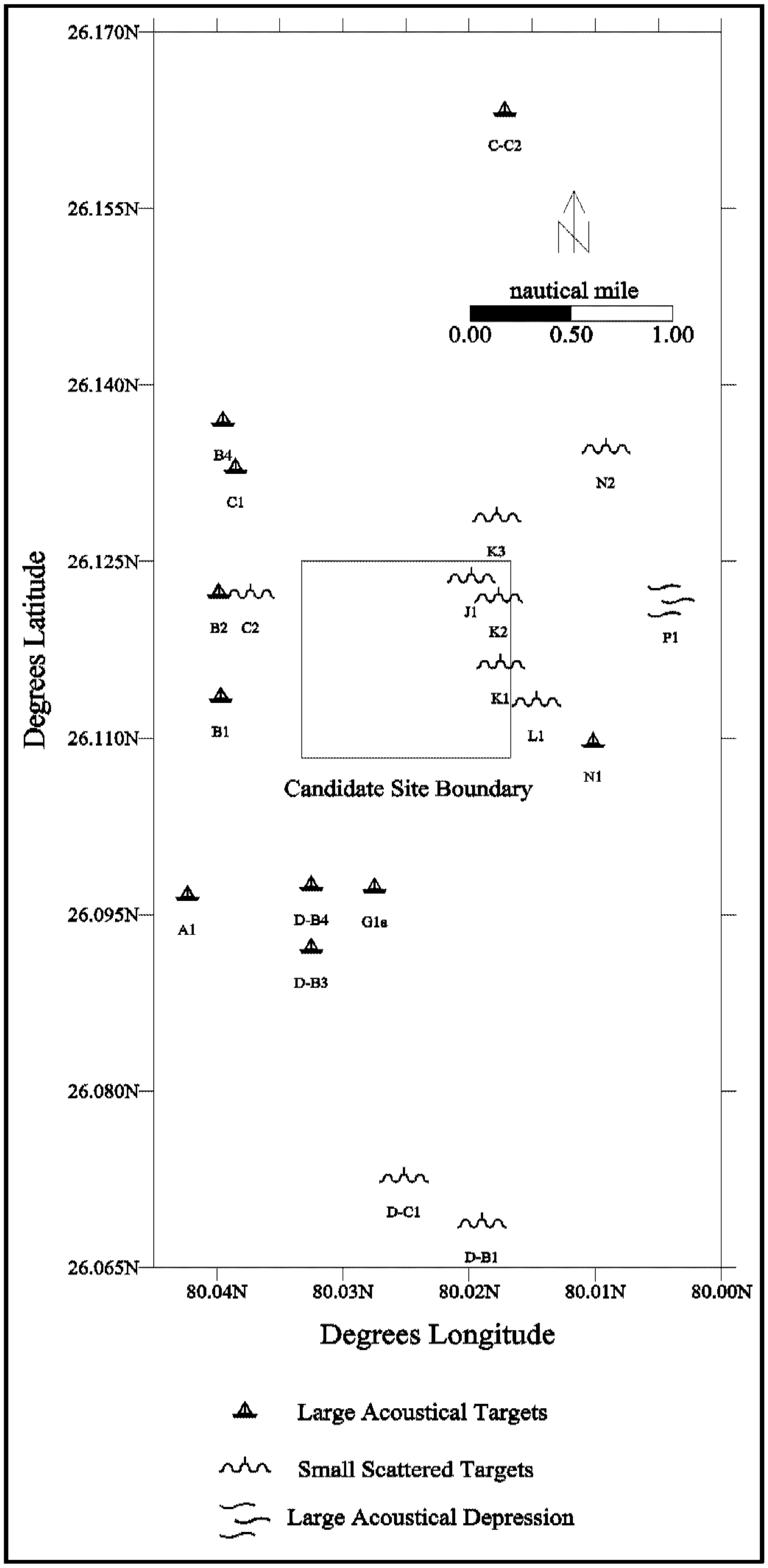

Figure 3: Acoustical Targets In and Near the Port Everglades 4 Mile Candidate Site. Labels correspond to acoustic images presented in Appendix B.

shown in Appendix B. One of these acoustic targets (P1) consists of three large depressions surrounded by large sand waves. The depressions are approximately 25 meters across and refraction of the acoustical signal was observed in the vicinity. Refraction is indicative of density changes in the water column (Fish, 1990). These depressions resemble impact craters or possibly freshwater vents.

Five of the acoustical targets were identified as possible wrecks based on the shape of their reflective return and shadow. The position of these targets are shown in Figure 4. The acoustical images for these targets are shown in Appendix B. All of these targets are outside of the candidate site boundaries and three are within the Navy South Florida Testing Facility Testing Range.

3.2 Port Everglades 7 Mile Candidate Site

A quality sidescan mosaic of the survey area is not available due to poor DGPS navigation data and the frequent system crashes described in Section 2.0. A mosaic of the available digital data is presented in Appendix C. The southern portion of the survey area (south of 26º 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 0.22mm with 10 to 18 percent silts and clays (EPA, 1999). Figure 5 shows the transition zone from the hard bottom area to the sandy bottom area. Examples of the low relief hard bottom areas and the uniform sandy bottom areas can be found in Appendix C.

Only a few scattered targets were detected throughout the survey area. These were identified by dark acoustical signals with shadows. The locations of the targets are shown in Figure 6. The acoustic images for most of these targets are shown in Appendix C.

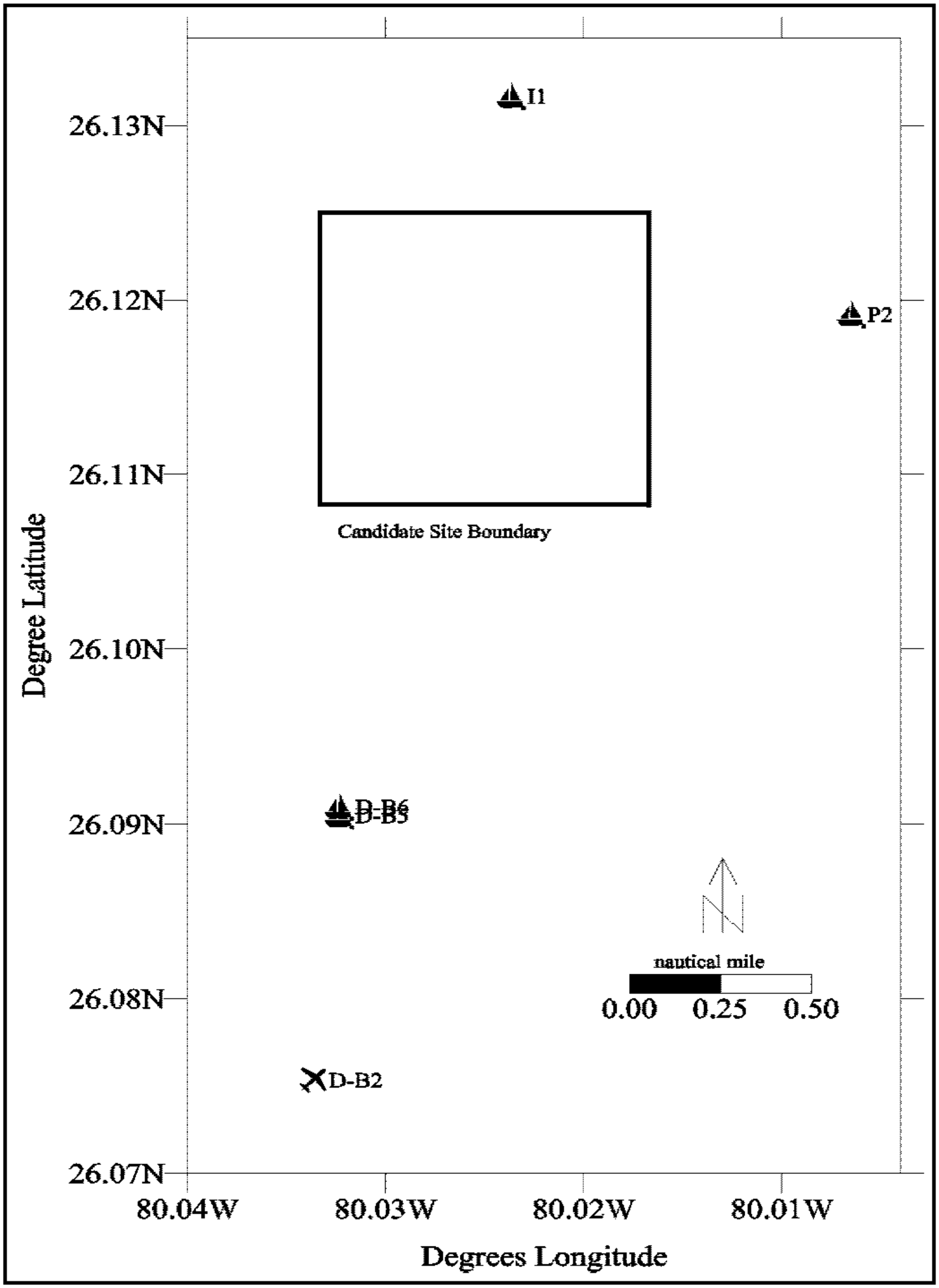

Figure 4: Potential Wrecks Near the Port Everglades 4 Mile Candidate Site. Labels correspond to acoustic images presented in Appendix B.

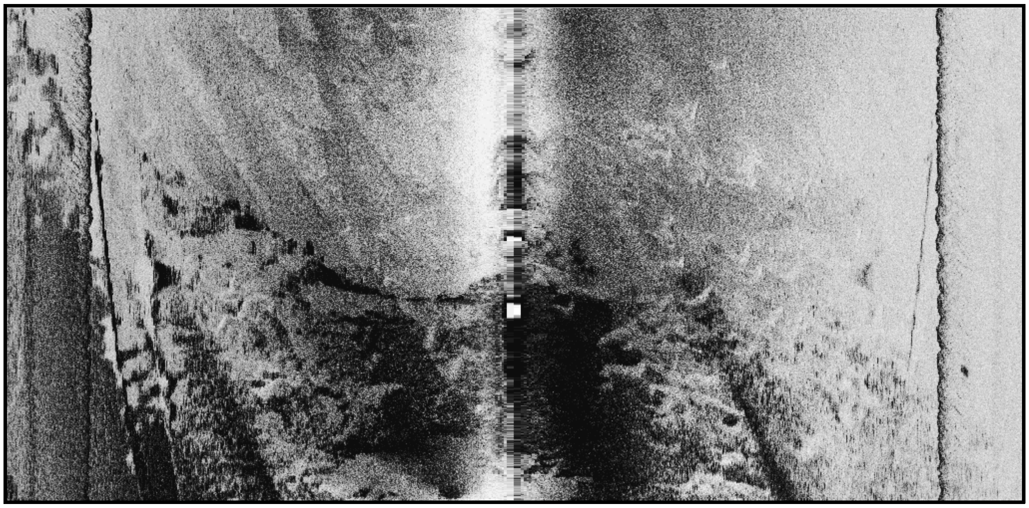

Figure 5: Port Everglades 7 Mile Candidate Site Hard Bottom to Soft Bottom Transition Zone Sidescan Sonar Image.

3.3 Palm Beach Interim, 3, and 4.5 Mile Candidate Sites

The sidescan mosaic of the Palm Beach Interim, 3 and 4.5 Mile Candidate Sites (Figure 7) shows a composite of the survey lanes. Gaps in the data are due to technical difficulties in recording the sidescan data electronically (see Section 2.0). A mosaic including the survey lanes to the north and south of the 4.5 Mile Candidate Site is in Appendix D. Results show a relatively uniform sandy bottom of medium reflectance throughout most of the site with areas indicative of rubble or cobbles within the Interim Site and along the western boundary of the 3 Mile Candidate Site. Only a few scattered targets were detected throughout the survey area. These were identified by dark acoustical signals. The locations of the targets are shown in Figure 8. The acoustic images for most of these targets are shown in Appendix D. The most notable target (A1) is found in the northwest corner of the survey area. It consists of acoustical returns representative of scattered patches of low relief hard bottom. These patches range in size up to 100 meters in length.

Interim Candidate Site

Interpretation of the side-scan sonar data indicated that sediments within the site ranged from fine to coarse-grained sand. Circular areas of coarser material were scattered throughout the site. These are possibly indicative of previous disposal activity at the site. The Interim Site has been used for disposal of greater than five million cubic yards of dredged material in the past. The disposed dredged material has been characterized as poorly graded sand (median grain size of 0.43 mm) with traces of shell fragments (BVA, 1985). Grab samples taken in 1985 showed the substrata to consist of silty sand, sand and sand/coralline rubble. Median grain size ranged from 0.17 to 0.30 mm (BVA, 1985).

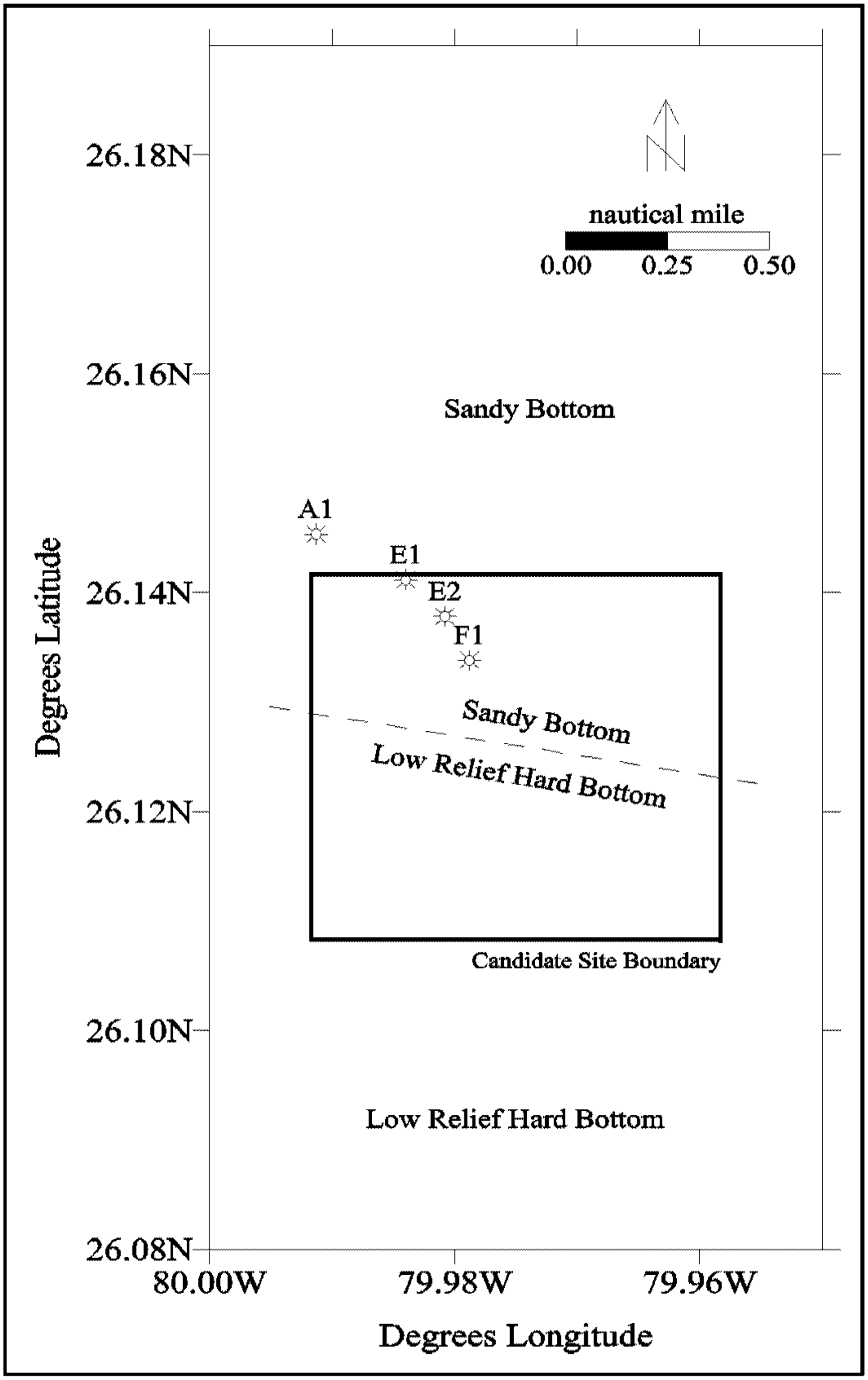

Figure 6: Bottom Type and Acoustical Targets In and Near the Port Everglades 7 Mile Candidate Site. Labels correspond to acoustic images presented in Appendix C.

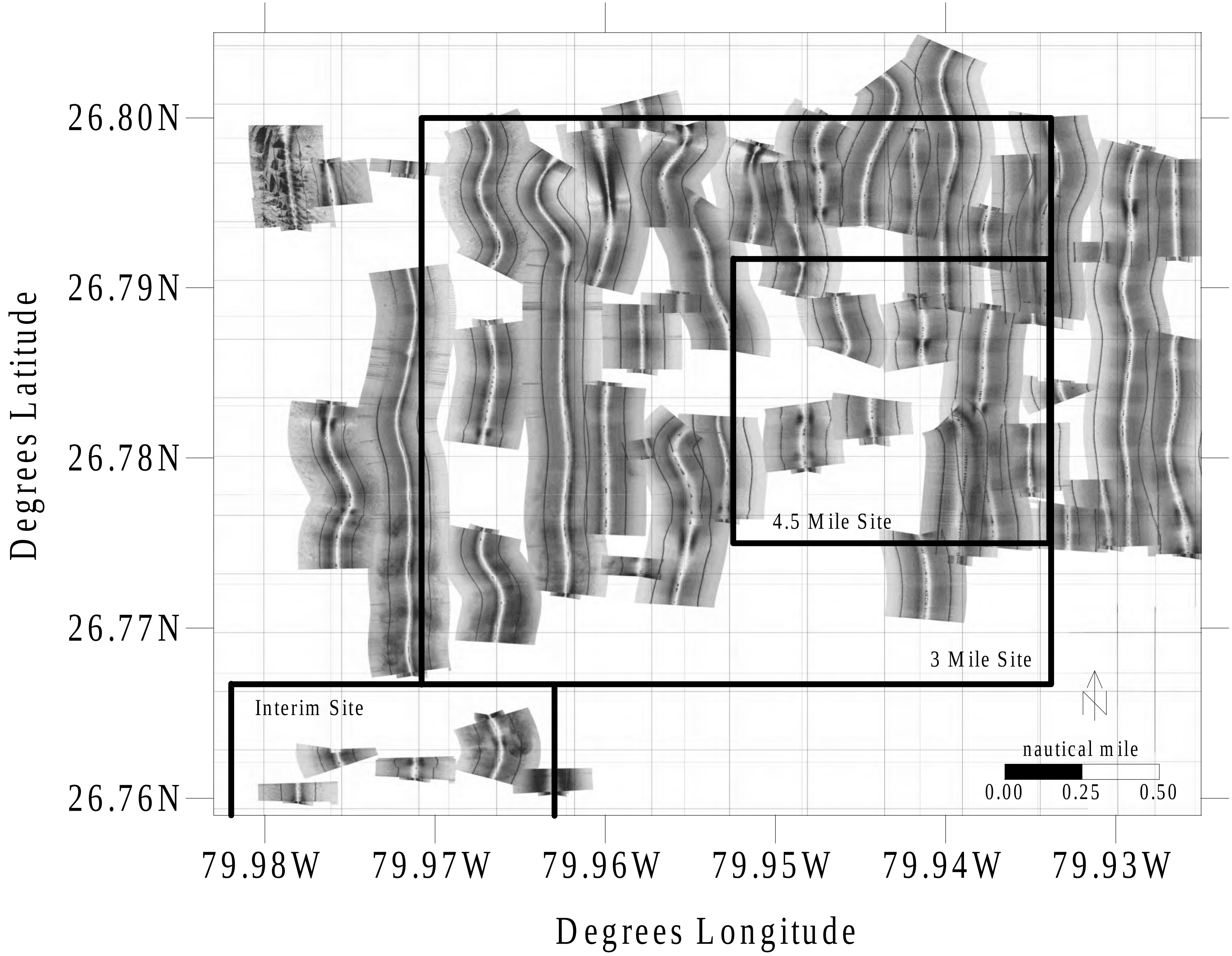

Figure 7: Sidescan Mosaic for the Palm Beach Interim, 3 Mile and 4.5 Mile Candidate Sites.

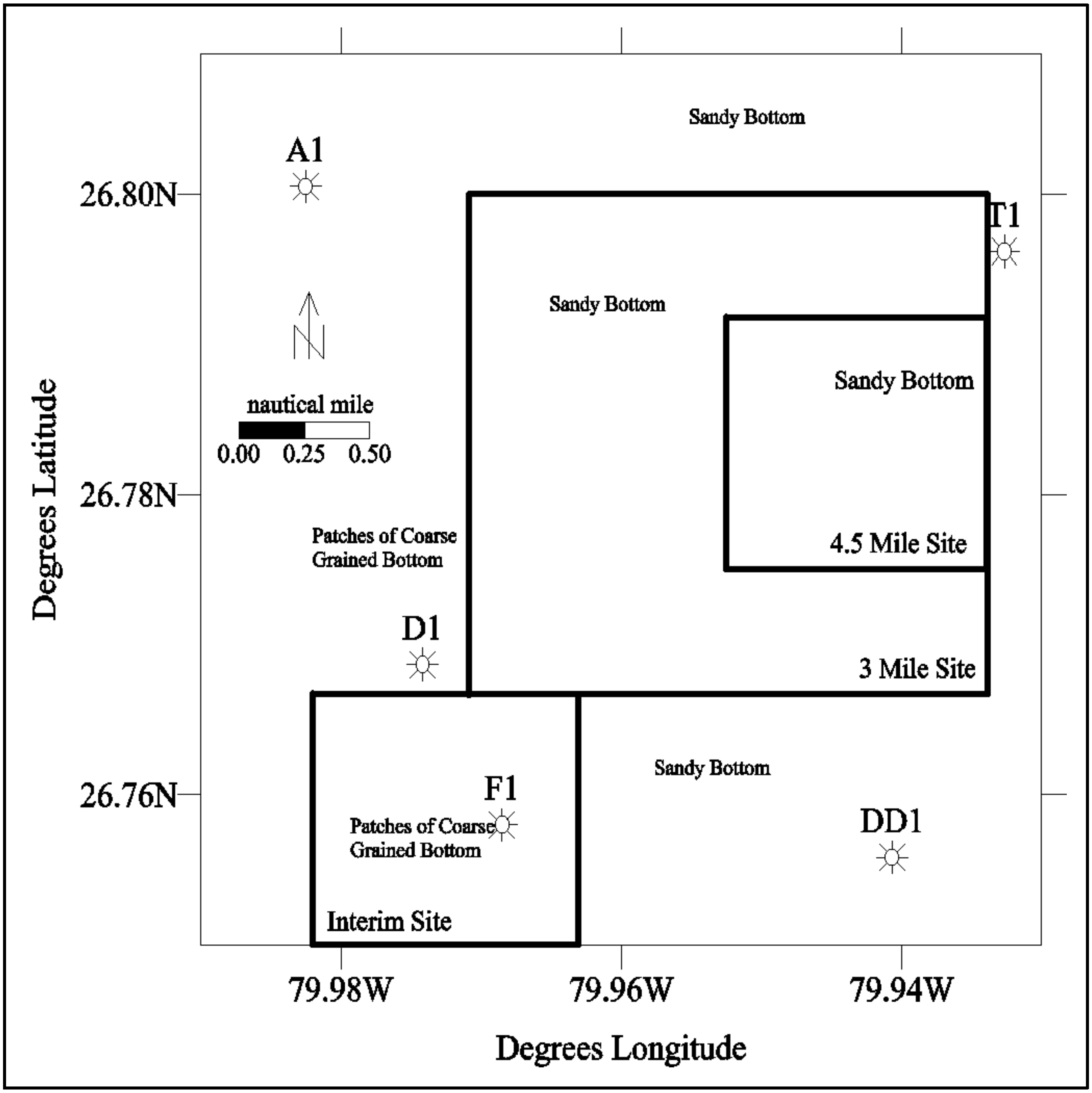

Figure 8: Sidescan Targets and Bottom Type for the Palm Beach Interim, 3 Mile and 4.5 Mile Candidate Sites. Labels correspond to acoustic images presented in Appendix D.

3 Mile Candidate Site

The side-scan sonar data indicated a relatively uniform fine sandy bottom throughout the site. Areas of coarser material were indicated just outside the western boundary of the site. Grab samples taken in 1988 showed a predominately medium-to-very fine sand sediment texture in the site (CSA, 1989). No areas of hard bottom or potential wrecks were identified through the side-scan record within the site.

4.5 Mile Candidate Site

The side-scan 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 (Figure 7 and Appendix D). Grab samples taken earlier in the year showed sediments in the 4.5 Mile Candidate site to consist of a grey silty fine sand with shell fragments. The mean grain sizes for the area ranged from 0.14 to 0.17mm with 25 to 35 percent silts and clays (EPA, 1999). No areas of hard bottom or potential wrecks were identified through the side-scan record within the site or north or south of the site.

3.4 Palm Beach 9 Mile Candidate Site

A quality sidescan mosaic of the survey area is not available due to poor DGPS navigation data and the frequent system crashes described in Section 2.0. A mosaic of the available digital data is presented in Appendix E. The side-scan 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 0.21mm with 18 to 23 percent silts and clays (EPA, 1999).

Only a few scattered targets were detected throughout the survey area, none signifying any significant resources. These were identified by dark acoustical signals. The locations of the targets are shown in Figure 9. The acoustic images for these targets are shown in Appendix E.

4.0 SUMMARY

The objective of this survey was to characterize the substrate types and geologic features of candidate ocean dredged material disposal sites offshore Port Everglades and Palm Beach, Florida and to identify any potential significant resources within their vicinity. A total of 6 sites were examined. Most of the area surveyed consisted of sandy bottom. However, a significant portion of the Port Everglades 7 Mile Candidate Site consisted of low relief limestone hard bottom and the Port Everglades 4 Mile Candidate Site and surroundings contained numerous unidentified highly reflective objects.

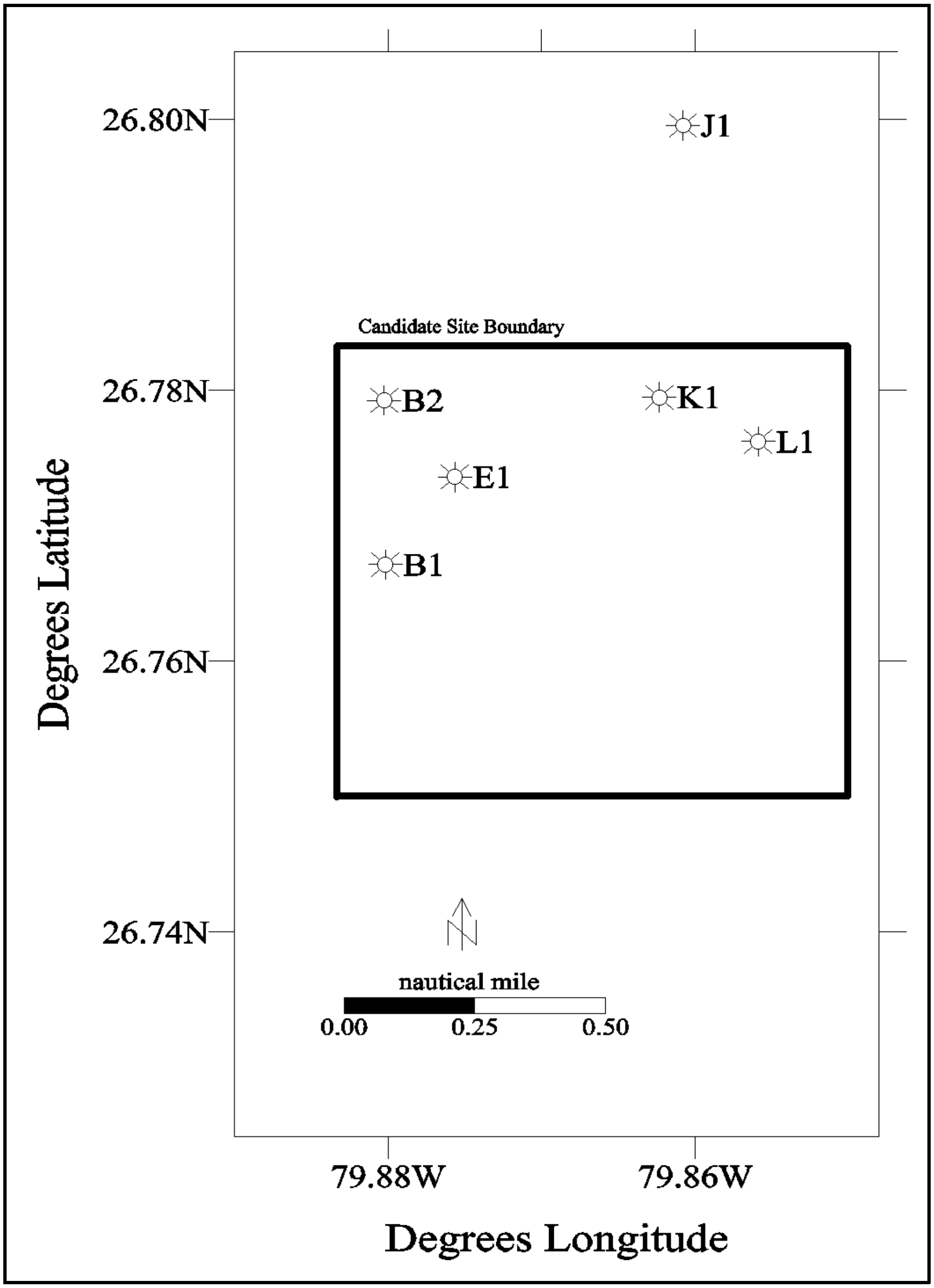

Figure 9: Sidescan Targets for the Palm Beach 9 Mile Candidate Site Labels correspond to acoustic images presented in Appendix E.

6.0 REFERENCES

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Continental Shelf Associates, Inc. (CSA), 1989. *Final Report for a Field Survey of an Ocean Dredged Material Disposal Site Off Palm Beach Harbor, Florida*. Prepared for Department of the Army Corps of Engineers, Jacksonville District, Jacksonville, FL.

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APPENDIX A

SIDESCAN SONAR TRANSECTS

Appendix F

BIOLOGICAL ASSESSMENT FOR PALM BEACH HARBOR ODMDS

Appendix F

BIOLOGICAL ASSESSMENT

PALM BEACH HARBOR, FLORIDA
OCEAN DREDGED-MATERIAL DISPOSAL SITE
FINAL DESIGNATION STUDY

Introduction. This Biological Assessment (BA) evaluates the potential impacts to Federally listed threatened and endangered species from designating a final ocean dredged material disposal site (ODMDS) for Palm Beach Harbor, Palm Beach County, Florida.

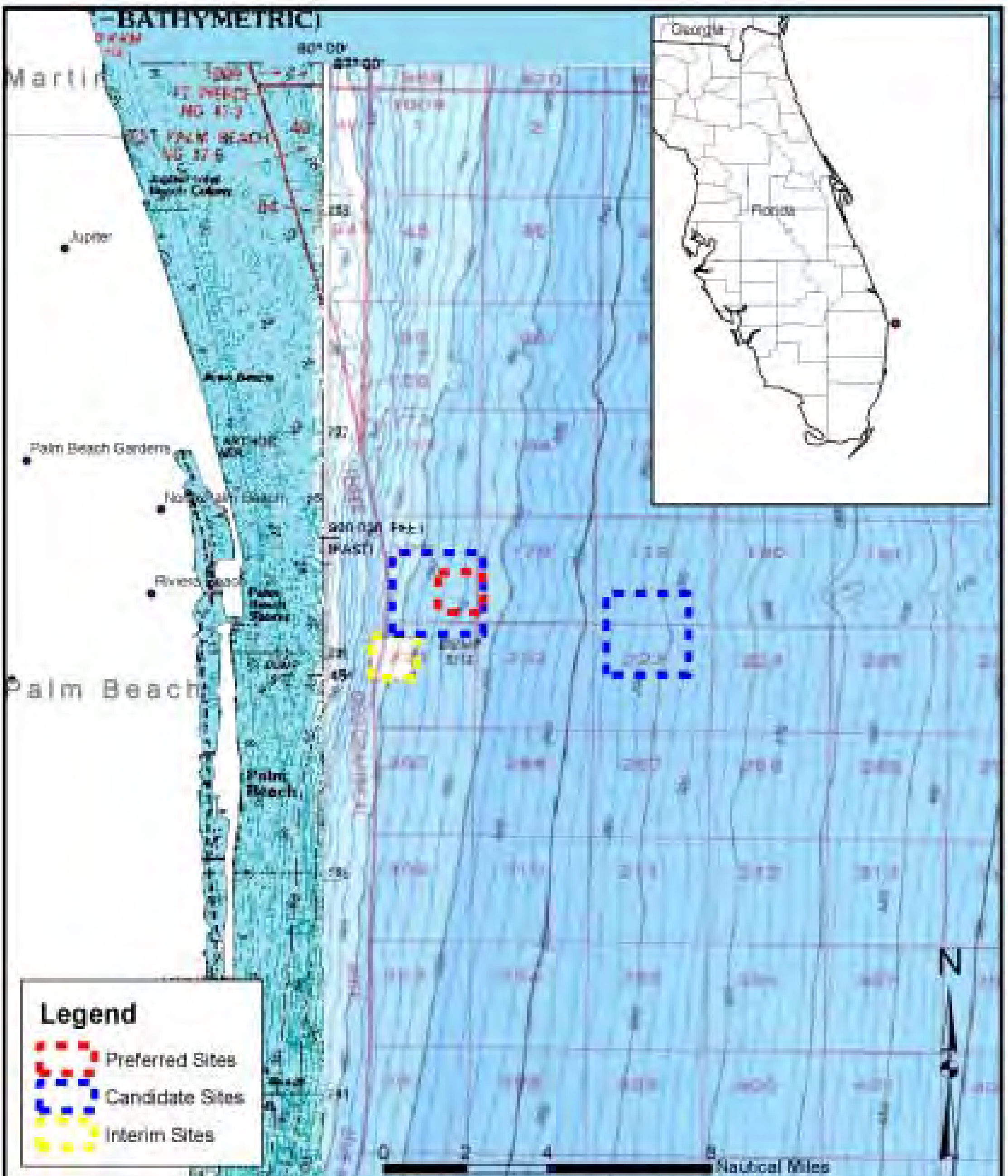
Study Description. Three candidate sites, located off the Atlantic coast of Florida, are under consideration as an ODMDS. The candidate sites are located 3 nautical miles (nmi) off shore, 4.5 nmi offshore, and another is at 7 nmi offshore. Each candidate site is approximately 1 square nmi in area. Further investigation and comparison of these sites will lead to the selection of one final ODMDS for Palm Beach Harbor, Palm Beach County, Florida. The designated site will hold dredged material from planned maintenance dredging activities in Palm Beach Harbor. The specific location of the candidate sites are shown in Figure 1.

Threatened/Endangered Species and Critical Habitat. The following table presents a list of the threatened and endangered species that may inhabit or occur within the general project area. Currently, there are no critical habitat areas designated in the study area.

Listed Species	Scientific Name	Status	Date Listed
Marine Mammals			
Blue whale	*Balaenoptera musculus*	Endangered	12/02/1970
Finback whale	*Balaenoptera physalus*	Endangered	12/02/1970
Humpback whale	*Megaptera novaeangliae*	Endangered	12/02/1970
Right whale	*Eubalaena glacialis*	Endangered	12/02/1970
Sei whale	*Balaenopera borealis*	Endangered	12/02/1970
Sperm whale	*Physeter macrocephalus*	Endangered	12/02/1970
West Indian manatee	*Trichechus manauts*	Endangered	06/02/1970
Sea Turtles			
Green sea turtle	*Chelonia mydas*	Endangered (1)	07/28/1978
Hawksbill sea turtle	*Eretmochelys imbricate*	Endangered	06/02/1970
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered	12/02/1970
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	06/02/1790
Loggerhead sea turtle	*Caretta caretta*	Threatened	07/28/1978
Fish			
Shortnose sturgeon	*Acipenser brevirostrum*	Endangerd	03/11/1967
Smalltooth sawfish	*Pristis pectinata*	Endangered	04/01/2003
Seagrass			
Johnson's seagrass	*Halophilia johnsonii*	Threatened	09/14/1998

(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.

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



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 (1968) Bathymetric Map

Gulf Engineers & Consultants

Figure: 1

Date: March 2003

Scale: 1:237,022

Source: USGS/GEC/NOAA

Blue Whale (*Balaenoptera musculus*). The blue whale is the largest mammal, possibly the largest animal, to ever inhabit the earth. An average blue whale is between 75 and 80 feet long and weighs about 110 tons. Females are typically larger than the males and can weigh up to 150 tons. Blue whales can be found in all the oceans of the world. They mate and calve in tropical to temperate waters during the winter months and feed in polar waters during the summer months. Today it is estimated that about 5,000 blue whales exist in three populations in the North Atlantic, North Pacific, and the Southern Hemisphere.

Finback whale (*Balaenoptera physalus*). Adult males can measure up to 78 feet with the females being slightly larger. Weight for both sexes of the finback whale is between 50-70 tons. Finback whales can be found in all oceans of the world. They migrate to subtropical waters for mating and calving during the winter. The summer months are spent feeding in the colder areas of the Arctic. The present population is estimated to be about 40,000, a small percentage of the original population.

Humpback whale (*Megaptera novaeangliae*). Adult humpback males can measure between 40-48 feet while female humpbacks can grow to be 45-50 feet in length. Both the male and female of the species can weigh between 25 to 40 tons. Humpbacks can be found in all the oceans of the world. Most follow a regular migration pattern summering in temperate and polar waters for feeding and wintering in tropical waters for mating and calving. Presently there are about 15,000 to 20,000 humpback whales in existence. That represents approximately 15-20 percent of the original population.

Right whale (*Eubalaena glacialis*). Adult right whales can measure between 45 and 65 feet in length with the females of the species typically being larger than the males. Right whales can also grow to 30 to 80 tons. Right whales range throughout the western North Atlantic and have five known congregation areas, including an area off of the Southeastern United States. Right whales are the most endangered large whale in the world. There are approximately 300 whales known to inhabit the eastern coasts of the U.S. and Canada.

Sei whale (*Balaenoptera borealis*). Most sei whales range between 40 to 50 feet in length. Males tend to be slightly smaller than the females. Sei whales can be found in all the oceans of the world. They live in the temperate and sub-polar regions during the summer months and migrate to sub-tropical seas during the winter. Current numbers of sei whales is estimated to be about 54,000, approximately 20 percent of the original population.

Sperm whale (*Physter manrocephalus*). The sperm whale is the largest of the toothed whales. Males can reach lengths of 49 to 59 feet long and weigh up to 35 to 45 tons. Female sperm whales are usually much smaller, typically growing to about 36 feet and weighing a maximum of 13 to14 tons. Sperm whales can be found worldwide. Males tend to stay in higher latitudes during the summer months and then migrate to lower latitudes. Only physically mature males enter into breeding grounds close to the equator. Females, claves, and juveniles stay in tropical waters year round. There are at least 500,000 sperm whales in existence. It is estimated that at one time there were 2 million sperm whales throughout the world.

West Indian manatee (*Trichechus manatus*). West Indian manatees are large, slow moving coastal mammals. Adults are typically 10 to 13 feet in length and 440 to 1,100 pounds in weight. Distribution of the West Indian manatee in the United States is predominately in the southeastern portion of the country (Florida, Georgia, Louisiana, Mississippi, North Carolina, and South Carolina). U.S. populations are primarily in Florida. The estimated population in Florida was 1465 individuals in February of 1991.

Green sea turtle (*Chelonia mydas*). Adult green sea turtles can measure about 3 feet in length and weigh up to 400 pounds. Green sea turtles can be found from Texas to Massachusetts and around the U.S. Virgin Islands and Puerto Rico. They can also be found in the North Pacific and around tropical islands in the Central Pacific. Total populations are unavailable. However, there is an estimated 200 to 1,100 nesting females on U.S. beaches. Palm Beach County typically contains the second-largest number of green sea turtle nests in the continental United States.

Hawksbill sea turtle (*Eretmochelys imbricata*). Hawksbill sea turtles are small to medium sized. Nesting females average 2 to 3 feet in length and typically weigh up to 175 pounds. The hawksbill sea turtle occurs in the tropical and sub-tropical waters of the Atlantic, Pacific, and Indian Oceans. They are observed with regularity on the reefs off of Palm Beach County where the warm Gulf Stream current passes close to shore. Population estimates and trends are difficult to determine due to its habit of solitary nesting. However, the decline in nesting populations is accepted by most researchers.

Kemp’s ridley sea turtle (*Lepidochelys kempii*). Kemp’s ridley sea turtle is the smallest of the extant sea turtles. Adults are typically less than 175 pounds in weight and are about 2 feet in length. They can be found mainly in the Gulf of Mexico as well as the Atlantic Ocean. The Kemp’s ridley sea turtle has been in decline many years. In one day of nesting in 1947, approximately 42,000 females were counted. In the mid 1980s that number had declined to about 1,000.

Leatherback sea turtle (*Dermochelys coriacea*). The leatherback is the largest living turtle. Adult turtles average 5 feet in length. Weight can range from 440 to 1,500 pounds. The leatherback can be found in areas between Nova Scotia south to Puerto Rico and the U.S. Virgin Islands. They are also commonly seen in the offshore waters of Hawaii. Nesting populations of leatherback turtles are difficult to estimate because females frequently change beach locations. However, it is estimated that there are approximately 20,000 to 30,000 females worldwide. Palm Beach County typically contains the largest number of leatherback sea turtle nests in the continental United States.

Loggerhead sea turtles (*Caretta caretta*). Adult loggerhead turtles average 3 feet in length and 250 pounds in weight. They can be found worldwide, inhabiting continental shelves, bays, estuaries, and lagoons in temperate, subtropical, and tropical waters. The leatherbacks range in the Atlantic is from Newfoundland south to Argentina. The number of nesting females in South Carolina and Georgia may be declining while the number of nesting females in Florida appears to be stable. Palm Beach County typically contains the second-largest number of loggerhead sea turtle nests in the continental United States.

Shortnose sturgeon (*Acipenser brevirostrum*). The shortnose sturgeon is among the most primitive of the boney fishes. The shortnose sturgeon is the smallest of the three sturgeon species that live in the eastern North America. It has a maximum known length of 4.5 feet and a weight of 50 pounds. The shortnose sturgeon is an anadromous fish, mainly living is slower moving rivers and nearshore marine waters, and migrating to faster moving freshwater areas to spawn. It inhabits the Atlantic seaboard from New Brunswick, Canada to Florida. No estimate of shortnose sturgeon populations is available.

Smalltooth sawfish (*Pristis pectinata*). This species 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 smalltooth 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*). This flowering marine plant has a limited distribution and is the least abundant seagrass within its range. Johnson's seagrass is found in patchy distribution along the east coast of Florida from central Biscayne Bay to Sebastian Inlet. The largest documented patches are located inside the Lake Worth Inlet.

Assessment of Potential Impacts on Listed Species and Critical Habitat. The list of designated threatened and endangered species for the project area was obtained from the National Marine Fisheries Service and the U.S. Fish and Wildlife Service. Maps were studied for evidence of possible conflict with threatened and endangered species and critical habitat.

Of the species listed in the above table as threatened and endangered, several can be virtually eliminated from consideration for potential adverse impacts due to their unlikely presence within the immediate vicinity of the proposed ODMDS. The West Indian manatee favors habitat that is associated with rivers, estuaries and nearshore areas. The shortnose sturgeon also favors similar habitat. In light of the offshore and distant nature of the candidate sites from any nearshore area, the West Indian manatee and the shortnose sturgeon are not likely to be present. Considering the rare and very limited distribution of Johnson's seagrass and the extensive depth at each candidate site, it is improbable the Johnson's seagrass would be present. Bottom samples taken at each candidate site indicates that there were no seagrasses present in the candidate sites.

The remaining marine mammals (whales) and sea turtles identified for consideration are transient by nature and, therefore, their presence in the both candidate sites would be brief. All of these species are highly motile and could easily avoid any dredged material disposal activities that would occur at either site. The designation of either candidate site for the disposal of dredged material would not affect any listed species nor would it contribute in any way to the primary reasons for their being listed as threatened or endangered (overhunting for the whales; and overhunting, loss of nesting areas, hatchling disorientation by artificial light, and trawl net entrapment for sea turtles). Due to the lack of designated critical habitat within either candidate site, there will be no adverse impacts to critical habitat.

Conclusions. The final designation of an ocean dredged material disposal site for Palm Beach Harbor maintenance dredging materials will not adversely affect any listed threatened or endangered species or critical habitat. Formal Section 7 Consultation with the U.S. Fish and Wildlife Service or the National Marine Fisheries Service will not be required.

Appendix G

BIOLOGICAL ASSESSMENT FOR PORT EVERGLADES ODMDS

Appendix G

BIOLOGICAL ASSESSMENT

PORT EVERGLADES, FLORIDA
OCEAN DREDGED-MATERIAL DISPOSAL SITE
FINAL DESIGNATION STUDY

Introduction. This Biological Assessment (BA) evaluates the potential impacts to Federally listed threatened and endangered species from designating a final ocean dredged material disposal site (ODMDS) for Port Everglades, Broward County, Florida.

Study Description. Two candidate sites, located off the Atlantic coast of Florida, are under consideration as an ODMDS. The candidate sites are located 4 nautical miles (nmi) off shore and another is at 7 nmi offshore. Each candidate site is approximately 1 square nmi in area. Further investigation and comparison of these sites will lead to the selection of one final ODMDS for Port Everglades, Broward County, Florida. The designated site will hold dredged material from planned maintenance dredging activities in Port Everglades Harbor. The specific location of the candidate sites are shown in Figure 1.

Threatened/Endangered Species and Critical Habitat. The following table presents a list of the threatened and endangered species that may inhabit or occur within the general project area. Currently, there are no critical habitat areas designated in the study area.

Listed Species	Scientific Name	Status	Date Listed
Marine Mammals			
Blue whale	*Balaenoptera musculus*	Endangered	12/02/1970
Finback whale	*Balaenoptera physalus*	Endangered	12/02/1970
Humpback whale	*Megaptera novaeangliae*	Endangered	12/02/1970
Right whale	*Eubalaena glacialis*	Endangered	12/02/1970
Sei whale	*Balaenopera borealis*	Endangered	12/02/1970
Sperm whale	*Physeter macrocephalus*	Endangered	12/02/1970
West Indian manatee	*Trichechus manauts*	Endangered	06/02/1970
Sea Turtles			
Green sea turtle	*Chelonia mydas*	Endangered (1)	07/28/1978
Hawksbill sea turtle	*Eretmochelys imbricate*	Endangered	06/02/1970
Kemp’s ridley sea turtle	*Lepidochelys kempii*	Endangered	12/02/1970
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Fish			
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Seagrass			
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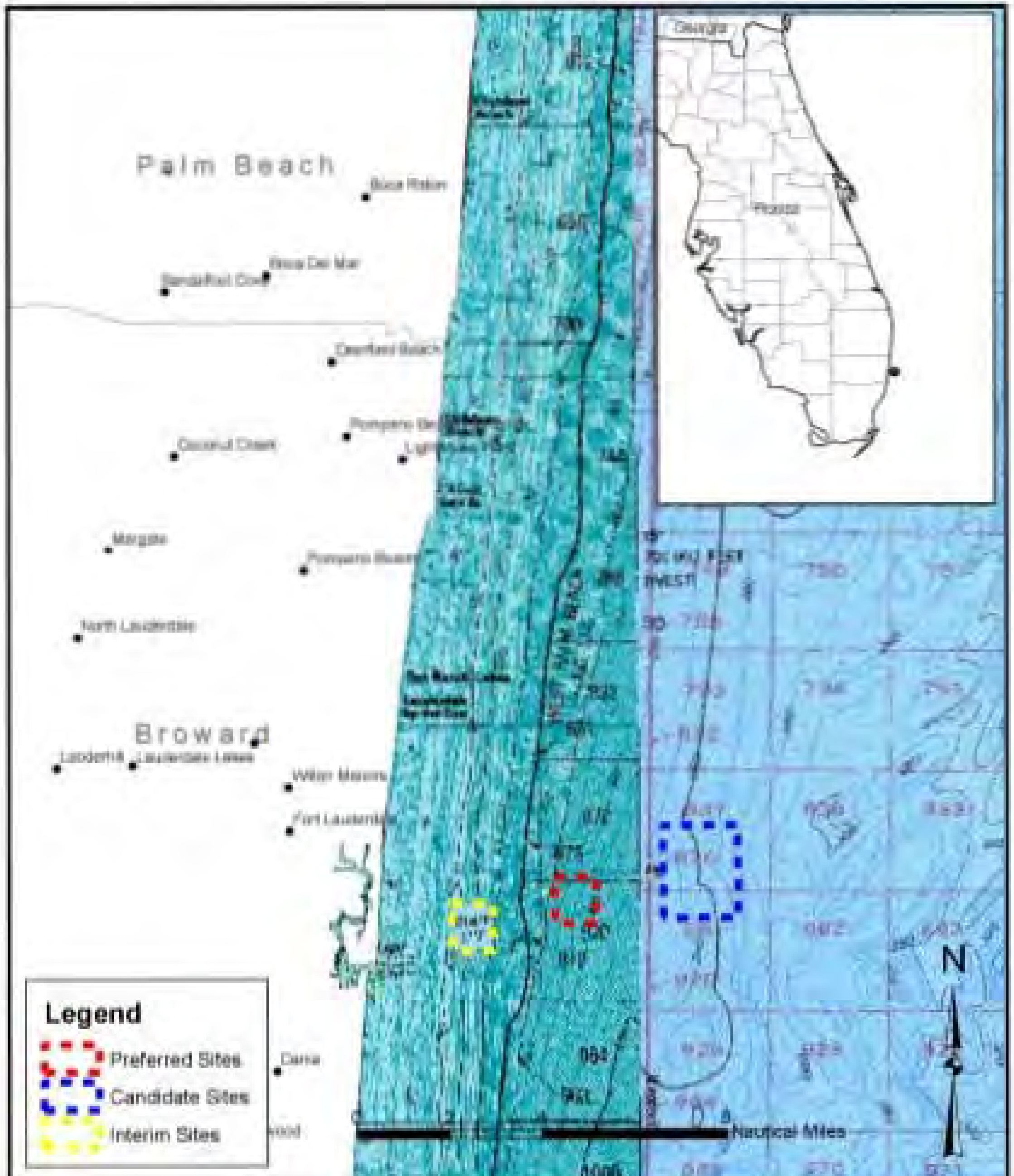
(1) Green sea turtles are listed as threatened, except for breeding populations of green sea turtles in Florida and on the Pacific coast of Mexico, which are listed as endangered.

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



ALTERNATIVE SITE LOCATION MAP

Port Everglades ODMDS

Palm Beach and Broward Counties, Florida

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

Gulf Engineers & Consultants

Figure: 1	
Date: March 2002	
Scale 1:209,788	
Source: USGS/GEC/NOAA	

Blue Whale (*Balaenoptera musculus*). The blue whale is the largest mammal, possibly the largest animal, to ever inhabit the earth. An average blue whale is between 75 and 80 feet long and weighs about 110 tons. Females are typically larger than the males and can weigh up to 150 tons. Blue whales can be found in all the oceans of the world. They mate and calve in tropical to temperate waters during the winter months and feed in polar waters during the summer months. Today it is estimated that about 5,000 blue whales exist in three populations in the North Atlantic, North Pacific, and the Southern Hemisphere.

Finback whale (*Balaenoptera physalus*). Adult males can measure up to 78 feet with the females being slightly larger. Weight for both sexes of the finback whale is between 50-70 tons. Finback whales can be found in all oceans of the world. They migrate to subtropical waters for mating and calving during the winter. The summer months are spent feeding in the colder areas of the Arctic. The present population is estimated to be about 40,000, a small percentage of the original population.

Humpback whale (*Megaptera novaeangliae*). Adult humpback males can measure between 40-48 feet while female humpbacks can grow to be 45-50 feet in length. Both the male and female of the species can weigh between 25 to 40 tons. Humpbacks can be found in all the oceans of the world. Most follow a regular migration pattern summering in temperate and polar waters for feeding and wintering in tropical waters for mating and calving. Presently there are about 15,000 to 20,000 humpback whales in existence. That represents approximately 15-20 percent of the original population.

Right whale (*Eubalaena glacialis*). Adult right whales can measure between 45 and 65 feet in length with the females of the species typically being larger than the males. Right whales can also grow to 30 to 80 tons. Right whales range throughout the western North Atlantic and have five known congregation areas, including an area off of the Southeastern United States. Right whales are the most endangered large whale in the world. There are approximately 300 whales known to inhabit the eastern coasts of the U.S. and Canada.

Sei whale (*Balaenoptera borealis*). Most sei whales range between 40 to 50 feet in length. Males tend to be slightly smaller than the females. Sei whales can be found in all the oceans of the world. They live in the temperate and sub-polar regions during the summer months and migrate to sub-tropical seas during the winter. Current numbers of sei whales is estimated to be about 54,000, approximately 20% of the original population.

Sperm whale (*Physter manrocephalus*). The sperm whale is the largest of the toothed whales. Males can reach lengths of 49 to 59 feet long and weigh up to 35 to 45 tons. Female sperm whales are usually much smaller, typically growing to about 36 feet and weighing a maximum of 13 to14 tons. Sperm whales can be found worldwide. Males tend to stay in higher latitudes during the summer months and then migrate to lower latitudes. Only physically mature males enter into breeding grounds close to the equator. Females, claves, and juveniles stay in tropical waters year round. There are at least 500,000 sperm whales in existence. It is estimated that at one time there were 2 million sperm whales throughout the world.

West Indian manatee (*Trichechus manatus*). West Indian manatees are large, slow moving coastal mammals. Adults are typically 10 to 13 feet in length and 440 to 1,100 pounds in weight. Distribution of the West Indian manatee in the United States is predominately in the southeastern portion of the country (Florida, Georgia, Louisiana, Mississippi, North Carolina, and South Carolina). U.S. populations are primarily in Florida. The estimated population in Florida was 1,465 individuals in February of 1991.

Green sea turtle (*Chelonia mydas*). Adult green sea turtles can measure about 3 feet in length and weigh up to 400 pounds. Green sea turtles can be found from Texas to Massachusetts and around the U.S. Virgin Islands and Puerto Rico. They can also be found in the North Pacific and around tropical islands in the Central Pacific. Total populations are unavailable. However, there is an estimated 200 to 1,100 nesting females on U.S. beaches.

Hawksbill sea turtle (*Eretmochelys imbricata*). Hawksbill sea turtles are small to medium sized. Nesting females average 2 to 3 feet in length and typically weigh up to 175 pounds. The hawksbill sea turtle occurs in the tropical and sub-tropical waters of the Atlantic, Pacific, and Indian Oceans. They are observed with regularity on the reefs off of Palm Beach County where the warm Gulf Stream current passes close to shore. Population estimates and trends are difficult to determine due to its habit of solitary nesting. However, the decline in nesting populations is accepted by most researchers.

Kemp's ridley sea turtle (*Lepidochelys kempii*). Kemp's ridley sea turtle is the smallest of the extant sea turtles. Adults are typically less than 175 pounds in weight and are about 2 feet in length. They can be found mainly in the Gulf of Mexico as well as the Atlantic Ocean. The Kemp's ridley sea turtle has been in decline many years. In one day of nesting in 1947, approximately 42,000 females were counted. In the mid 1980s that number had declined to about 1,000.

Leatherback sea turtle (*Dermochelys coriacea*). The leatherback is the largest living turtle. Adult turtles average 5 feet in length. Weight can range from 440 to 1,500 pounds. The leatherback can be found in areas between Nova Scotia south to Puerto Rico and the U.S. Virgin Islands. They are also commonly seen in the offshore waters of Hawaii. Nesting populations of leatherback turtles are difficult to estimate because females frequently change beach locations. However, it is estimated that there are approximately 20,000 to 30,000 females worldwide.

Loggerhead sea turtles (*Caretta caretta*). Adult loggerhead turtles average 3 feet in length and 250 pounds in weight. They can be found worldwide, inhabiting continental shelves, bays, estuaries, and lagoons in temperate, subtropical, and tropical waters. The leatherbacks range in the Atlantic is from Newfoundland south to Argentina. The number of nesting females in South Carolina and Georgia may be declining while the number of nesting females in Florida appears to be stable.

Shortnose sturgeon (*Acipenser brevirostrum*). The shortnose sturgeon is among the most primitive of the boney fishes. The shortnose sturgeon is the smallest of the three sturgeon species that live in the eastern North America. It has a maximum known length of 4.5 feet and a weight of 50 pounds. The shortnose sturgeon is an anadromous fish, mainly living is slower moving rivers and nearshore marine waters, and migrating to faster moving freshwater areas to spawn. It inhabits the Atlantic seaboard from New Brunswick, Canada to Florida. No estimate of shortnose sturgeon populations is available.

Smalltooth sawfish (*Pristis pectinata*). This species 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 smalltooth 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*). This flowering marine plant has a limited distribution and is the least abundant seagrass within its range. Johnson's seagrass is found in patchy distribution along the east coast of Florida from central Biscayne Bay to Sebastian Inlet. The largest documented patches are located inside the Lake Worth Inlet.

Assessment of Potential Impacts on Listed Species and Critical Habitat. The list of designated threatened and endangered species for the project area was obtained from the National Marine Fisheries Service and the U.S. Fish and Wildlife Service. Maps were studied for evidence of possible conflict with threatened and endangered species and critical habitat.

Of the species listed in the above table as threatened and endangered, several can be virtually eliminated from consideration for potential adverse impacts due to their unlikely presence within the immediate vicinity of the proposed ODMDS. The West Indian manatee favors habitat that is associated with rivers, estuaries and nearshore areas. The shortnose sturgeon also favors similar habitat. In light of the offshore and distant nature of the candidate sites from any nearshore area, the West Indian manatee and the shortnose sturgeon are not likely to be present. Considering the rare and very limited distribution of Johnson's seagrass and the extensive depth at each candidate site, it is improbable the Johnson's seagrass would be present. Bottom samples taken at each candidate site indicates that there were no seagrasses present in the candidate sites.

The remaining marine mammals (whales) and sea turtles identified for consideration are transient by nature and, therefore, their presence in the both candidate sites would be brief. All of these species are highly motile and could easily avoid any dredged material disposal activities that would occur at either site. The designation of either candidate site for the disposal of dredged material would not affect any listed species nor would it contribute in any way to the primary reasons for their being listed as threatened or endangered (overhunting for the whales; and overhunting, loss of nesting areas, hatchling disorientation by artificial light, and trawl net entrapment for sea turtles). Due to the lack of designated critical habitat within either candidate site, there will be no adverse impacts to critical habitat.

Conclusions. The final designation of an ocean dredged material disposal site for Port Everglades Harbor maintenance dredging materials will not adversely affect any listed threatened or endangered species or critical habitat. Formal Section 7 Consultation with the U.S. Fish and Wildlife Service or the National Marine Fisheries Service will not be required.

Appendix H

SEDIMENT AND WATER QUALITY OF CANDIDATE ODMDS FOR PORT EVERGLADES AND PALM BEACH, FLORIDA

SEDIMENT AND WATER QUALITY OF CANDIDATE OCEAN DREDGED MATERIAL DISPOSAL SITES FOR PORT EVERGLADES AND PALM BEACH, FLORIDA

Prepared for:

U.S. Army Corps of Engineers
Jacksonville District

Under Interagency Agreement # RW96945795

By:

U.S. Environmental Protection Agency
Region 4
Wetlands, Coastal and Water Quality Branch

June 1999

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SEDIMENT AND WATER QUALITY OF CANDIDATE OCEAN DREDGED MATERIAL DISPOSAL SITES FOR PORT EVERGLADES AND PALM BEACH, FLORIDA

1.0 INTRODUCTION

The U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers have the responsibility under Section 102 of the Marine Protection, Research and Sanctuaries Act (MPRSA), for the management and monitoring of Ocean Dredged Material Disposal Sites (ODMDSs). EPA has the responsibility under the MPRSA for designation of sites for dredged material disposal. The Corps of Engineers Jacksonville District has requested that EPA Region 4 designate disposal sites off shore Palm Beach, Florida and Port Everglades, Florida for the disposal of dredged material.

To date, EPA and the COE have identified four candidate sites for Palm Beach and three for Port Everglades. In accordance with 40 CFR §228.4 of the Ocean Dumping regulations site designations will be made based on environmental studies of each site. Various surveys have been conducted in the past in the vicinity of these candidate site. These surveys along with this effort and a literature search will be used to characterize the candidate sites and adjacent regions to support dredged material disposal site designations offshore Port Everglades and Palm Beach, Florida. Survey station location and analyte selection for this survey were based on guidance provided in the Ocean Dumping regulations (40 CFR §228.13(a-f)) and in, *Revised Procedural Guide for Designation Surveys of Ocean Dredged Material Disposal Sites* (Pequegnat, 1990).

This report details the methods and results of an environmental characterization survey of the candidate sites for Ocean Dredged Material Disposal Sites (ODMDSs) offshore Port Everglades and Palm Beach, Florida conducted in 1998. Survey sampling was conducted by EPA Region 4 personnel aboard the OSV Peter W. Anderson. Water samples were collected on April 1, 1998 and sediment and biological samples were collected from May 18 through May 20 and from August 13 through August 14, 1998. Water and Sediment analysis was conducted by PPB Environmental Laboratories under contract to the Corps of Engineers Jacksonville District. Biological analysis was conducted by Water and Air Research under contract to the Corps of Engineers Jacksonville District.

2.0 METHODS

2.1 Station Locations

A sufficient number of stations were selected in order provide the minimum number of stations within and outside each of the candidate sites in conjunction with previous surveys conducted in the area. Ocean Dumping regulations (40 CFR §228.13c) recommend that sampling be conducted within the site and in the contiguous area including at least two stations down current of the site and at least two stations up current of the site. Pequegnat recommended that the number of sampling stations within a site range from two to six (Pequegnat, 1990). This survey in conjunction with previous surveys will provide two benthic stations (physical and biotal) within each candidate site and two up current and down current of the sites. It will also provide two water column stations within each site and two up current and down current of the sites (see figures 1 and 2). The discrete water samples were collected at 4 depths (surface, within the thermocline, between the thermocline and bottom and near bottom) for stations in greater than 200 meter depths and at 3 depths (surface, within the thermocline, and near bottom) for shallower stations in accordance with Pequegnat (1990). Water column profiles were taken at each sample station during each sampling event. Station locations, depths and analysis are shown in table 1.

Table 1: Sample Stations

Station	Latitude		Longitude		Depth	Candidate Site	Benthic Analysis			Benthic Sampler	Water Analysis		
#	Degrees	Minutes	Degrees	Minutes	(M)		B	SC	SGS		WP	WQ	No. of Depths
Palm Beach ODMDS Candidate Sites													
1	26	49.9980	79	57.0000	158	4.5 Mile	X		X	Young	X		
2	26	46.9980	79	56.2500	183	4.5 Mile	X	X	X	Young	X	X	4
3	26	46.9980	79	57.0000	166	4.5 Mile	X		X	VanVeen	X		
4	26	45.4980	79	58.5000	148	Interim					X	X	3
5	26	43.9980	79	57.0000	183	4.5 Mile					X	X	4
6	26	48.4980	79	52.0020	283	9 Mile	X	X	X	VanVeen	X		
7	26	46.0020	79	51.4980	297	9 Mile	X	X	X	VanVeen	X	X	4
8	26	46.0020	79	52.5000	278	9 Mile	X	X	X	VanVeen	X		
9	26	43.0020	79	52.0020	289	9 Mile	X	X	X	VanVeen	X	X	4
Port Everglades ODMDS Candidate Sites													
10	26	9.0000	80	4.0020	61	Interim					X		
11	26	6.4980	80	4.0020	110	Interim					X	X	3
12	26	4.9980	80	4.0020	116	Interim					X	X	3
13	26	9.0000	80	1.5000	207	4 Mile	X	X	X	VanVeen	X		
14	26	7.0200	80	1.5000	211	4 Mile	X	X	X	VanVeen	X	X	4
15	26	4.9980	80	1.5000	221	4 Mile	X	X	X	VanVeen	X	X	4
16	26	10.0020	79	58.6200	241	7 Mile	X	X	X	VanVeen	X		
17	26	7.5000	79	57.9000	266	7 Mile	HB	HB	HB	VanVeen	X	X	4
18	26	7.5000	79	59.1000	231	7 Mile	HB	HB	HB	VanVeen	X		
19	26	4.9980	79	58.6200	238	7 Mile	HB	HB	HB	VanVeen	X	X	4
20	26	8.3120	79	59.2060	238	7 Mile	X	X	X	Young	X		

Key:
B=Community Analysis SC=Sediment Chemistry X=Analysis Completed
WP=Water Profile (Depth, Temp., Salinity, Density & Transmissivity) WQ=Water Samples (lab analysis & onboard turbidity)
HB=Hard Bottom Encountered
Van Veen=Deep Ocean Van Veen (1 foot by 2 foot sampling area) Young=Large Young Grab (1 foot by 1 foot sampling area)

Positioning data was obtained using a Northstar 941 Differential GPS.

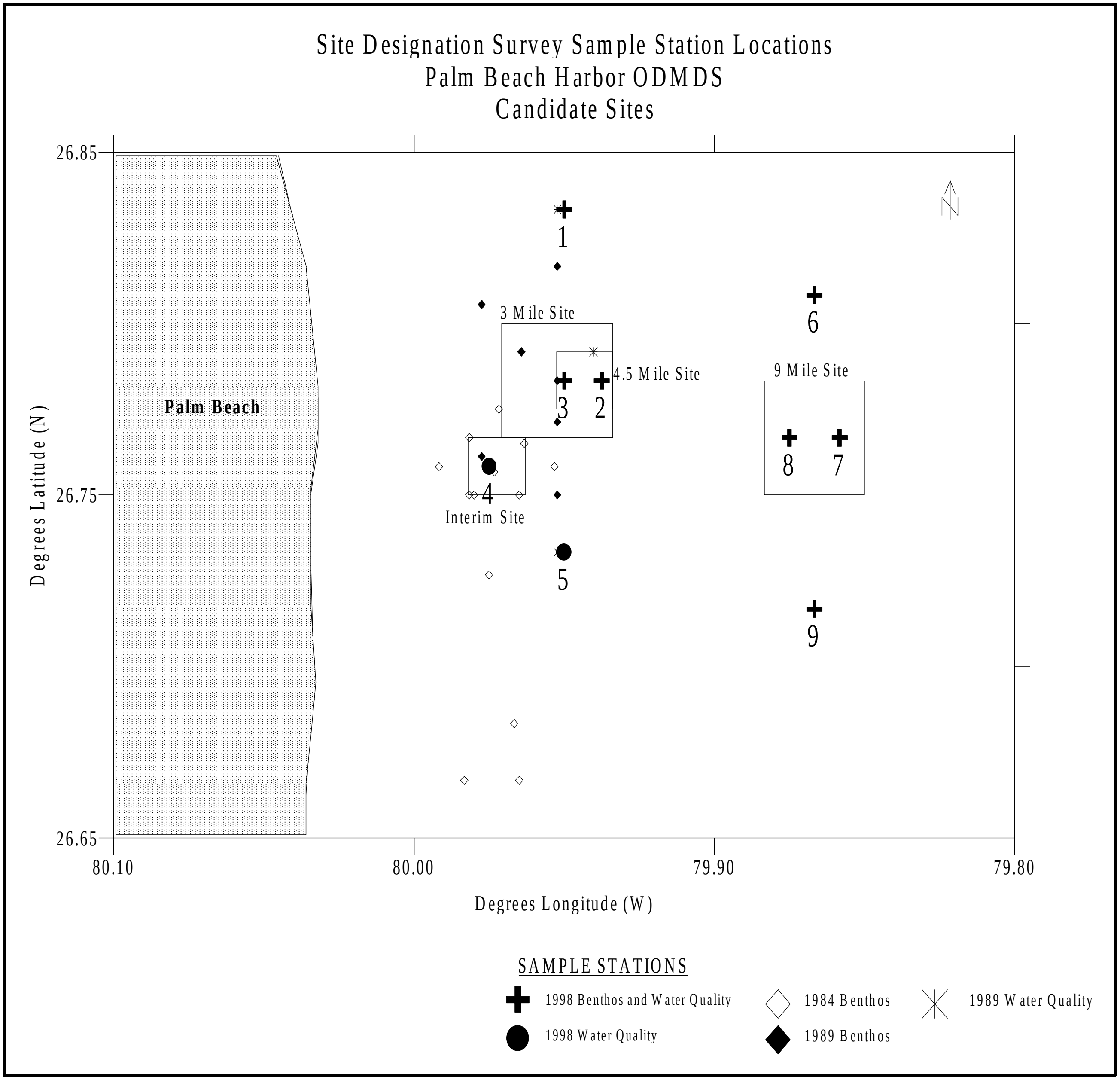
Site Designation Survey Sample Station Locations
Palm Beach Harbor ODMDS
Candidate Sites
26.85
26.75
26.65
Degrees Latitude (N)
80.10
80.00
79.90
79.80
Degrees Longitude (W)
Palm Beach
3 Mile Site
4.5 Mile Site
9 Mile Site
Interim Site
1
2
3
4
5
6
7
8
9
N
SAMPLE STATIONS
1998 Benthos and Water Quality
1998 Water Quality
1984 Benthos
1989 Benthos
1989 Water Quality

Figure 1

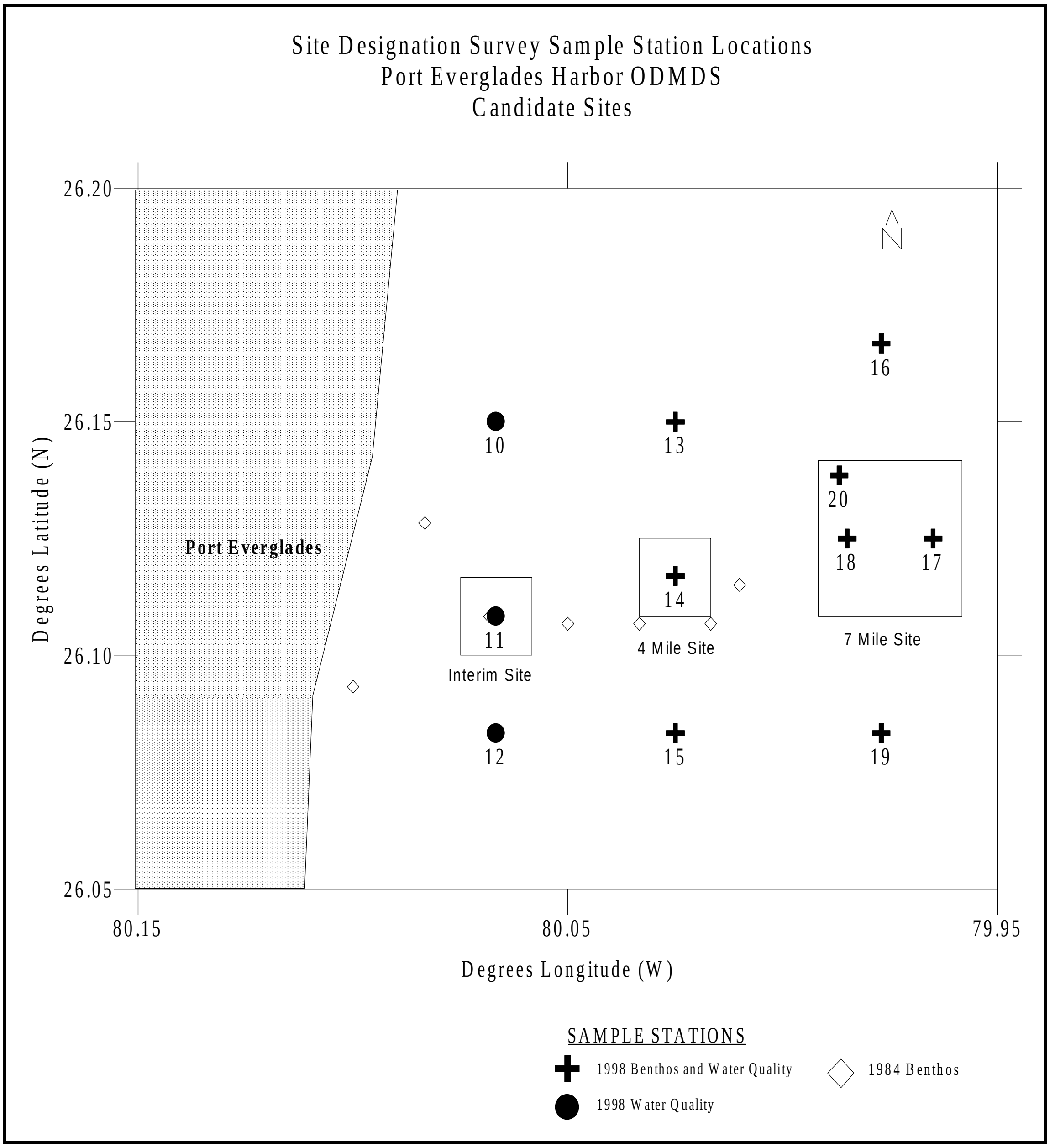
Site Designation Survey Sample Station Locations
Port Everglades Harbor ODMDS
Candidate Sites
26.20
26.15
26.10
26.05
80.15
80.05
79.95
Degrees Latitude (N)
Degrees Longitude (W)
N
Port Everglades
10
11
12
13
14
15
16
17
18
19
20
Interim Site
4 Mile Site
7 Mile Site
SAMPLE STATIONS
1998 Benthos and Water Quality
1998 Water Quality
1984 Benthos

Figure 2

2.2 Water Quality

Water column analysis consisted of depth profiles and discrete samples for lab analysis. Discrete samples were collected on April 1, 1998. Hydrographic profiles were conducted at each of the water and sediment stations on April 1, May 18-20 and August 13-14, 1998. Selection of variables for analysis was based on recommendations in Pequegnat (1990). The time, date and tidal state for each station is presented in table 2.

Table 2: Water Quality Stations

Station	Associated Candidate Site	Date Sampled	Time Sampled	Tidal Stage
1	Palm Beach 4.5 Mile	05/19/98	2311h	Low
2	Palm Beach 4.5 Mile	04/01/98	0855h	Slack
2	Palm Beach 4.5 Mile	05/19/98	2215h	Low
3	Palm Beach 4.5 Mile	05/19/98	1852h	Low
5	Palm Beach 4.5 Mile	04/01/98	1030h	High
6	Palm Beach 9 Mile	05/20/98	0142h	High
6	Palm Beach 9 Mile	08/14/98	1259h	Slack
7	Palm Beach 9 Mile	04/01/98	1225h	High
7	Palm Beach 9 Mile	05/20/98	0907h	Low
7	Palm Beach 9 Mile	08/13/98	1933h	Low
8	Palm Beach 9 Mile	05/20/98	0838h	Low
8	Palm Beach 9 Mile	08/13/98	1616h	High
9	Palm Beach 9 Mile	04/01/98	1119h	High
9	Palm Beach 9 Mile	08/13/98	2029h	Low
4	Palm Beach Interim	04/01/98	0955h	Slack
4	Palm Beach Interim	05/20/98	0952h	Low
5	Palm Beach Interim	05/20/98	1011h	Low
13	Port Everglades 4 Mile	05/19/98	0720h	Low
14	Port Everglades 4 Mile	04/01/98	2013h	Low
14	Port Everglades 4 Mile	05/19/98	1224h	High
15	Port Everglades 4 Mile	04/01/98	1932h	Low
15	Port Everglades 7 Mile	05/18/98	2146h	Low
16	Port Everglades 7 Mile	05/19/98	0905h	Low
17	Port Everglades 7 Mile	04/01/98	1751h	Low
17	Port Everglades 7 Mile	05/19/98	1033h	Low
18	Port Everglades 7 Mile	05/19/98	1105h	Low
19	Port Everglades 7 Mile	04/01/98	1845h	Low
19	Port Everglades 7 Mile	05/19/98	1153h	Slack
20	Port Everglades 7 Mile	05/20/98	1528h	High
10	Port Everglades Interim	04/01/98	2139h	Slack
10	Port Everglades Interim	05/19/98	1335h	High
11	Port Everglades Interim	04/01/98	2117h	Low
11	Port Everglades Interim	05/19/98	1316h	High
12	Port Everglades Interim	04/01/98	2052h	Low
12	Port Everglades Interim	05/19/98	1255h	High

2.2.1 Hydrography

Hydrographic profiles were taken at each of the water and sediment stations utilizing a Sea-Bird SBE-9 CTD aboard the OSV Anderson. Because temperature, salinity, and oxygen data can provide information on water flow, it was recommended that profiles be conducted at every station (Pequegnat, 1990). Profile measurements consisted of temperature, salinity, dissolved oxygen and transmissivity. The depth (pressure), temperature, and conductivity probes and transmissometer are calibrated annually at the first of the year. The dissolved oxygen sensor was calibrated prior to each survey.

2.2.2 Water Chemistry

Samples for chemical analysis were collected with teflon lined Niskin bottles. Samples were collected at 4 depths (surface, within the thermocline, between the thermocline and bottom and near bottom) for stations in greater than 200 meter depths and at 3 depths (surface, within the thermocline, and near bottom) for shallower stations. Samples were analyzed for: turbidity; total suspended sediments; dissolved cadmium, copper, lead and mercury; total petroleum hydrocarbons; pesticides; and PCBs based on the recommendations of Pequegnat (1990). Turbidity was measured utilizing a Hach Turbidimeter Model 2100A. Standardization was performed prior to each measurement. Methods of preservation and analysis for the remaining analytes are given in Appendix A.

2.3 Benthos Characteristics

Characterization of the benthos consists of physical properties (granulometry and chemistry) of the sediments and macroinfauna descriptions of the sampled stations. Stations 1 and 3 did not have chemistry analysis conducted due to availability of data from previous surveys in this area. Stations 4 and 5 did not have benthic analysis conducted due to availability of data from previous surveys.

Sample collection was attempted on April 1, 1998 utilizing a Deep Ocean Box Corer. This method provided insufficient sample and sampling was aborted. Sample collection in May 18-20 was conducted utilizing a stainless steel Deep Ocean Van Veen (see figure 3) with a 1 foot by 2 foot footprint. Damage to the Van Veen occurred due to encounter with rocky bottom. Stations 1, 2, and 20 were successfully sampled utilizing the Large Young Grab with a 1 foot by 1 foot footprint. Stations 6 through 9 could not be sampled utilizing the Large Young Grab. Sampling at these stations was completed August 13 to14, 1998 following repair of the Van Veen.

2.3.1 Granulometry

One gallon of sample was collected at each station. Samples were stored in glass jars and chilled. Grain size was determined following Plumb (1981).

2.3.2 Sediment Chemistry

Two gallons of sample were collected at each station utilizing the Van Veen or Young Grab. The samples were transferred from the sampling device to a stainless steel pan to glass jars. Samples were stored in glass jars and chilled. The sampling devices were cleansed with Liquinox and rinsed with isopropal alcohol between stations. Methods of preservation and analysis for the analytes are given in Appendix B.

2.3.3 Biotal Characteristics

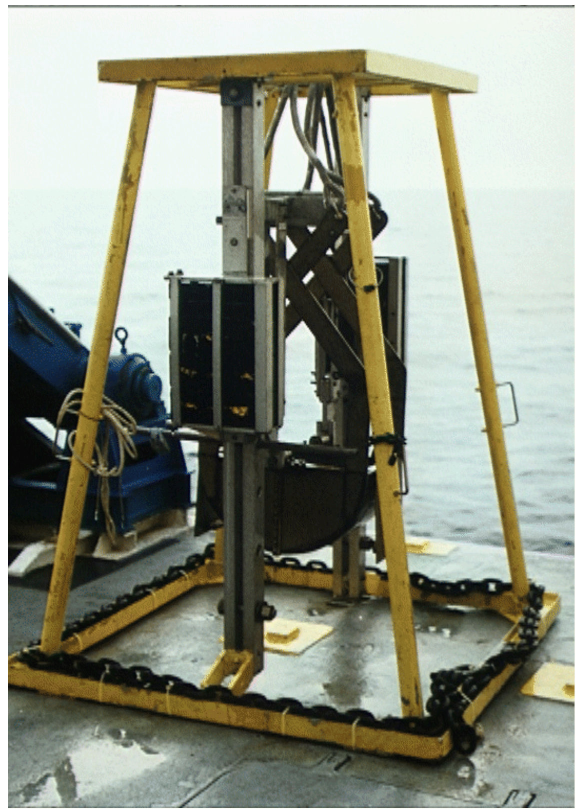

Figure 3: Deep Ocean Van Veen

Three replicate macroinfauna grab samples were collected at each station utilizing the Deep Ocean Van Veen or Large Young Grab as identified in table 2. The Van Veen samples 2 square feet (0.19 m^2) and the Young Grab 1 square foot (0.09 m^2). Upon collection, samples were sieved (500 µ mesh) and preserved in the field with 10 percent formalin stained with Rose Bengal (200 mg/L). In the laboratory samples were rinsed with tap water, re-sieved (500 µ mesh), sorted under dissecting scope, and re-preserved using 70 percent ethanol. Ten percent of the samples were re-examined by a co-worker to ensure all organisms were removed from sediments for future enumeration and identification. Organisms were counted and identified under a dissecting microscope (up to 80x). Representative specimens were preserved in a reference collection.

Benthic macroinvertebrate communities or infauna are defined as those small invertebrates living in or on the sediments that are retained by a 0.5 mm mesh sieve. In this study infaunal communities are described by a number of community parameters such as composition (species present), dominant taxa (most abundant species) density (number of individual/m^2), and species richness (number of species). Additionally, a number of community indices were calculated to allow comparison and evaluation of the candidate sites within and between locations (Palm Beach or Port Everglades). Species diversity was estimated by the Shannon -Weaver diversity index H', (Shannon and Weaver, 1963). The formula applied was as follows:

$$H' = -\sum_{i=1}^{s} P_i (\log_e p_i)$$

Where: s - is the number of taxa in the sample,
i - is the i'th species in the sample, and
Pi - is the number of individuals of the i'th species divided by the total number of individuals of all species in the sample.

Species diversity is determined by both the number of taxa present in the community (richness) and the distribution of individuals among those species. Species richness was estimated as Margalef's species richness index D, (Margalef, 1957). The formula is D = S-1/$\log_e$ N, where S is the number of taxa and N is the number of individuals in the sample. Evenness, the distribution of individuals among taxa was estimated by Pielou's evenness index J' , (Pielou, 1966). Pielou's Index J' was calculated as J' = H' /$\log_e$ S, where H' is the Shannon-Weaver diversity index and S is the number of taxa in the sample. Simpson's dominance diversity index Si, provides an estimate of community dominance based on the distribution of individuals among species. Simpson's dominance diversity is calculated as:

$$Si = 1 - \frac{1}{N^2} \times \sum_{i=s} n_i^2$$

Where: N - is the total number of individuals
S - is the number of different species
n_i - is the number of individuals in sample i

3.0 RESULTS AND DISCUSSION

3.1 Water Quality

3.1.1 Hydrography

A total of 13 CTD profiles were conducted. Salinity, temperature, dissolved oxygen and transmissivity were recorded. Data for each station is presented in Appendix C.

3.1.1.1 Temperature

Water temperatures for the survey ranged from a high of 31^{o}C to a low of 7^{o}C at the bottom (300m). Surface temperatures ranged from 25 to 31^{o}C. Bottom temperature ranged from 7 to 11^{o}C. In general, offshore stations were warmer than nearshore stations. Thermoclines were observed between 20 and 50 meters at most stations. Average temperature profiles for the candidate sites are shown in figures 4 and 5.

3.1.1.2 Transmissivity

The water at all stations was very clear, as would be expected of Gulf Stream waters. Transmissivity was highest near the surface and relatively constant over the upper 140 meters. Surface transmissivities ranged from 62 to 70%. Nearshore stations in less than 150 meters of water experienced little or no decrease in transmissivity with depth. In the deeper stations transmissivity decreased below 150 meters reaching ranges of 42 to 65% near the bottom. Average transmissivity profiles for the candidate sites are shown in figures 6 and 7.

3.1.1.3 Salinity

Salinities within the survey areas fell within the range of 34.8 to 36.5 $^{o}/_{oo}$. Salinities were highest in the upper 100 meters. Salinities tended to increase from the surface to a depth of about 20 to 80 meters and then decrease as depth decreased. Average salinity profiles for the candidate sites are shown in figures 8 and 9.

3.1.1.4 Dissolved Oxygen

Dissolved oxygen levels in the water column ranged from 2.7 to 6.6 mg/l. For most stations, dissolved oxygen was approximately 4.5 mg/l over the upper 50 meters, dropped to 3.4 mg/l by a depth of 120 meters and remained at that level until bottom was reached. Stations sampled in April had dissolved oxygen concentrations approximately 2 mg/l higher in surface waters and 1 mg/l higher in bottom waters. Average dissolved oxygen profiles for the candidate sites are shown in figures 10 and 11.

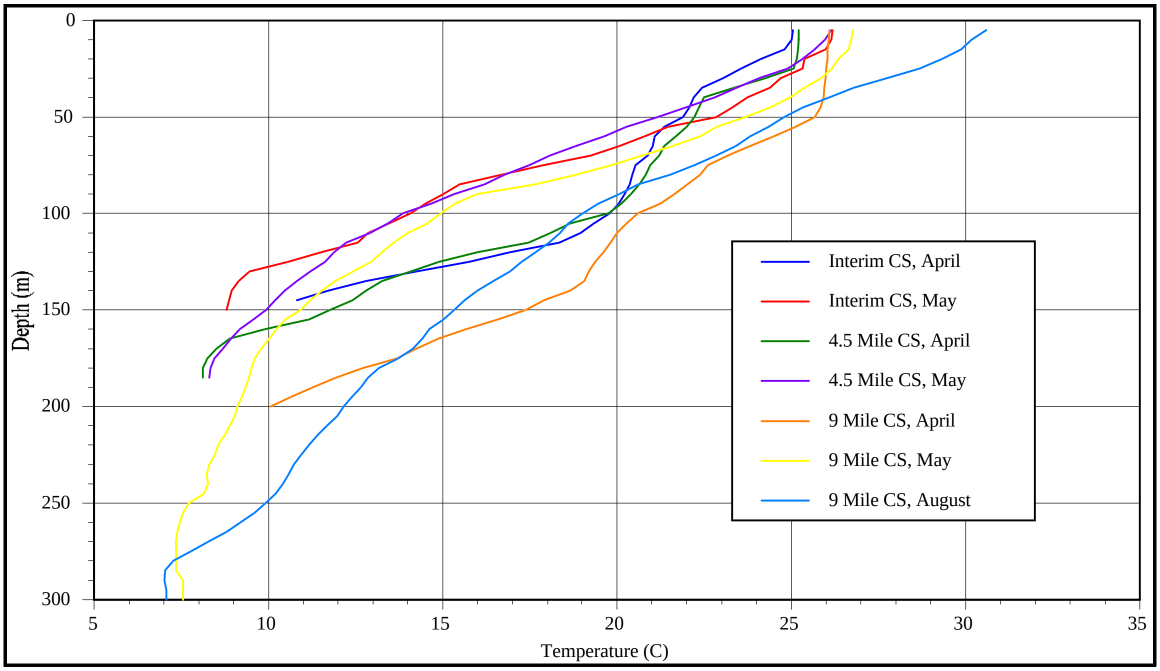

Figure 4: Average Temperature Profiles from CTD stations at the Palm Beach Candidate Sites (CS)

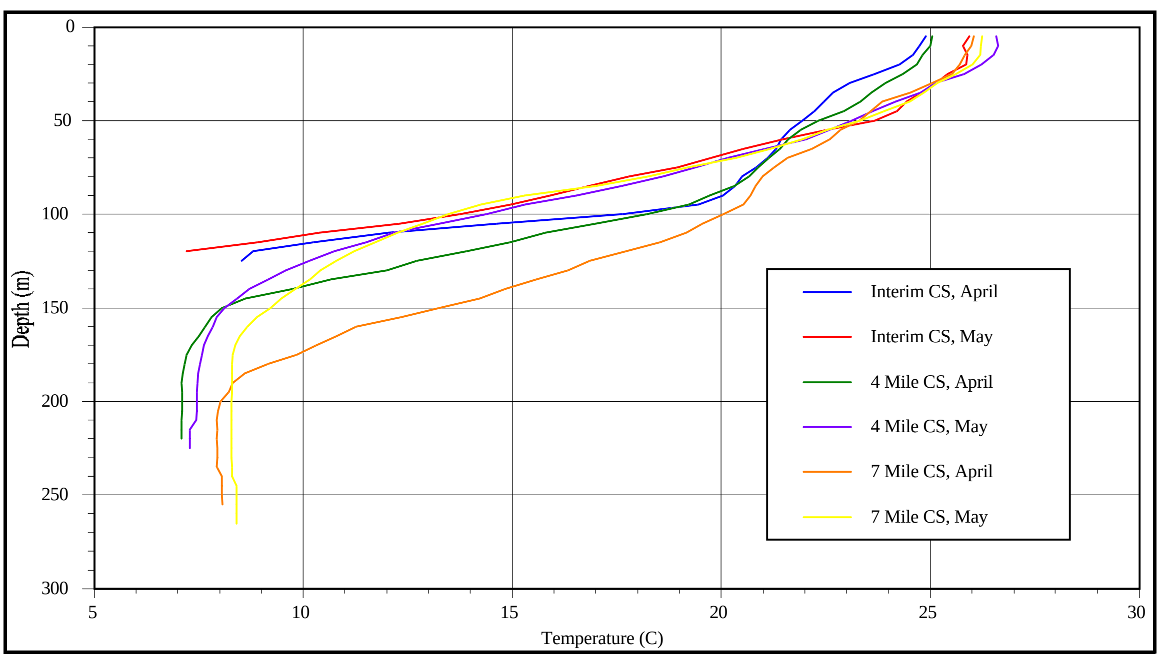

Figure 5: Average Temperature Profiles from CTD stations at the Port Everglades Candidate Sites (CS)

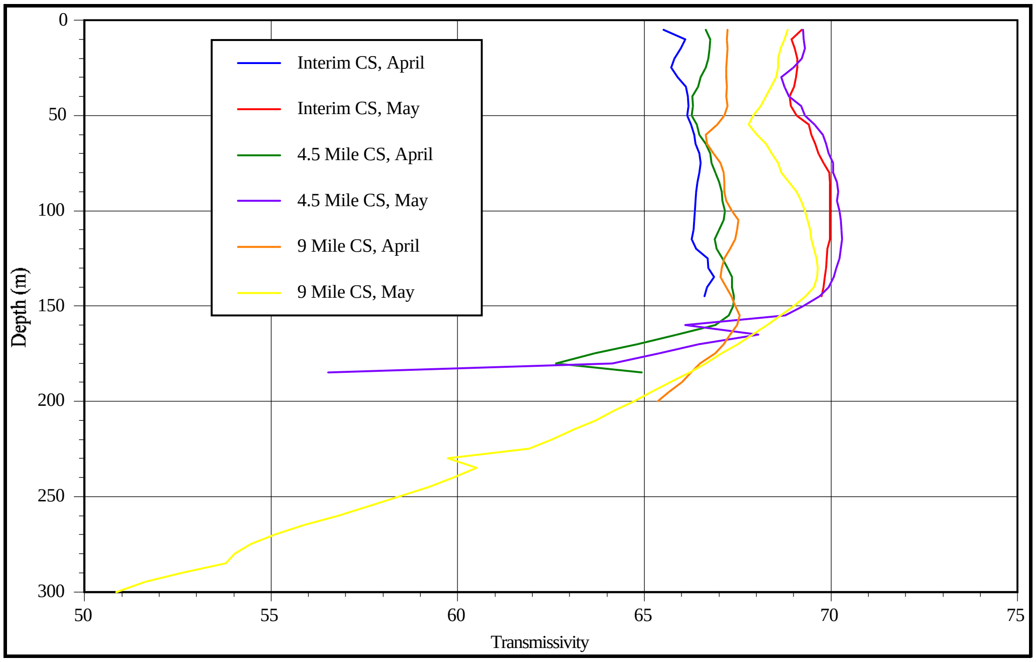

Figure 6: Average Transmissivity Profiles from CTD stations at the Palm Beach Candidate Sites (CS)

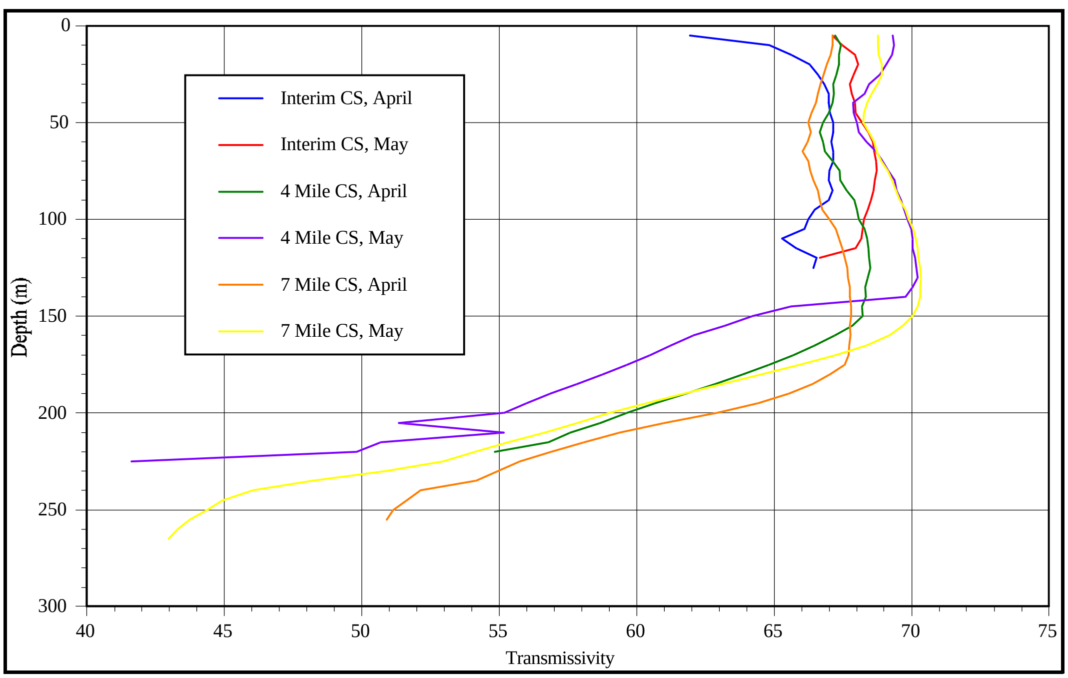

Figure 7: Average Transmissivity Profiles from CTD stations at the Port Everglades Candidate Sites (CS)

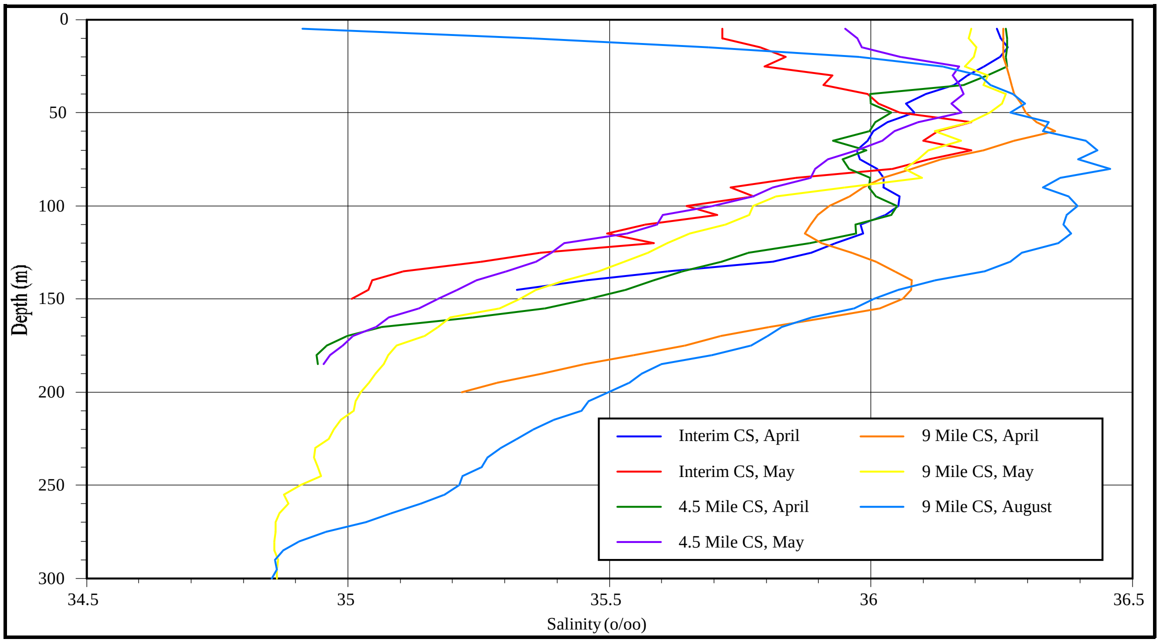

Figure 8: Average Salinity Profiles from CTD stations at the Palm Beach Candidate Sites (CS)

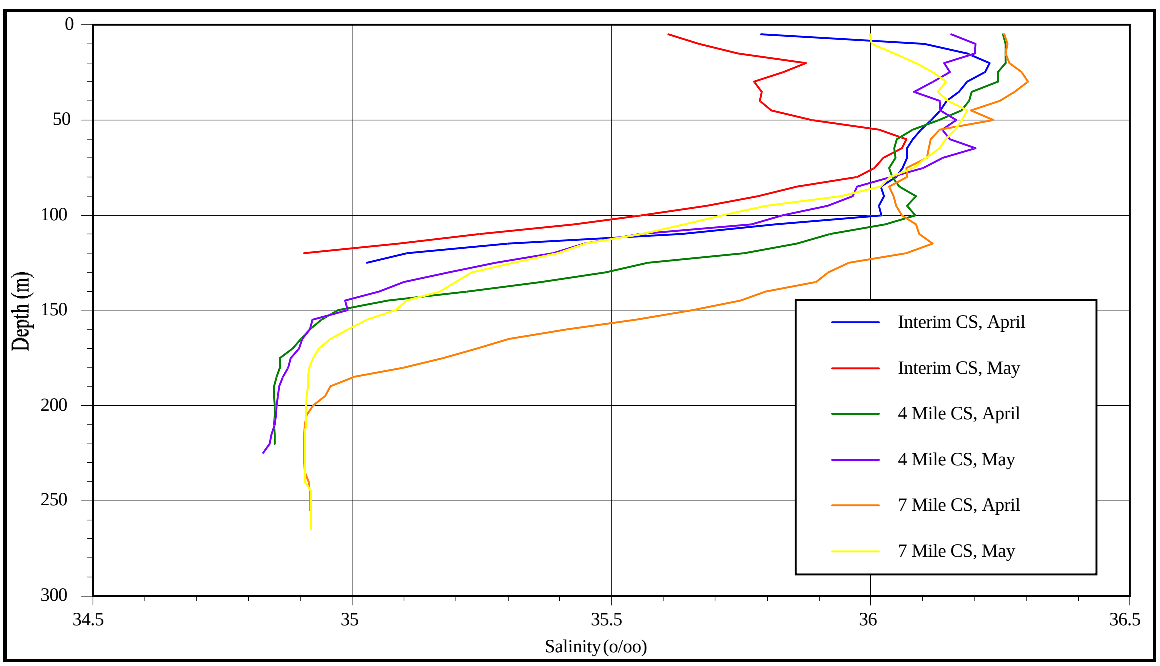

Figure 9: Average Salinity Profiles from CTD stations at the Port Everglades Candidate Sites (CS)

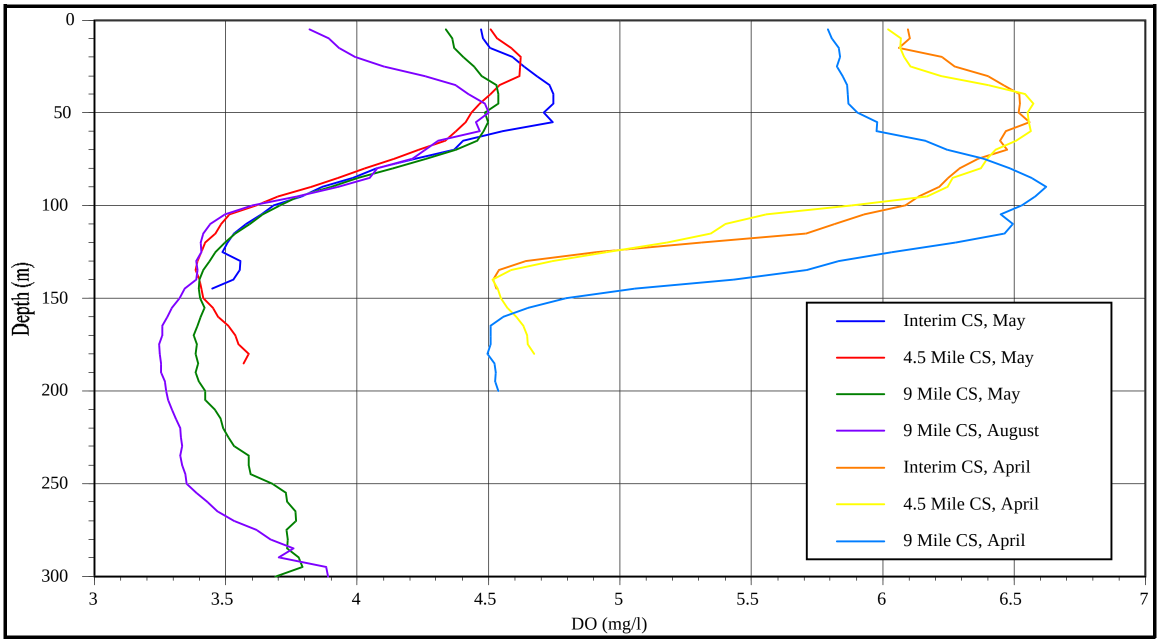

Figure 10: Average Dissolved Oxygen Profiles from CTD stations at the Palm Beach Candidate Sites (CS)

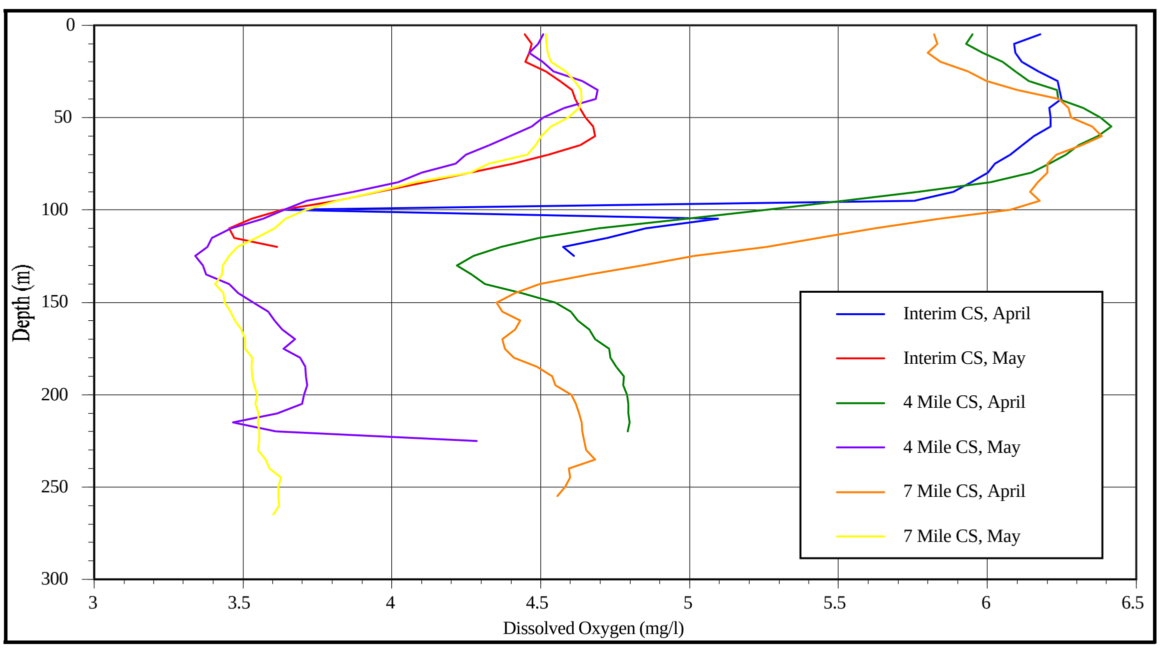

Figure 11: Average Dissolved Oxygen Profiles from CTD stations at the Port Everglades Candidate Sites (CS)

3.1.2 Water Chemistry

Samples were collected at 4 depths (surface, within the thermocline, between the thermocline and bottom and near bottom) for stations in greater than 200 meter depths and at 3 depths (surface, within the thermocline, and near bottom) for shallower stations. Data for each station is presented in Appendix A.

3.1.2.1 Turbidity & Total Suspended Solids

Turbidity values ranged from a low of 0.65 NTU to a high of 2.50 NTU. In general, higher turbidity values were observed at the Port Everglades Candidate Sites. Turbidity values ranged from 0.75 to 2.50 at the Port Everglades Candidate Sites and 0.65 to 1.2 at the Palm Beach Candidate Sites. No trends with depth or proximity to shore were observed. Box plots of the data are shown in figure 12.

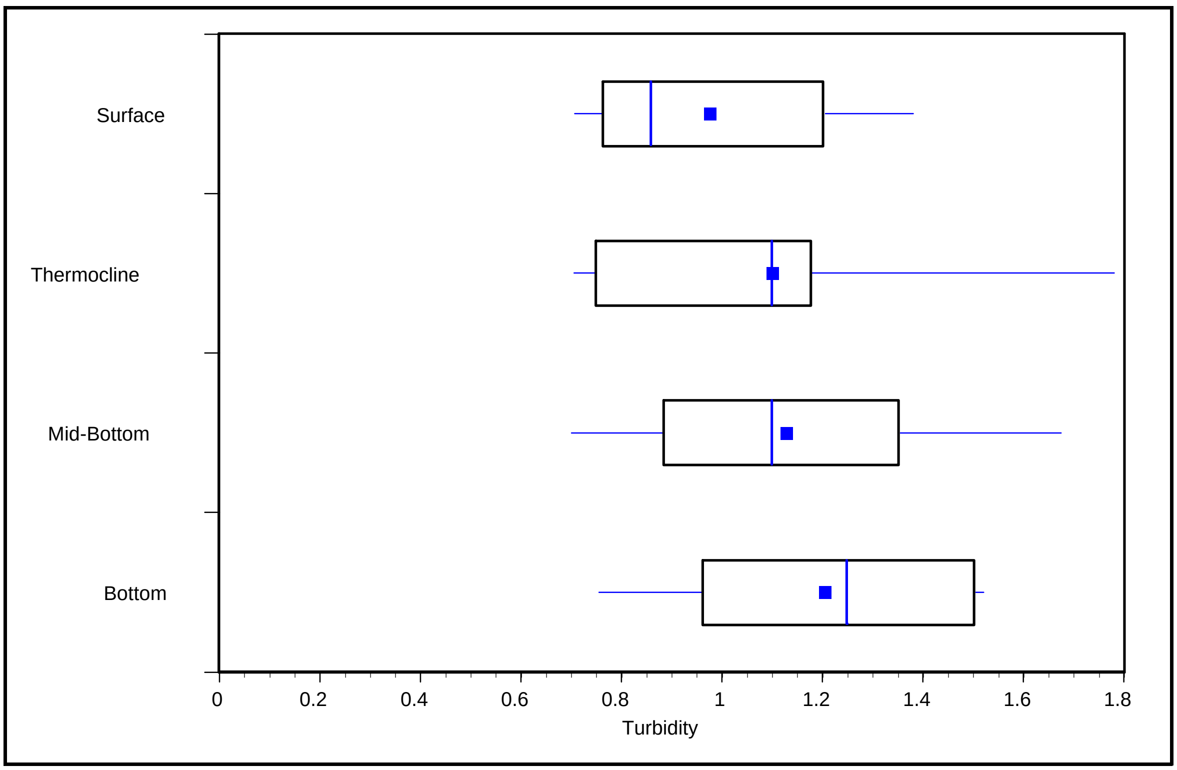

Figure 12: Box Plot for Turbidity Concentrations (NTU) in Water Samples from the Port Everglades and Palm Beach ODMDS Candidate Sites. The left, right and line through the middle of the box correspond to the top quartile, the bottom quartile and the median respectively. The whiskers extend from the bottom decile and top decile and the square represents the arithmetic mean.

Total suspended solids values ranged from a low of 3 mg/L to a high of 26 mg/L. The highest values were found within the thermocline of the Port Everglades 4 Mile Candidate Site. No correlation is apparent between turbidity and total suspended solids. Box plots of the data are shown in figure 13.

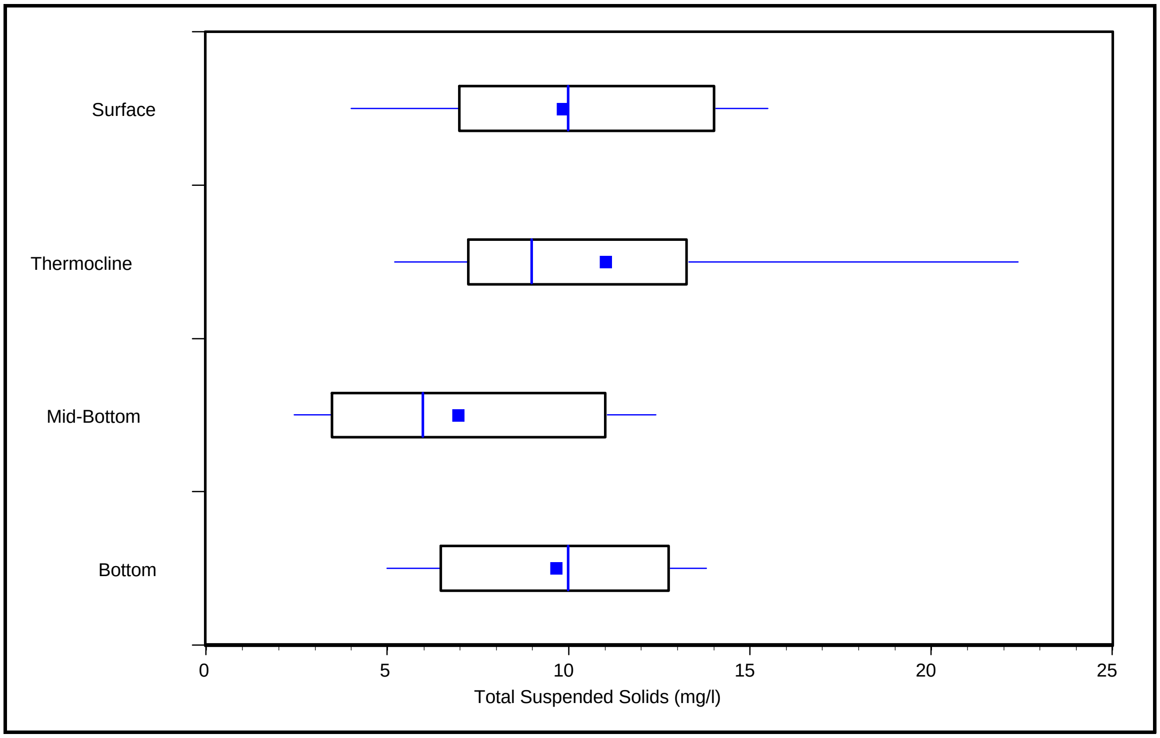

Figure 13: Box Plot for Total Suspended Solids Concentration in Water Samples from the Port Everglades and Palm Beach ODMDS Candidate Sites. The left, right and line through the middle of the box correspond to the top quartile, the bottom quartile and the median respectively. The whiskers extend from the bottom decile and top decile and the square represents the arithmetic mean.

3.1.2.2 Trace Metals

Water samples for mercury, copper, cadmium, and lead were collected. Levels of cadmium and mercury were below the level of detection (1.0 µ/L and 0.2 µ/L respectively) for all samples. Lead was detected in only 5 samples ranging from 1.3 to 6.4 µ/L. Copper levels ranged from below detection limits (1.0 µ/L) to 3.9 µ/L. Box plots for copper are shown in figure 14. Only copper had sufficient number of samples with detected levels for plotting.

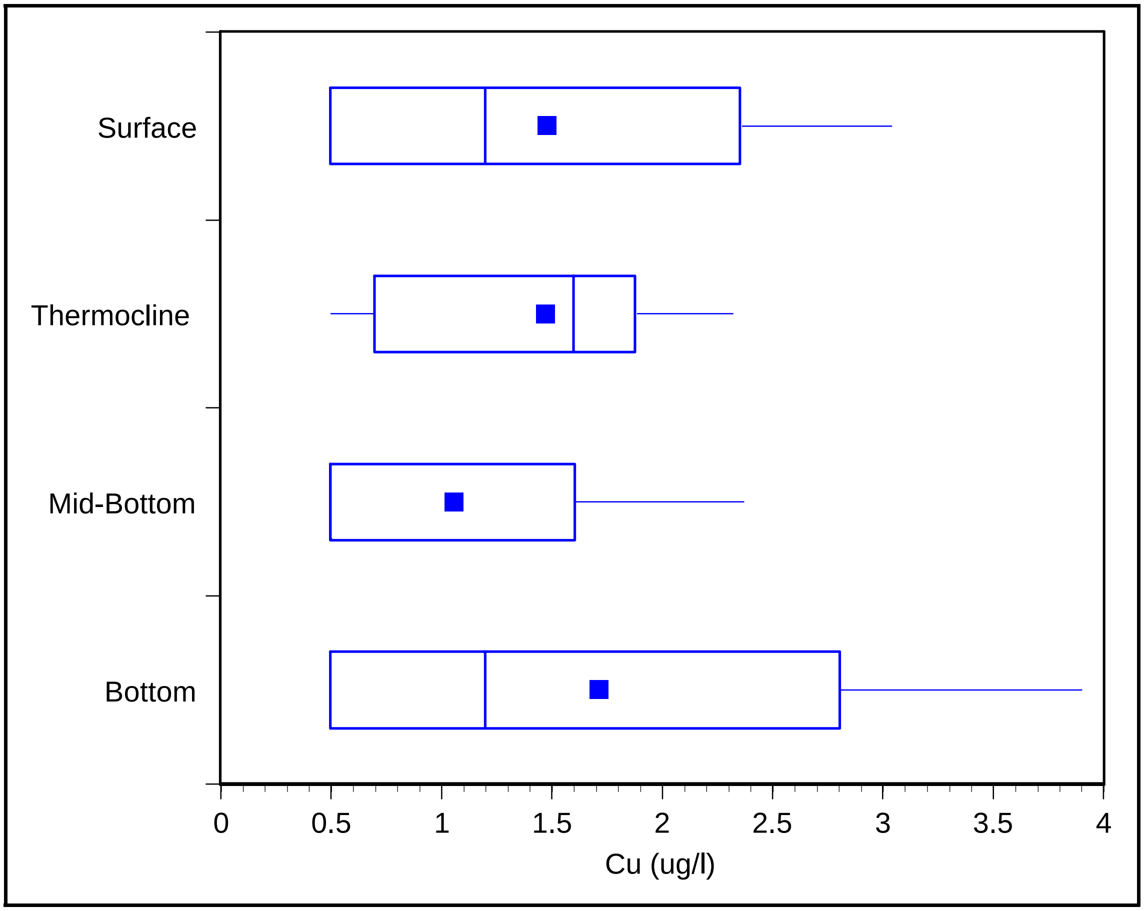

Figure 14: Box Plot for Copper Concentrations in Water Samples from the Port Everglades and Palm Beach ODMDS Candidate Sites. The left, right and line through the middle of the box correspond to the top quartile, the bottom quartile and the median respectively. The whiskers extend from the bottom decile and top decile and the square represents the arithmetic mean.

3.1.2.3 Pesticides and PCBs

All samples analyzed for PCBs and pesticides were below detection limits.

3.1.2.4 Total Petroleum Hydrocarbons

Total petroleum hydrocarbon (TPH) concentrations were found in concentrations from below detection limits (100 µg/L) to 6300 µg/L. Box plots for TPH for each candidate site are shown in figures 15 and 16. In general TBH concentrations were higher in the offshore stations than the nearshore stations.

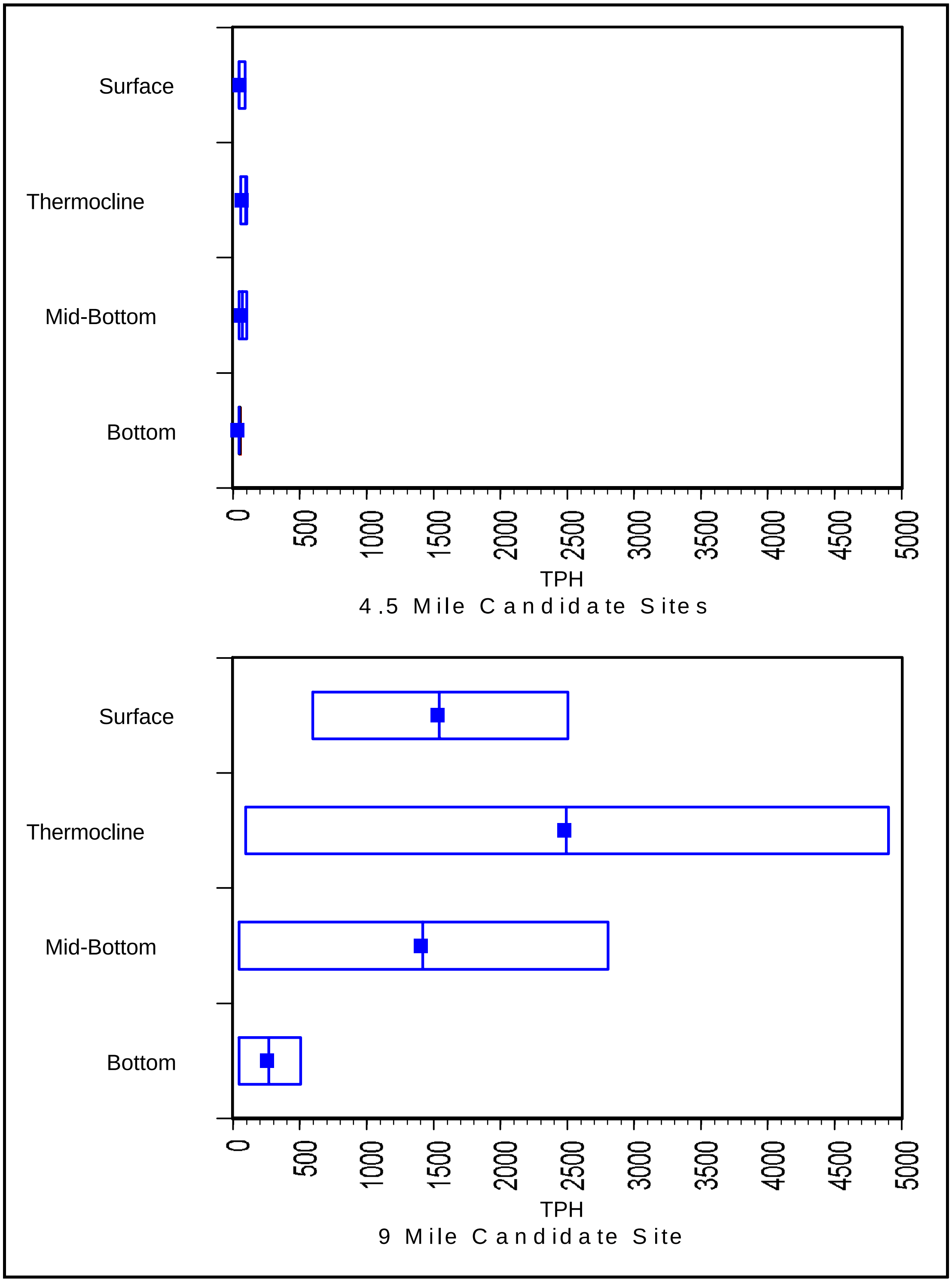

Figure 15: Box Plot for Total Petroleum Hydrocarbons Concentrations (µg/L) in Water Samples from the Palm Beach ODMDS Candidate Sites.

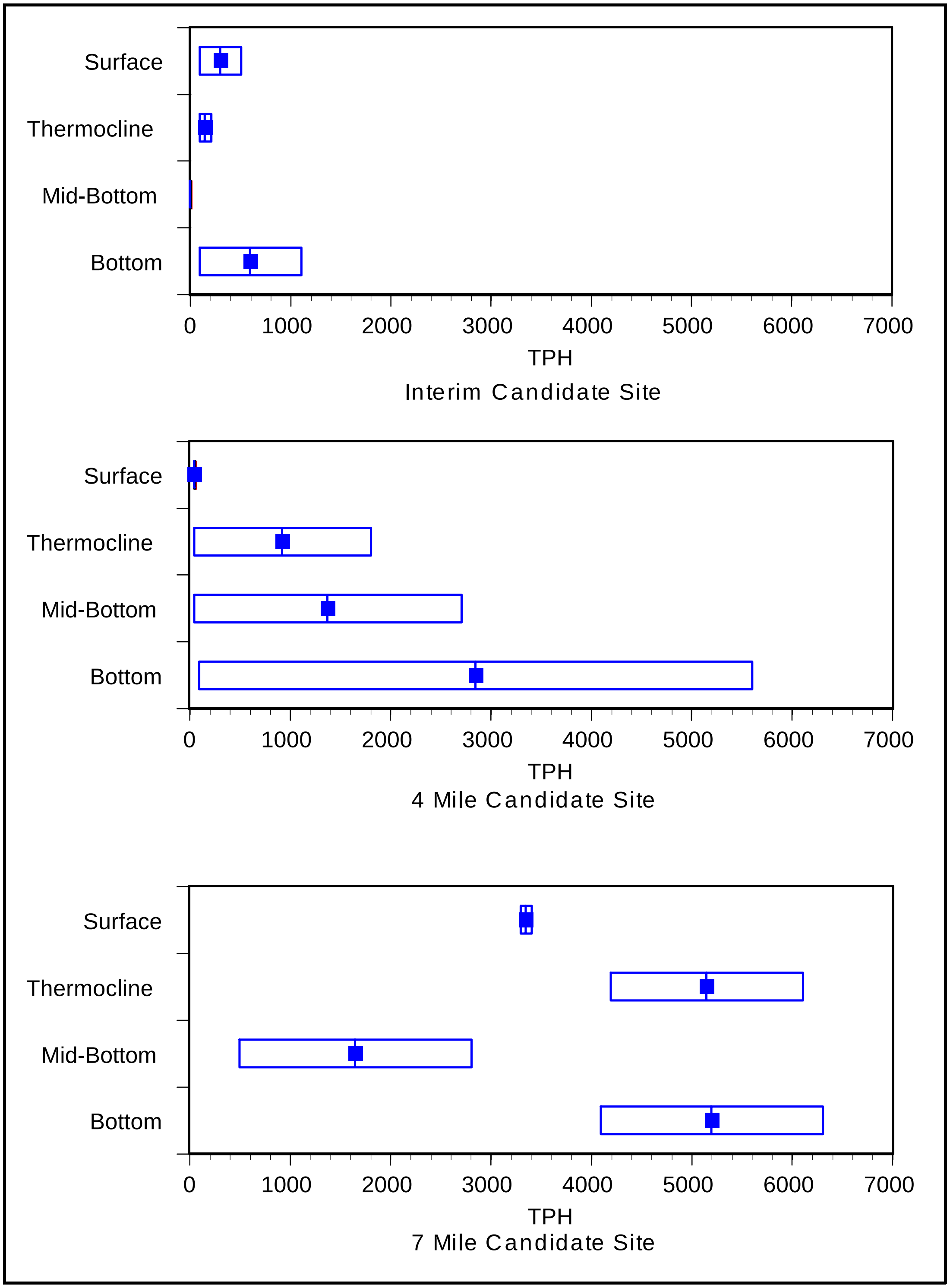

Figure 16: Box Plot for Total Petroleum Hydrocarbons Concentrations (µg/L) in Water Samples from the Port Everglades ODMDS Candidate Sites.

3.2 Benthos Characteristics

All benthos samples were collected on May 18-19 except for stations 6 through 8 which were sampled on August 13 due to damage of the sampling device in May. Rock bottom was encountered at stations 17, 18 and 19. Epifaunal samples were collected from the rock retrieved and were analyzed separately.

3.2.1 Granulometry

Table 3 lists the grain size percent composition for each sample station. Complete results and particle size distributions are in Appendix D. Most stations consisted of grey slightly to very silty fine sand with shell fragments. Stations 6 through 9 (Palm Beach 9 Mile Candidate Site) had a greenish grey color. Mean grain sizes for each station are shown in figure 17. The Port Everglades candidate sites had slightly larger mean grain sizes and higher percentages of sand. For both locations the offshore stations had larger mean grain sizes and higher percentages of sand. Percent silts and clays ranged from 19 to 35 percent for the Palm Beach candidate sites and 11 to 18 percent for the Port Everglades candidate sites. Sample collection was attempted at stations 17 through 19, but hard bottom was encountered. The hard bottom rocks retrieved consisted of fossiliferous limestone that was slightly dolomitic with magnesite dendrites. They are from the Floridan Aquifer of the Suwanee Formation (McManus, 1998).

Table 3: Grain Size Composition

Station	Candidate Site	% Sand	% Silt and Clay
1	Palm Beach 4.5 Mile Candidate Site	74.2	25.8
2	Palm Beach 4.5 Mile Candidate Site	71	29
3	Palm Beach 4.5 Mile Candidate Site	64.8	35.2
6	Palm Beach 9 Mile Candidate Site	76.6	23.4
7	Palm Beach 9 Mile Candidate Site	79.2	20.8
8	Palm Beach 9 Mile Candidate Site	81.2	18.8
9	Palm Beach 9 Mile Candidate Site	81.5	18.5
13	Port Everglades 4 Mile Candidate Site	84.3	15.7
14	Port Everglades 4 Mile Candidate Site	83	17
15	Port Everglades 4 Mile Candidate Site	84.5	15.5
16	Port Everglades 9 Mile Candidate Site	89.5	10.5
20	Port Everglades 9 Mile Candidate Site	81.9	18.1

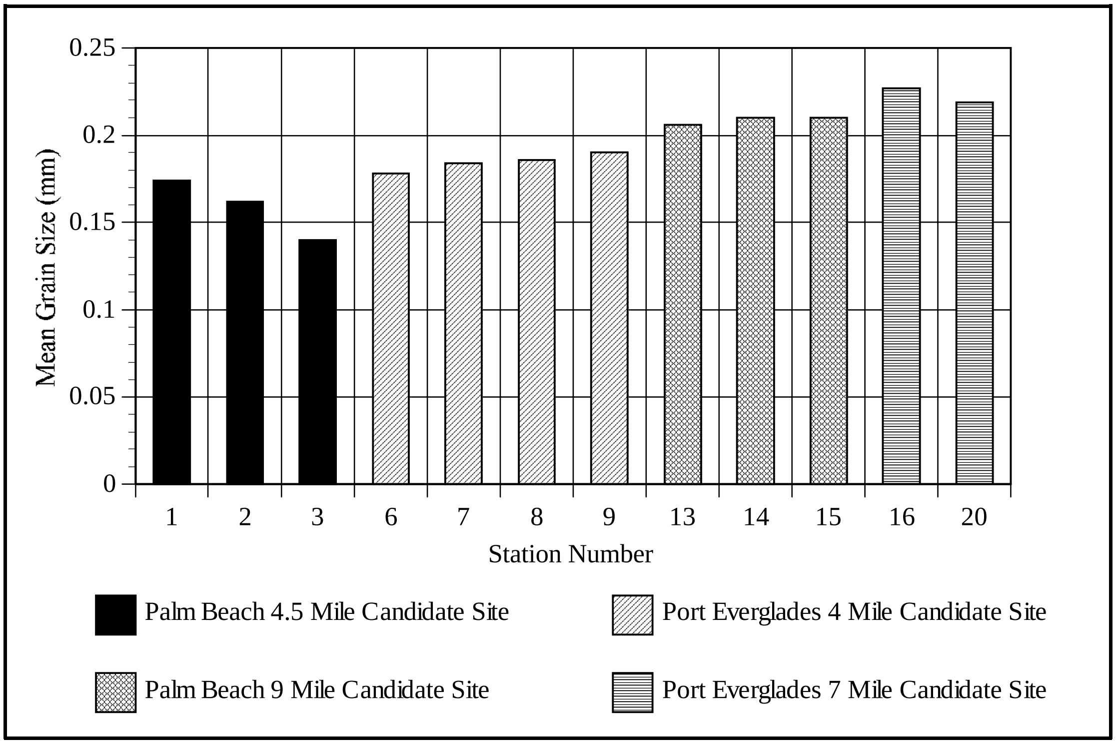

Figure 17: Mean Grain Size

The grain size distributions were within the ranges encountered during previous surveys in the area. Median grain size diameter for the November 1984 Palm Beach survey ranged from 0.10 to 0.33 mm with an overall average of the means of 0.21 mm. Median grain size diameter for the November 1984 Port Everglades survey ranged from 0.08 to 0.25 mm with an overall average of the means of 0.16 mm (BVA, 1985). Median grain size data was not available from the 1989 Palm Beach survey. However, percent silt and clays ranged from 15 to 33 percent (CSA, 1989).

3.2.2 Sediment Chemistry

3.2.2.1 Total Organic Carbon

Total organic carbon concentrations were reported ranging from 6.0 to 13.2%. However, these results are unreliable due to quality control issues. Sample matrix spikes were not within acceptance criteria. Previous sampling in the Palm Beach 3/4.5 Candidate Site area reported results ranging from 0.3 to 0.6% (CSA, 1989) and in the Miami ODMDS area 1.1 to 1.8% (CC, 1985).

3.2.2.2 Oil & Grease, Total Petroleum Hydrocarbons, Pesticides, and PCBs

Oil and grease were generally below detection limits (50 µg/g) except for two stations, station 13 (86 µg/g) and station 2 (590 µg/g). Total petroleum hydrocarbons, pesticides and PCBs were all below detection limits. Analytical results can be found in Appendix B.

3.2.2.3 Metals

Cadmium levels ranged from below detection limits (0.10 µg/g) to 0.15 µg/g. Copper levels were in the range of 1.8 to 4.8 µg/g with the highest levels at the Palm Beach 9 Mile Candidate Site (See figure 18). Lead levels were in the range of 1.3 to 31.3 µg/g with the lowest levels at the Palm Beach 9 Mile Candidate Site (see figure 19). Mercury was not detected (0.05 µg/g) at any station. Results can be found in Appendix B. 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).

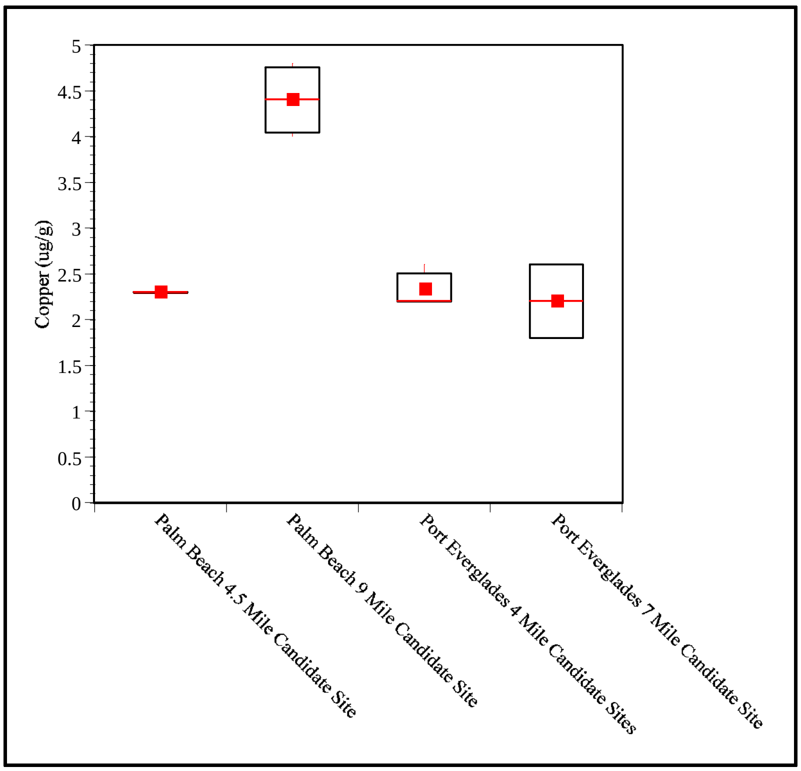

Figure 18: Sediment Copper Concentrations

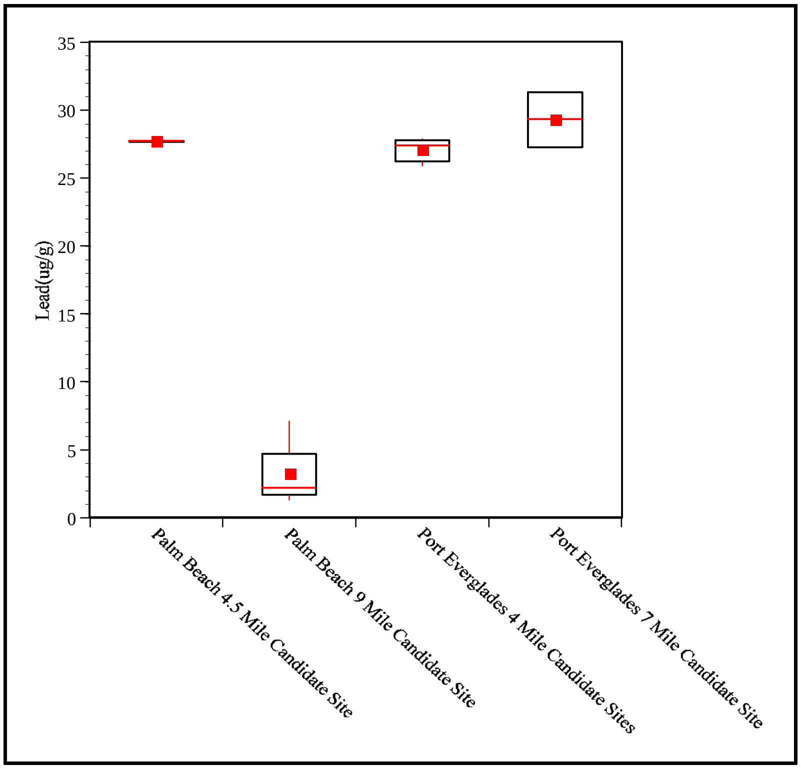

Figure 19: Sediment Lead Concentrations

3.2.3 Biotal Characteristics

Palm Beach Harbor Candidate ODMDSs

The taxonomic composition of the Palm Beach Harbor Candidate ODMDSs infauna is presented in Appendix E. A total (all samples and all stations) of 1,318 individuals and 160 taxa across 71 families were collected in 1998. Densities ranged from 305 individuals/m^2 to 592 individuals/m^2 with a mean density of 421 individuals/m^2. This contrasts with a 1984 study that found 392 taxa present and a mean density of 2840 individuals/m^2 at the Palm Beach Candidate ODMDSs and control stations (BVA, 1985). A 1989 study showed 124 families and a mean density of 2,246 individuals/m^2 at the Palm Beach Candidate ODMDS (CSA, 1989). Annelids (Polychaeta and Oligochaeta) and arthropods were the most abundant groups overall representing 50.72% and 9.27% of the total fauna respectively. Past studies showed similar trends with 60.8% and 13.7% respectively in the 1984 study (BVA, 1985) and 30.6% and 32.3% respectively in the 1989 study (CSA, 1989).

The infauna composition was distributed differently between the candidate sites. At the Candidate 4.5 Mile (CS4.5) site annelids and arthropods comprised 42.03% and 13.24% of the total community respectively, while comprising 80.42% and 5.29% of the total fauna respectively at the Candidate 9 Mile (CS9) site. The mean number of taxa among CS4.5 site and CS9 site stations was 46 and 62 respectively. The mean densities among CS4.5 site and CS9 site stations was 405 individuals/m^2 and 433 individuals/m^2 respectively. Table 4 shows community indices for Palm Beach ODMDS candidate sites.

Table 4: Benthic infauna community indices for the Palm Beach Harbor Candidate sites from the 1998 surveys and 1984 survey[1]. Index values are expressed as means.

Candidate Site	Diversity (H')	Evenness (J')	Richness (D)	Dominance (Si)
Palm Beach 4.5 Mile Candidate Site	4.70	0.857	9.08	0.055
Palm Beach 9 Mile Candidate Site	5.26	0.886	11.37	0.036
ODMDS 1984	3.64	0.830	13.58	

[1] BVA 1985

Community indices calculated for the Palm Beach Harbor ODMDS CS4.5 and CS9 sites were generally similar. The slightly higher mean H' diversity in the CS9 site (5.26) was due to the higher number of taxa found there which can be seen in the higher D richness value. Diversity was slightly lower during the 1984 survey though the number of species was higher than during the 1998 survey (392 vs. 160) which is shown by the higher D richness (BVA, 1985). The 1984 survey resulted in a much large number of samples collected than in 1998 which typically produces more rare species. Rare species are usually lower in abundance which, in turn, lowers H' which relies on species richness and evenness (distribution of individual among species). The lower Si dominance value in the CS9 site versus the CS4.5 site (0.036 vs. 0.055) indicates that a smaller number of species accounted for a higher proportion of individuals in the CS4.5 site.

Overall, infaunal communities at both the CS4.5 and CS9 sites are represented by most of the same families within the major taxonomic groups. Several families of annelids (Class Polychaeta), mollusks (class Bivalvia) and crustaceans (order Cumacea) represented at CS9 were not present at the CS4.5 site. These were relatively low in numerical abundance and are most likely due to natural community variation.

*Port Everglades Candidate ODMDS*s

The taxonomic composition of the Port Everglades Candidate ODMDS infauna is presented in Appendix F. A total (all samples and all stations) of 1,973 individuals and 159 taxa across 65 families were collected at Port Everglades ODMDS in 1998. Organism densities ranged from 488 individuals/m^2 to 1,239 individuals/m^2 with a mean density of 756 individuals/m^2. A 1984 study of the Port Everglades ODMDS found 453 taxa present and a mean density of 4637 individuals/m^2 (BVA, 1985). Annelids were the most abundant group overall representing 49.65% of the total fauna. The arthropods were the second largest group overall with 36.86% of the total fauna. The 1984 Port Everglades study found annelids dominant with 61.8%, mollusks second with 11.8% and arthropods third with 9.9% of the total fauna.

The infaunal community composition differed between the Port Everglades Candidate 4 Mile (CS4) and Candidate 7 Mile (CS7) sites. At the CS4 site arthropods were the most abundant group overall representing 52.71% of the total fauna. The ampeliscid amphipods (Ampeliscidae) comprised 23.80% of the total. Annelids were the second largest group overall with 36.86% of the total fauna. Annelids dominate the fauna at the CS7 site with 62.49% of the total, while arthropods followed with 22.87% of the total fauna. Mean densities among stations at the CS4 site ranged from 392-440 individuals/m^2 and total taxa ranged from 73-77 taxa. Mean densities among stations at the C7 site ranged from 488-1,239 individuals/m^2 and total taxa ranged from 38-79 taxa. Table 5 shows community indices for Port Everglades ODMDS candidate sites.

Table 5: Benthic infauna community indices for the Port Everglades Candidate sites from the 1998 surveys and 1984 survey[1]. Index values are expressed as means.

Candidate Site	Diversity (H')	Evenness (J')	Richness (D)	Dominance (Si)
Port Everglades 4 Mile Candidate Site	4.92	0.789	12.28	0.077
Port Everglades 7 Mile Candidate Site	4.45	0.756	10.73	0.113
ODMDS 1984	3.62	0.780	15.53	

[1] BVA 1985

Community indices for the Port Everglades ODMDS CS4 and CS7 sites were generally similar. The higher D richness value for the CS4 site indicates a high total taxa found at CS4. Again, the larger number of rarer (low numerical abundance) species found in the 1984 survey may account for the somewhat lower H' diversity value. The lower Si dominance value at the CS4 site corresponds to the somewhat higher H' diversity estimated for the CS4 site.

Overall, infaunal communities at both the CS4 and CS7 sites are represented by most of the same families within the major taxonomic groups. The shift in numerical dominance between the ampeliscid amphipods (arthropods) in CS4 and polychaets (annelids) in CS7 is most easily explained by natural community variation rather than true community differences.

Additionally, a limestone outcropping was discovered at the CS7 during the May 18-20 survey. Limestone was encountered at stations 17, 18 and 19 during box coring and a small rock sample was collected at each station and brought to the surface. No attempt was made to quantify the assemblages of epifaunal organisms on the rock fragments though visual examination determined that the outcropping contained a number of sessile and free living invertebrates. The limestone outcropping was later examined by sidescan sonar and was shown to dominate the southern half of the candidate site (south of 26º 7.8'). The outcropping extended beyond the survey area and had little to no relief.

Comparisons between Palm Beach and Port Everglades Infauna

Overall the Port Everglades ODMDS and Palm Beach ODMDS infaunal communities share a number of similarities with regard to structure. Both locales had a similar number of taxa dominated by the same major taxonomic groups. As the dominant group, annelids were represented at Palm Beach by 36 families and at Port Everglades by 31 families. Fully 100% of the Port Everglades annelid families were represented in the Palm Beach infauna. At Port Everglades 58.33% of its most important (numerically abundant) 24 arthropod families were shared at Palm Beach. Environmental factors that affect benthic community structure e.g., temperature, DO, sediment grain size distribution etc., were not shown to be significantly different between Palm Beach and Port Everglades.

Sites among locales were examined to determine whether infaunal communities were effected by depth or distance from shore (table 6). When grouped by distance from shore, sites do not appear to be more similar than sites grouped by locale with regard to community parameters. Environmental factors that affect benthic community structure were not shown to be significantly different between the nearshore and farshore sites.

Table 6: Dominant infaunal groups and community indices for the Palm Beach Harbor and Port Everglades Candidate sites.

Candidate Site	Annelida % of Total	Arthropoda % of Total	Diversity (H')	Evenness (J')	Richness (D)	Dominance (Si)
Near Shore						
Palm Beach 4.5 Mile Candidate Site	42.03	13.24	4.70	0.857	9.08	0.055
Port Everglades 4 Mile Candidate Site	36.86	52.71	4.92	0.789	12.28	0.077
Far Shore						
Palm Beach 9 Mile Candidate Site	80.42	5.29	5.26	0.886	11.37	0.036
Port Everglades 7 Mile Candidate Site	62.49	22.87	4.45	0.756	10.73	0.133

4.0 SUMMARY

The objective of this project was to collect data to characterize the candidate ODMDSs offshore Port Everglades and Palm Beach, Florida. Data collected included water column profiles, water quality samples, bottom sediment chemistry, bottom sediment granulometry and benthic biota.

Salinity, dissolved oxygen, and transmissivity data indicated water masses over the candidate sites were similar to open ocean waters and deviated little between candidate sites. Water quality analyses for trace metals, PCB's and pesticides showed very low levels for these parameters. Total petroleum hydrocarbons were higher than expected for the offshore candidate sites.

Grain size distributions at the candidate sites were similar with the offshore Port Everglades candidate sites having a slightly coarser distribution. Oil and grease, total petroleum hydrocarbons, pesticides and PCBs were generally below detection limits in the sediments. For metals, only copper and lead were detected in significant amounts in the sediments. Copper and Lead were detected at similar amounts for all candidate sites except the Palm Beach 9 Mile Candidate Site which had higher copper and lower lead amounts.

Macroinfaunal samples were dominated in numbers by annelids and arthropods. All candidate sites were similar in that they had a similar number of taxa dominated by the same major taxonomic groups.

5.0 REFERENCES

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Appendix I

ESSENTIAL FISH HABITAT ASSESSMENT

ESSENTIAL FISH HABITAT ASSESSMENT

Environmental Protection Agency Region 4
Designation of the Palm Beach Harbor, Florida
Ocean Dredged Material Disposal Site
pursuant to the
Marine Protection, Research, and Sanctuaries Act

July 2004

1.0 PROJECT DESCRIPTION

1.1 Overview

The U.S. Environmental Protection Agency Region 4 (EPA) is proposing to designate an Ocean Dredged Material Disposal Site (ODMDS) offshore Palm Beach Harbor, Florida. The Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA) Section 102(c) authorizes EPA to designate recommended sites for ODMDSs. An ODMDS is a precise geographic area within which ocean disposal of dredged material can be 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 (40 CFR 228.5) and specific (40 CFR 228.6(a)) site evaluation criteria.

The transportation of dredged material for the purpose of disposal into ocean waters (ie. the actual use of the designated site) is permitted by the Corps of Engineers (COE) or authorized in the case of federal Civil Works navigation projects under Section 103 of the MPRSA after applying environmental criteria established in EPA's Ocean Dumping Regulations (40 CFR 227). Therefore, the proposed action is the selection and designation of the Palm Beach Harbor ODMDS and not the permitting or authorization for use of the site.

1.2 Location

The proposed ODMDS for Palm Beach Harbor is an area approximately one square nautical mile (nmi) located east northeast of the Lake Worth Inlet and approximately 4.5 nmi offshore. The western edge of the site is located 4.3 nmi offshore. 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°52'35"W. Depths in the site range from 525 feet (160 meters) to 625 feet (190 meters). The site location is shown in figure 1.

1.3 Dredged Material

As mentioned above, site designation does not authorize use or disposal of dredged material in the ODMDS. Each project will be required to be evaluated for its suitability for utilization of the ODMDS. This will include an analysis for the need for ocean disposal, compliance with the Ocean Dumping Criteria and compliance with the current approved Site Management and Monitoring Plan (SMMP). A draft SMMP was included with the Draft EIS for Designation of the Palm Beach Harbor ODMDS and the Port Everglades Harbor ODMDS previously submitted to NOAA Fisheries. The COE has projected ocean disposal of maintenance dredged material at Palm Beach Harbor ODMDS every three years with disposal volumes of 75,000 to 100,000 cubic yards (Murphy, 2004). This equates to annual average disposal rates of 25,000 to 35,000 cubic yards. Historical maintenance dredging projects have ranged from 14,000 cubic yards to 179,000 cubic yards (Murphy, 1998) and maximum maintenance volumes are not expected to exceed 200,000 cubic yards per event (Murphy, 2004). Disposal volumes at the ODMDS are therefore likely to be within these ranges. These volumes are relatively low in comparison to other ODMDS in the southeast. For example, the Jacksonville Harbor ODMDS receives approximately 300,000 cubic yards per year and the Canaveral Harbor ODMDS receives over 600,000 cubic yards per year. The Miami ODMDS received a project in the mid-1990's in excess of 3 million cubic yards (Ocean Disposal Database, 2002). Dredged material from maintenance dredging for Palm Beach Harbor has been characterized as a solids content of 80 to 85% and a grain size distribution of 6 percent fine grained material. Additional projects could also utilize the ODMDS if a need is demonstrated. Computer model simulations of the sediment movement of a disposal mound consisting of up to 500,000 cubic yards during storm events was conducted and concluded that insignificant erosion would occur (CERC, 2001). Larger projects were not evaluated. Therefore, the SMMP limits project size to 500,000 cubic yards until additional studies are conducted.

1.4 Transport and Disposal Methods

There are no restrictions on the types of vessels to be used for disposal of dredged material at the Palm Beach Harbor ODMDS. Ocean disposal of dredged material typically utilizes either a self propelled hopper dredge or a disposal barge towed by a tug. Hydraulic dredges such as the hopper dredge typically results in a disposed material with a much higher water content (e.g. 20% solids, 80% water) as a result of slurrying the sediments with water in a one-part sediment to four-parts water mixture (Herbich, 1992). The COE has determined that the most effective method for dredging Palm Beach Harbor is utilization of a mechanical dredge (clamshell) and disposal barge (COE, 1996), however, use of a small hopper dredge is also likely (Murphy, 2004).

The SMMP provides requirements for disposal operations. These include a disposal zone (within 600 feet of the center of the ODMDS) and disposal monitoring requirements.

2.0 FISH HABITAT OVERVIEW

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 the National Marine Fisheries Service (NMFS) in association with regional fishery management councils (FMC). Essential Fish Habitat 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 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.

2.1 Managed Species

The area proposed for designation as an ODMDS for Palm Beach Harbor falls under the jurisdiction of the South Atlantic Fishery Management Council (SAFMC). The SAFMC extends from the northern coast of North Carolina south to the Florida Keys. The SAFMC has identified and described EFH for hundreds of marine species covered by 20 FMPs. In addition, the NMFS, has prepared a FMP for Highly Migratory Species (tunas, billfishes, sharks, and swordfish) which includes associated essential fish habitat. A list of species managed by the SAFMC and South Atlantic species managed under the Federally-Implemented Fishery Management Plans can be found in Table 1.

Table 1. Essential Fish Habitat (EFH) Species for Marine Waters Managed by the South Atlantic Fishery Management Council and under the Federally-Implemented Fishery Management Plans.

Species	**Life Stage Ecotype**	**EFH**	**Potential for EFH within ODMDS**
Brown shrimp Greatest abundance from NC-FL Keys	eggs larvae adults	13.7-110m, demersal <110m, planktonic <110m, silt sand, muddy sand	No Yes No
White shrimp Greatest abundance from NC-St. Lucie Inlet	eggs larvae adults	nearshore & 6.1-24.4m, demersal <24.4m, planktonic <27m, silt, soft mud	No Yes No
Pink shrimp Greatest abundance in NC & Florida	eggs larvae adults	3.7-16m, demersal <16m, planktonic <100m, hard sand/shell substrate	No Yes No
Rock Shrimp	adults	terrigenous & biogenic sand 18-182m	Yes
Royal red Shrimp Greatest abundance in NC-FL	adults	180-730m, mud/sand substrate	Yes
Red drum Greatest abundance from NC-FL Keys	eggs larvae adults	tidal inlets, planktonic tidal inlets, planktonic inlets & surf zone - 50m; mud bottoms, oyster reefs	Yes Yes No
Snowy grouper Greatest abundance in NC-FL	eggs/larvae adults	pelagic <180m, boulders & relief features	Yes Yes
Yellowedge grouper Greatest abundance in NC-FL	eggs/larvae adults	pelagic 190-220m, rocky outcrops & hardbottom	Yes Yes
Warsaw grouper Greatest abundance in NC-FL Keys	eggs adults	pelagic 76-219m, cliffs, notches & rocky ledges	Yes Yes
Scamp Greatest abundance in NC-FL	adults	hard bottoms, rock outcrops, 20-100m	No
Speckled hind Greatest abundance in NC-FL	adults	27-122m, hardbottom	No
Jewfish Greatest abundance in FL	adults	<50m, hardbottom, ledges, reefs	No

Table 1. Essential Fish Habitat (EFH) Species for Marine Waters Managed by the South Atlantic Fishery Management Council and under the Federally-Implemented Fishery Management Plans.

Species	**Life Stage Ecotype**	**EFH**	**Potential for EFH within ODMDS**
Wreckfish Greatest abundance in NC-FL(Black Plateau)	adults	<1000m, high relief features	Yes
Red snapper Greatest abundance in NC-FL	larvae postlarvae/juv adults	planktonic pelagic hardbottom; 10-190m	Yes Yes Yes
Vermilion snapper Greatest abundance in NC-FL	juvenile adults	reefs, hard bottom, 20-200m reefs, hard bottom, 20-200m	Yes Yes
Mutton snapper Greatest abundance in FL	egg/larvae juvenile adults	planktonic SAV, mangrove, sand, mud reefs/hardbottom, sand; <100m	Yes Yes No
Blackfin snapper Greatest abundance in NC-FL	juvenile adults	hardbottom; 12-40m shelf edge, 40-300m	No Yes
Silk snapper Greatest abundance in NC-FL	juvenile adults	structure, hardbottom, 12-242m cliffs/ledges, 64-242m	Yes Yes
White grunt Greatest abundance in NC-FL	eggs/larvae adults	planktonic shore-35m, reefs/hardbottom, SAV, mangrove	Yes No
Greater amberjack Greatest abundance in NC-FL	juvenile adults	floating plans (Sargassum), debris pelegic over reefs/wrecks	Yes Yes
Blueline tilefish Greatest abundance in NC-FL	eggs adults	planktonic shelf edge, 68-236	Yes Yes
Golden tilefish Greatest abundance in NC-FL	adults	burrows in rough bottom; 76-457m	Yes
King mackerel Greatest abundance in NC-FL	juvenile adults	pelagic, S. Atlantic Bight pelagic, S. Atlantic Bight	Yes Yes
Spanish mackerel Greatest abundance in NC-FL	larvae juvenile adults	offshore <50 meter isobath offshore, beach, estuarine pelagic	No No Yes

Table 1. Essential Fish Habitat (EFH) Species for Marine Waters Managed by the South Atlantic Fishery Management Council and under the Federally-Implemented Fishery Management Plans.

Species	**Life Stage Ecotype**	**EFH**	**Potential for EFH within ODMDS**
Cobia Greatest abundance in NC-FL	eggs larvae postlarvae/juv adults	pelagic estuarine & shelf estuarine & shelf coastal & shelf	Yes Yes Yes Yes
Dolphin Greatest abundance in NC-FL	larvae postlarvae/juv adults	epipelagic, Sargassum epipelagic, Sargassm epipelagic	Yes Yes Yes
Golden crab Greatest abundance in NC-FL	adults	mud, dead coral, pebble; 367-549m	No
Spiny lobster Greatest abundance in FL	larvae juvenile adults	planktonic sponge, algae, coral, hardbottom sponge, algae, coral, hardbottom, crevices	Yes Yes Yes
Coral Greatest abundance in FL	all stages		Yes
Albacore tuna	adult	Blake Plateau & Spur Area(FL),>100m	Yes
Atlantic bigeye tuna	juvenile/adult	Blake Plateau & Spur Area(FL),>100m	Yes
Atlantic bluefin tuna	eggs/larvae juve/subadult adult	nearshore to 200 m isobath nearshore, south of 27N Blake Plateau & nearshore to 200m	Yes Yes Yes
Atlantic skipjack tuna	eggs/larvae juvenile to adult	south of 28.25N, 200m to EEZ 25-200m isobath	No Yes
Atlantic yellowfin tuna	eggs/larvae juvenile to adult	south of 28.25N, 200m to EEZ north of 31N, 500-2000m isobath; Blake Plateau	No No
Swordfish	eggs/larvae juvenile to subadult adult	south of Hatteras, 200m to EEZ south of 31.5N, 25-2000m& south of 29N from 100m-EEZ 100-2000m isobath	No Yes Yes

Table 1. Essential Fish Habitat (EFH) Species for Marine Waters Managed by the South Atlantic Fishery Management Council and under the Federally-Implemented Fishery Management Plans.			
Species	**Life Stage Ecotype**	**EFH**	**Potential for EFH within ODMDS**
Blue marlin	eggs/larvae juvenile adult	south of 29.5N, 100m-EEZ south of 30N, 200-2000m south of 29.5N, 100m to 50mi	Yes No Yes
White marlin	juvenile adult	north of 25.225N, 200-2000m north of 33.75N, 200-2000m; Charleston Bump; south of 29N, 200m-EEZ	No No No
Sailfish	eggs/larvae juvenile adult	south of 28.25N, 5 mi offshore-EEZ south of 32N, 5-125 mi offshore south of 36N, 5-125mi offshore	No No No
Longbill spearfish	juvenile adults	36.5-35N, 200m-EEZ Charleston Bump	No No
White shark	juvenile	28-29.5N, 25-100m	No
Bignose shark	juvenile	north of 32N & south of 30N, 100-500m	Yes
Caribbean reef shark		<25 m off Miami & Cape Canaveral	No
Night shark	juvenile adult	north of 33.5N, 100-2000m 36-25.5N, 100m-EEZ/100mi/2000m	No Yes
Silky shark	juvenile	25m(FL) or 100m-2000m	Yes
Longfin mako shark	all stages	north of 35N, 110m-EEZ; 35N-28.25N, 100-500m; south of 28.25N, 200m-EEZ	No
Shortfin mako shark	all stages	north of Onslow Bay, NC, 25-200m	No
Blue shark	late juvenile/adult	north of 35N, 25m-EEZ	No
Oceanic whitetip shark	early juvenile late juvenile adult	Charleston Bump 26-32N, 200m-EEZ 30-36N, 200m-EEZ	No No No
Bigeye thresher shark	all stages	34-36.5N, 200-2000m	No
Great hammerhead shark	juvenile/adult	coastal waters to 100m, south of 30N	No

Table 1. Essential Fish Habitat (EFH) Species for Marine Waters Managed by the South Atlantic Fishery Management Council and under the Federally-Implemented Fishery Management Plans.

Species	**Life Stage Ecotype**	**EFH**	**Potential for EFH within ODMDS**
Nurse shark	juvenile/adult	south of 30.5N, shoreline to 25m	No
Blacktip shark	juvenile adult	north of 28.5N, coastal to 25m Outer Banks, NC, shore to 200m; 28.5N-30N, coastal-50m	No No
Bull shark	juvenile	south of 32N, inlets, estuaries, waters<25m FL	No
Lemon shark	juvenile adult	Bulls Bay, SC-28N & south of 25.5N, inlets, estuaries, waters<25m 30-31N & south of 27N, inlets, estuaries, waters<25m	No No
Blacknose shark	juvenile adult	SC-Cape Canaveral to 25m St. Augustine to Canaveral, FL <25m	No No
Finetooth shark	all stages	30-33N, coastal waters to 25m	No
Scalloped hammerhead shark	juvenile adult	shoreline to 200m north of 28N, 25-200m	Yes No
Dusky shark	juvenile adults	north of 33N & south of 30N, inlets, estuaries, waters <200m north of 28N, 25-200m	Yes No
Sandbar shark	juvenile adults	north of 27.5N, coastal waters to 25m coastal waters to 25m	No No
Spinner shark	early juvenile juvenile/adult	south of 32.25N, coastal waters- 25m 30.7-28.5N, coastal waters-200m	No No
Tiger shark	early juvenile late juvenile adults	north of Cape Canaveral, coastal-200m shore-100m, except GA to Cape Lookout where EFH is 25-100m north of Ft. Lauderdale, coastal-Gulf Stream	No No Yes
Sand tiger shark	juvenile adults	north of Cape Canaveral, coastal-25m St. Augustine to Cape Canaveral, coastal to 25m	No No

Table 1. Essential Fish Habitat (EFH) Species for Marine Waters Managed by the South Atlantic Fishery Management Council and under the Federally-Implemented Fishery Management Plans.

Species	Life Stage Ecotype	EFH	Potential for EFH within ODMDS
Bonnethead shark	juvenile	Cape Fear to W. Palm Beach, inlets, estuaries & waters<25m	No
	adults	Cape Fear to W. Palm Beach, inlets, estuaries & shallow coastal waters	No
Atlantic sharpnose shark	juvenile	Daytona Beach-Cape Hatteras, bays & waters to 25m	No
	adult	NC& St. Augustine-C. Canaveral, to 100m	No

Source: Essential Fish Habitat: A Marine Fish Habitat Conservation Mandate for Federal Agencies, NMFS, St. Petersburg, FL, October 2000.

2.2 Essential Fish Habitat and Habitat Areas of Concern

Table 2 shows the categories of Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC) for managed species which were identified in the Fishery Management Plan Amendments of the South Atlantic Fishery Management Council and the NMFS and which may occur in marine waters of the southeastern states.

Table 2: Categories of Essential Fish Habitat and Habitat Areas of Concern in Southeastern States.

ESSENTIAL FISH HABITAT - MARINE AREAS	**Potentially present in vicinity of ODMDS**
Artificial / Manmade Reefs	Yes
Coral & Coral Reefs	Yes
Live / Hard Bottoms	Yes
Sargassum	Yes
Water Column	Yes
GEOGRAPHICALLY DEFINED HABITAT AREAS OF PARTICULAR CONCERN	
Area Wide	
Council-designated Artificial Reef Special Management Zones	No
Hermatypic (reef-forming) Coral Habitat & Reefs	Yes

ESSENTIAL FISH HABITAT - MARINE AREAS	Potentially present in vicinity of ODMDS
Hard Bottoms	Yes
Hoyt Hills	No
Sargassum habitat	Yes
State-designated areas of importance to managed species	No
Submerged aquatic vegetation	No
Florida	
Blake Plateau (manganese outcroppings)	No
Biscayne Bay	No
Biscayne National Park	No
Card Sound	No
Florida Bay	No
Florida Keys National Marine Sanctuary	No
Jupiter Inlet Point	No
Mangrove Habitat	No
Marathon Hump	No
Oculina Bank	No
Phragmatopoma (worm) reefs	No
The Wall (Florida Keys)	No

Source: Essential Fish Habitat: A Marine Fish Habitat Conservation Mandate for Federal Agencies, NMFS, St. Petersburg, FL, October 2000.

2.3 Fishery Resources in vicinity of the Palm Beach Harbor ODMDS

Based on the information provided in Tables 1 and 2 above, the following managed species and EFH warrant further discussion:

- Penaied Shrimp (larvae)
- Rock Shrimp
- Royal Red Shrimp
- Red Drum
- Snapper-Grouper Complex
- Highly and Coastal Migratory Species
- Spiny Lobster
- Coral and Coral Reefs and Live/Hard Bottom
- Artificial Reefs

- Sargassum
- Water Column

2.3.1 Penaied Shrimp (larvae)

White Shrimp range from Fire Island, New York to St. Lucie Inlet, Florida. White shrimp are generally concentrated in water of 27 meters or less, although occasionally found much deeper, up to 270ft. (SAFM,C 1998) The proposed Palm Beach Harbor ODMDS is south and deeper than this range.

Brown shrimp range from Massachusetts to Key West, Florida. The species may occur in commercial quantities in waters as deep as 110 meters, but they are most abundant in waters less than 55 meters. (SAFMC, 1998) These ranges are inshore of the proposed Palm Beach Harbor ODMDS.

Pink shrimp range from Chesapeake Bay to the Florida keys and around into the Gulf of Mexico. Pink shrimp are common in the estuaries and shallow marine waters surrounding southern Florida and within the Dry Tortugas shrimping grounds and Florida Bay. Adult pink shrimp congregate in deep water off the Dry Tortugas to spawn. One route larvae take to estuarine nursery areas is by way of the Florida Current. The larvae are swept soutwesterly into the Florida Current by way of the Loop Current and are carried northeasterly along the outer edge of the Florida Reef Tract or of east coast of Florida. Larval periods for pink shrimp are in the order of 15-25 days. (SAFMC, 1998) The potential exists for Pink shrimp larvae to be transported in the water column through the proposed Palm Beach Harbor ODMDS. The offshore waters are considered habitat for larval shrimp. No essential fish habitat-habitat areas of particular concern in the project area have been identified. Replicate trawl samples were collected at three stations at the proposed site (CSA, 1989). Only two individuals from the family Peneaidae were collected.

2.3.2 Rock Shrimp

The center of abundance and the concentrated commercial fishery for rock shrimp in the south Atlantic region occurs off northeast Florida to Jupiter Inlet which lies north of the proposed Palm Beach Harbor ODMDS. Essential fish habitat for rock shrimp consists of offshore terrigenous and biogenic sand bottom habitats from 18 to 182 meters in depth with highest concentrations occurring between 34 and 55 meters. (SAFMC, 1998). The proposed Palm Beach Harbor ODMDS lies in 160 to 190 meters of water near the deeper limits of the rock shrimp habitat. No essential fish habitat-habitat areas of particular concern in the project area have been identified.

2.3.3 Royal Red Shrimp

Royal red shrimp are found in large concentrations in the South Atlantic primarily offshore northeast Florida. They inhabit the upper regions of the continental slope from 180 to 730 meters, with concentrations usually found at depths between 250 and 475 meters over blue/black mud, sand, muddy sand, or white calcareous mud. These areas are considered EFH for royal red shrimp as well as the Gulf Stream as it provides a mechanism to disperse larvae. (SAFMC, 1998) The proposed Palm Beach Harbor ODMDS lies near the shallower limits of the royal red shrimp habitat.

2.3.4 Red Drum

For red drum, EFH includes habitats to a depth of 50 meters offshore (SAFMC, 1998). The proposed Palm Beach Harbor ODMDS lies far beyond the 50 meter contour. No essential fish habitat-habitat areas of particular concern in the project area have been identified.

2.3.5 Snapper Grouper Complex

The SAFMC Snapper-Grouper Management Unit consists of 73 species from 10 families (SAFMC 1983; 1998a). Members of this management unit inhabit reefs and hard bottom areas as adults and are very important components of commercial and recreational fisheries of the area. Because of their affinity for hard bottom and reefs, members of the Snapper-Grouper Management Unit are collectively referred to as reef fishes. Although snappers (Lutjanidae) and groupers (Serranidae) are the most valuable members of the group, species from other families including grunts (Haemulidae), jacks (Carangidae), porgies (Sparidae), spadefishes (Ephippidae), temperate basses (Percichthyidae), tilefishes (Malacanthidae), triggerfishes (Balistidae), and wrasses (Labridae) are also represented. In deeper waters of the ODMDS, species such as snowy grouper, yellowedge grouper, Warsaw grouper, scamp, and blackfin snapper will associate with hard substrates (SAFMC, 1998). Figures 2 and 3 show the deep reef fish habitat range.

Not strictly a reef species, tilefish will occur in water depths of the ODMDS where the substrate is muddy or clayey. Golden tilefish inhabits the outer continental shelf and upper continental slope along the entire east coast of the U.S. It is a bottom dweller, living in burrows of clay substrate at depths from 76 to 457 meters. Blueline tilefish occurs from Virginia to Mexico in water depths between 68 and 236 meters. The species frequents irregular bottom comprised of troughs and terraces inter-mingled with sand, mud, or shall hash bottom along the continental shelf break. Tilefish are epibenthic browsers, often feeding upon crabs, shrimps, snails, worms, sea urchins, and fish (SAFMC, 1998). Tilefish habitat range is shown in figures 2 and 3.

Most reef fishes (and invertebrates) have a two-phase life cycle that greatly influences habitat use by individuals throughout their development. The early phase of the life cycle consists of planktonic or demersal eggs and planktonic larvae capable of considerable spatial transport by currents, tides, and winds. This transport can be advective or retentive. The second phase begins when larvae settle to the seafloor and begin life as benthic juveniles inhabiting shallow water habitats such as patch reefs, seagrass beds, mangroves, and other structurally complex features. As these young individuals grow, they gradually migrate offshore to adult habitat where they develop to maturity.(SAFMC, 1998)

There are 19 economically important species of reef fish in the deepwater (100-300m) which is where the proposed Palm Beach Harbor ODMDS is located. The five species that make up over 97% of the catch by weight are tilefish, snowy grouper, yellow grouper and warsaw grouper. EFH for these species include coral reefs, live/hard bottom, submerged aquatic vegetation, artificial reefs and medium to high profile outcroppings. EFH includes the spawning area above the adult habitat and the additional pelagic environment, including Sargasum, required for larval survival and growth up to and including settlement. In addition, the Gulf Stream is an essential fish habitat because it provides a mechanism to disperse snapper grouper larvae. Areas which meet the criteria for essential fish habitat-habitat areas of particular concern in the vicinity of the proposed ODMDS include medium to high profile offshore hardbottoms where spawning normally occurs; Sargassum; and all hermatypic coral habitats and reefs. (SAFMC, 1998)

2.3.6 Highly Migratory and Coastal Migratory Species

Highly migratory species typically range throughout the open ocean, however, many species move inshore, including coastal estuaries, at some time during their life cycles. Associations with particular bottom types are undefined. Tuna and swordfish distributions are most frequently associated with hydrographic features such as density fronts between different water masses (edge of Florida Current). *Sargassum* is important habitat for various life stages of the swordfish and tunas. (NMFS, 1999)

The habitat of adults in the coastal pelagic management unit, except dolphin, is the coastal waters out to the edge of the continental shelf (SAFMC, 1998). The proposed ODMDS lies beyond the continental shelf. EFH in the vicinity of the proposed ODMDS includes Sargassum and the Gulf Stream. The Gulf Stream is EFH as it provides a mechanism to disperse larvae. Many Dolphin prey are associated with Sargassum, and most of the fishes that were found associated with Sargassum in the Florida Current are eaten by dolphin. (SAFMC, 1998)

2.3.7 Spiny Lobster

EFH in the vicinity of the proposed ODMDS for the spiny lobster includes oceanic waters, soft sediments, coral and live/hard bottom habitat, and the Gulf Stream as it provides a mechanism to disperse spiny lobster larvae. Areas which meet the criteria for habitat areas of particular concern for the spiny lobster in the vicinity of the proposed ODMDS include coral/hard bottom habitat. (SAFMC, 1998)

2.3.8 Coral, Coral Reefs and Live/Hard Bottom Habitat

Shallow water (<200m) species include octocorallia (sea fans, sea whips, etc), milleporina and scleractinaia (fire corals, stinging corals, and stony corals), and antipatharia (black corals). EFH for hermatypic stony corals includes rough, hard, exposed, stable substrate from Palm Beach County south through the Florida reef tract in subtidal to 30 meter depth contour. The proposed ODMDS is much deeper than this range. EFH for ahermatypic stony corals, which are not light restricted, extends to outer shelf depths (SAFMC, 1998). EFH for black corals includes rough, hard, exposed, stable substrate, offshore in high salinity waters in depths exceeding 18 meters. EFH for octocorals includes rough, hard, exposed, stable substrate in subtidal to outer shelf depths within a wide range of salinity and light penetration. (SAFMC, 1998)

Areas which meet the criteria for EFH-habitat areas of particular concern for coral, coral reefs, and live/hard bottom in the vicinity of the proposed ODMDS include offshore (5 to 30 meter) hard bottom off the east coast of Florida from Palm Beach County to Fowey Rocks (SAFMC, 1998). This is considerably shallower and inshore of the proposed ODMDS.

The classic reef distribution pattern described for southeast Florida reefs north of Key Biscayne consists of an inner reef in approximately 15 to 25 ft (5 to 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 to 100 ft (18 to 30 m) of water. 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).

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. The 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 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 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 proposed ODMDS for Palm Beach Harbor (around 26°45'N and 79°59'W) (Reed, 1980) [see Figure 3]. Colonies of *Oculina* in general extend north from Palm Beach and parallel the break between the edge of the continental shelf and the Florida-Hatteras slope, which parallels the 80W meridian. The *Oculina* reefs occur approximately 1.7 nmi (3.2 km) west of the proposed ODMDS for Palm Beach Harbor.

The regional hardbottom habitat and locations of hard bottom natural reefs in the project vicinity is shown in Figure 3. A video survey of the proposed ODMDS was conducted by Continental Shelf and Associates in 1988. The video survey covered an area including the proposed ODMDS, one half mile to the north, one half mile to the south and one mile to the west. One transect running along the western boundary of the proposed ODMDS extended an additional 2 miles north and 2 miles south. North/south transects were spaced at 2,000 feet. Videocamera observations across the site showed the bottom consisted of fine-grained sediment with no visible exposed rock or outcrops. The near-bottom water was turbid, and visibility was generally less than 1 meter. There was a significant amount of bioturbation, including small holes, burrows, depressions, and mounds. Low numbers of epifauna, including sea pens, anemones, sand dollars, crabs, and unidentified fish were observed during the survey. (CSA, 1989)

Due to the limited coverage of the video survey, EPA conducted a sidescan sonar survey of the proposed Palm Beach Harbor ODMDS as well as alternative ocean sites in 1998. Sidescan sonar data was collected along north/south transects spaced at 250 meters at a speed of three knotts. A range of 250 meters was utilized providing 100% overlap (200% coverage). These settings provided a transverse resolution of 1 meter. 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). Transects extended two miles to the north and south of the site one half mile to the east and 1.5 miles to the west. Benthic photography for ground-truthing was unsuccessful due to high currents. Grab samples were collected to ground-truth the general characteristics of the bottom. A mosaic of the survey is shown in figure 4. Note, although data gaps are shown in the mosaic, data was recorded in both electronic and on thermal paper. Frequent digitizing system crashes caused data gaps in the electronic data. Full coverage was recorded on thermal paper and analyzed. The side scan sonar data indicated a relatively uniform fine sandy bottom throughout the site and areas two miles to the north and two miles to the south. Grab samples showed sediments to consist of a grey silty fine sand with shell fragments. The mean grain size for the area ranged from 0.14 to 0.17mm with 25 to 35 percent silts and clays. No areas of potential hard bottom or wrecks were identified through the side scan sonar record within the site or north or south of the site. An area approximately 1.5 nautical miles to the west of the site showed acoustical returns representative of scattered patches of low relief hard bottom (EPA, 2000). Low relief hard bottom is characterized as not having sufficient relief to cause a shadow in the sidescan record but providing a strong sonar return, but has typically been characterized as less than 2 feet. Therefore an associated height of the objects cannot be determined. This documents that hard bottom areas were detectible with the employed methodology.

<u>2.3.9 Artificial Reefs</u>

The species most often present on artificial reefs are predominately the adult and/or sub-adult stages of virtually all species within the Snapper-Grouper complex, as well as all species managed within the Coastal Migratory Pelagics. Red drum and spiny lobster, as well as some of the managed shrimp species may be found on and around specific reefs at different times of the year, depending on the exact location and design of the reef. (SAFMC, 1998)

There are several documented artificial reefs located in the vicinity of the proposed site for Palm Beach Harbor (Palm Beach County, undated). Table 3 provides amplifying information on artificial reefs in the vicinity (within 10 miles) of the proposed Palm Beach Harbor ODMDS. One cluster of two artificial reef sites is located 2.0 nmi (3.7 km) west of the western edge of the proposed ODMDS. Another cluster of four sites is located 3 nmi (5.5 km) west of the western edge. A third cluster of six sites is 4 nmi (7.4 km) west of the western edge.

Table 3: Artificial Reefs in Vicinity of the proposed Palm Beach Harbor ODMDS

Name	**Latitude**	**Longitude**	**Depth (ft)**	**Distance to Proposed ODMDS (mi)**	**Composition**
Classic Barge	26˚47.42'N	79˚59.10'W	275	2.6	Barge
Classic Barge	26˚47.30'N	79˚59.38'W	235	2.9	Barge
Princess Anne	80˚00.22'W	80˚00.22'W	98	3.8	Ferry
Playground	79˚59.79'W	79˚59.79'W	130-150	3.3	Concrete
Spearman's	26˚47.59'N	80˚00.35'W	70	4.0	Barge
Murphy's	26˚48.13'N	80˚01.10'W	75	4.8	Barge
Research	26˚47.36'N	80˚01.00'W	70	4.6	Barges,
Amaryllis	80˚00.96'W	80˚00.96'W	80	4.6	Freighter
Mizpah/PC11	26˚47.18'N	80˚00.96'W	80	4.5	Vessels
EIDSVAG/Barge/ Rolls Royce	26˚46.02'N	80˚00.50'W	80	4.2	Vessels, car
Cross Current	26˚45.69'N	80˚01.26'W	60	5.1	Barge, rock
TSO Paradise	80˚01.29'W	80˚01.29'W	60	5.1	Yacht
Tri-County	26˚45.78'N	80˚01.29'W	60	5.1	Concrete
PEP Reef	80˚01.73'W	80˚01.73'W	25-27	9.0	Modules
M/V Jed	26˚47.28'N	79˚59.54'W	N/A	3.1	Ship

Palm Beach County Dept. of Env. Resource Mgmt. Artificial Reef Program Brochure, n.d. Palm Beach County website, 2002.

2.3.10 Sargassum

Throughout the world's tropical and temperate oceans, there are many species of brown algae of the genus *Sargassu*m. Typically, *Sargassum* is brushy with a highly branched thallus or stem sporting many leaf-like blades. It also has small, bladder-like pnuematocysts providing the algae with its buoyant nature. Although they can reach up to several meters in length, they are typically much shorter. *Sargassum* circulates between 20˚ and 40˚ N latitude and 30˚ W longitude and the western edge of the Florida Current/ Gulf Stream. The proposed ODMDS falls within this range. The greatest concentrations are found within the North Atlantic Central Gyre in the Sargasso Sea. *Sargassum* mats often float in linear patches created by forcing winds or shear currents along frontal boundaries. (SAFMC, 1998)

Sargassum supports a diverse marine community including micro- and macro-epiphytes, fungi, more than 100 species of invertebrates, over 100 species of fishes and four species of sea turtles. Some organisms, unique to *Sargassum* habitats, have evolved unique shapes and coloration to take advantage of the additional camouflage among the algal mats. Others use the habitat for protection from predators and/or foraging. Community structures are variable and are influenced by the season, geographic location and algal "age." (SAFMC, 1998)

2.3.11 Water Column

The marine water column is defined as the open water (ocean) environment. It extends vertically from the ocean bottom to the water surface. That portion of the study area that contains marine water or open water habitat includes the water column area proposed for ODMDS designation.

The water column provides habitat for phytoplankton to carry out the processes of primary production. Zooplankton also utilizes the water column as habitat thus creating the foundation of the ocean food web and ecosystem. Some benthic invertebrates filter the surrounding water to collect food particles that are suspended within the water column. Higher vertebrates, such as fishes, marine mammals, and sea turtles use the water column for foraging, migration as well as spawning and breeding.

3.0 EFH IMPACTS

3.1 Overview of Dredged Material Disposal

Impacts related to the ocean disposal of dredged material are confined mainly to temporary water column impacts and longer term benthic impacts.

3.1.1 Water Column Impacts

Water quality impacts of concern with regard to dredged material disposal include those associated with increased turbidity, decreased dissolved oxygen levels, and the release of sediment-bound contaminants. Dredged material disposal typically has a short term (several hours to days) impact on the water column following discharges of solids and solutes from a barge (e.g., Gordon 1974). The greatest proportion of dredged material consists of negatively buoyant solids that sink as a turbid suspension through the water column to the sea floor. Dissolved constituents of dredged material are entrained in the turbulent water associated with the convective descent.

Turbidity plumes were evaluated be the Corps of Engineers at the proposed Palm Beach ODMDS (CERC 1998, CERC 2001). Acoustic Doppler Current Profiler (ADCP) data obtained from the National Oceanographic Data Center (NODC) for a location (26^{o}04.00'N, 80^{o}03.50'W) in the vicinity of the project site was analyzed to determine potential velocity profiles that disposed material might be subject to. The depth at the ADCP deployment site was 110 meters. NODC provided velocity data at 4 meter depth intervals and 20 minute time intervals for the 1995 to 1997 time period. Current profiles with the greatest shore directed currents and highest currents were evaluated (CERC 1998) as well as a typical current profile (CERC, 2001). Under typical conditions the disposal plume is transported to the north and the northeast. Suspended sediment concentrations drop below 10 mg/l within one hour of disposal and less than 2 mg/l within 2 hours. The plume is expected to be transported 4,000 meters (2 nmi) to the north/northeast within the first 2 hours.

Chemically reduced inorganic compounds associated with particles sinking through the upper water column may be oxidized, causing a transient increase in the chemical oxygen demand. Oxidation of labile organic material consequently may reduce dissolved oxygen concentrations in the water. However, because the water column is well oxygenated, offsite impacts are not expected and any onsite impacts should be of short duration.

The significant release of sediment-bound contaminants is not expected. All material proposed for ocean disposal must comply with EPA's Ocean Dumping Criteria (40 CFR 227). Chemical analyses are performed for contaminants that may be released from dredged material in dissolved form and the results are compared against the applicable water quality criteria (40 CFR 227.31) after making allowance for initial mixing. In addition, the material remaining in the water column after mixing has to be shown to be nontoxic through the application of bioassays on appropriate sensitive marine organisms (phytoplankton, zooplankton, crustacean or mollusk and fish species; see 40 CFR 227.27(c)). Initial mixing rates are expected to be greater than 15,000 to 1 (EPA, 2004).

3.1.2 Benthic Impacts

Dredged material disposal at the proposed ODMDS is not expected to result in any significant changes in regional bottom topography or sediment transport processes or adverse environmental impact. Dredged material must undergo whole-sediment bioassays to demonstrate compliance with the Ocean Dumping Criteria (40 CFR 2277) prior to ocean disposal. Bioassays are used to determine the biological availability of and potential for impact of contaminants associated with dredged material. Therefore, no adverse impacts associated with contaminants in the dredged material is anticipated. However, accumulation of dredged material, and associated changes in the sediment characteristics may cause impacts to benthic-dwelling organisms. The grain size of the ambient sediment at the proposed ODMDS consisted of grey silty fine to very fine sand. Dredged material disposed at the proposed ODMDS is likely to be sandier (<10% fines), but could also include finer material as well. As dredged material accumulates on the sea floor, benthic organisms in the area of initial deposition may be impacted. An idealized disposal mound for projects of 50,000 and 500,000 cubic yards of dredged material at the proposed ODMDS under typical conditions is shown in figure 5. Frequencies of disturbance that are more than one year tend to keep the colonizing benthos in an early successional stage while burial frequencies of less than one year allow colonization of higher order successional species (Rhoads et. al. 1978). In situ burial experiments by Nichols et al. (1978) indicated that overburden thickness of 5 to 10 cm did not cause significant mortality to "mud-dwelling" invertebrates as most of these motile infauna could initiate "escape" responses by burrowing upward, while organisms covered with overburdens of 30 cm could not initiate escape responses. The amount bottom expected to be covered by more than 10 cm for a 50,000 and 500,000 cubic yard projects (see figure 5) is expected to be approximately 0.07 nmi^2 (34 acres) and 0.16 nmi^2 (76 acres), respectively. The colonization process of a disposal mound can begin within a few days following cessation of dumping (Germano and Rhoades, 1984). For thin overburden layers (<10cm), buried adults have an upward escape response. The thicker part of the deposit primarily is colonized through larval recruitment or immigration of organisms from adjacent, undisturbed areas. Three phases of macroinfaunal recolonization have been described by Rhoads and Germano (1986): 1) small opportunistic polychaetes; 2) dense aggregations of tubiculous amphipods and tellinid bivalves; and 3) deep burrowing polychaetes, caudate holothurians, infaunal ophiuroids, or burrowing urchins. Larval recruitment and establishment through all stages following disposal can require several years (Rhoads et al., 1978). However, Cruz-Motta and Collins (2004) have documented that tropical soft-bottom macrobenthic assemblages respond quickly (3 months) to the disturbance associated with the dumping of dredged material. They hypothesized that the rapid rates of recovery was driven by migration of organisms from adjacent non-affected patches within the disposal area.

For epifauna, following dredged material disposal, it is likely that relatively motile pelagic megafauna would be most affected by suspended sediments causing displacement through avoidance of, or escape behavior from, the disposal plume. Slow moving epifaunal invertebrates may become buried and smothered as dredged material is deposited, while more motile benthic taxa may be displaced as a result of escape response. Recovery and recolonization of an impacted area will depend on the frequency and severity of the disturbance and the species involved. Some recovery may occur within hours to days, but full recovery could require a few years. (EPA, 1993)

3.2 Overview of Cumulative Impacts

Cumulative impacts in the vicinity of the proposed ODMDS were discussed in the Draft Environmental Impact Statement for Designation of the Palm Beach Harbor ODMDS and the Port Everglades Harbor ODMDS (EPA, 2004). These included impacts from navigational dredging projects, beach re-nourishment projects, wastewater outfalls, and subsea cable and pipeline projects. Of these, only the subsea pipeline projects and the navigation projects which would utilize the ODMDS are likely to have impacts to the EFH potentially impacted by this disposal site designation. In addition, other ODMDS are likely to have similar impacts.

3.2.1 Ocean Express Pipeline Project

According the Ocean Express Pipeline Project Final EIS (FERC, 2003), impacts to offshore and hardbottom habitat include:

- Sargassum: adverse impact unlikely
- Coral/Hardbottom Habitat:
    - 2.91 acres of hardbottom transition areas affected by construction. Transition areas consist of sand/rubble and/or low or no relief hardbottom with sand veneer.
    - Direct and indirect impacts to coral reefs in area resulting from increased turbidity and sedimentation.
- Pelagic species:
    - temporary localized disturbance of feeding and spawning activity
    - lethal and sublethal effects to eggs, larvae, juveniles and sub-adults
- Demersal species:
    - limited deposition of suspended sediments could smother eggs and larvae

3.2.2 Tractebel Calypso Pipeline Project

According to the Tractebel Calypos Pipeline Project Final EIS (FERC, 2004) impacts to offshore and hardbottom habitat include:

- 7.7 acres of direct impacts in federal waters (water depths greater than 585 feet) to seafloor
  - hardbottom respresent 16% of substrate
- 0.5 acres of direct impacts to state waters from water depth 200 feet to 585 feet.
  - 0.2 acres of impact to Crater Zone/White Cerianthid Zone
  - less than 0.1 acres of direct impacts to hardbottom
- minimal impacts to black corals or other significant solitary features
- minimal impacts to fish
  - short term displacement
  - potential creation of habitat (pipeline)

3.2.3 Port Everglades Harbor Deepening Project

A feasibility study is currently underway for improving the Federal navigation project at Port Everglades Harbor. The project has not been approved so no firm dredged material volumes are available. It is expected that total dredged material volumes from the project could exceed 5 million cubic yards. However, a significant portion of the dredged material could be used beneficially or be suitable for disposal alternatives other than ocean disposal. It is expected that some of the material will likely need to be disposed at the proposed Port Everglades Harbor ODMDS. Impacts from ocean disposal would be similar to that as described in Section 3.1 with the exception of the total seafloor area to be impacted. This will be a function of the total volume of material that needs to be disposed at the ODMDS.

3.2.4 Palm Beach Harbor Construction

Up to 1,000,000 cubic yards of dredged material may result from dredging from a proposed construction dredging project at Palm Beach Harbor. This proposed construction dredging has been proposed at the recommendation of a recent reconnaissance study by the COE which stated that deepening of the existing Federal project at Palm Beach Harbor was justified. The COE will perform a feasibility study to examine the plan in greater detail and evaluate disposal alternatives. Impacts from ocean disposal would be similar to that as described in Section 3.1 with the exception of the total seafloor area to be impacted. This will be a function of the total volume of material that needs to be disposed at the ODMDS.

3.2.4 Other Ocean Dredged Material Disposal Sites

Other ODMDSs in southeast Florida off the continental shelf include the Miami ODMDS and the proposed Port Everglades Harbor ODMDS. Monitoring following disposal from the Miami Harbor Deepening Project at the Miami ODMDS showed a shift in grain size at the site to a coarser material (Collins and Pruitt, 2001). The median grain size of native sediments was in the range of 0.01 mm to 0.04 mm. Following disposal, the median grain size increased to the 0.05 to 0.1 mm range. Impacts at the Port Everglades Harbor ODMDS are expected to be similar to that described in Section 3.1. All sites are designed to limit impacts to the area within the ODMDS boundaries. The actual extent of impact will mostly depend on the volume of the disposal project. Of the three sites, Miami is expected to receive the most material.

3.3 Effects of Site Designation on EFH

As discussed in Section 1.1, disposal site designation does not itself allow ocean disposal of dredged material. The transportation of dredged material for the purpose of disposal into ocean waters (ie. the actual use of the designated site) is permitted by the Corps of Engineers (COE) or authorized in the case of federal Civil Works navigation projects under Section 103 of the MPRSA. Therefore, the evaluation of potential effects is limited to "typical" disposal site use. Effects of activities beyond the scope of this evaluation (ie. large new work projects and projects greater than 500,000 cubic yards) should be evaluated separately.

Based on the discussion in section 2.3 above, effects on the habitats of following managed species will be addressed:

- Royal Red Shrimp
- Snapper Grouper Complex
    - Snowy Grouper
    - Yellowedge Grouper
    - Warsaw Grouper
    - Scamp
    - Blackfin Snapper
    - Golden Tilefish
    - Blueline Tilefish
- Highly and Coastal Migratory Species
- Spiny Lobster
- Coral, Coral Reefs, and Live/Hard Bottom Habitat
- Sargassum

3.3.1 Royal Red Shrimp

As noted in Section 2.3.3, the proposed ODMDS lies within the shallower limit of the royal red shrimp habitat. Concentrations are typically found much deeper than the proposed ODMDS. Dredged material disposal is likely to change the sediment characteristics at the proposed site to a sandier bottom and result in burial or displacement of existing ocean bottom. Changes to a sandier bottom is not expected to adversely affect the royal red shrimp habitat if present as the shrimp can utilize a variety of bottom types including muddy sand or sand (see Section 2.3.3). Recovery and recolonization from burial will likely occur (see Section 3.1.2). Whole sediment testing and evaluation of dredged material prior disposal will insure that no adverse impacts to benthic communities occur.

Royal red shrimp larvae utilize the Gulf Stream. Adverse impacts are not expected as dredged material must undergo liquid and suspended phase toxicity testing and must meet the applicable water quality criteria (see Section 3.1.1).

3.3.2 Snowy Grouper, Yellowedge Grouper, Warsaw Grouper, Scamp and Blackfin Snapper

EFH for these species include coral reefs, live/hard bottom, submerged aquatic vegetation, artificial reefs and medium to high profile outcroppings. EFH includes the spawning area above the adult habitat and the additional pelagic environment, including Sargassum, required for larval survival and growth up to and including settlement. In addition, the Gulf Stream is an essential fish habitat because it provides a mechanism to disperse snapper grouper larvae. Areas which meet the criteria for essential fish habitat-habitat areas of particular concern in the vicinity of the proposed ODMDS include medium to high profile offshore hardbottoms where spawning normally occurs; Sargassum; and all hermatypic coral habitats and reefs. (SAFMC, 1998)

Two 3 meter beam trawl samples (10 minutes at 2-3 knotts) were conducted at three stations at the proposed ODMDS in 1988. No species from the snapper-grouper complex were collected. (CSA, 1989) Benthic surveys conducted at the site are described in Section 2.3.8. The surveys indicate that there exists little potential for coral reefs, live/hard bottom, submerged aquatic vegetation, artificial reefs or medium to high profile outcroppings within or adjacent to the proposed ODMDS. Therefore these categories of EFH are not expected to be affected by site designation. Adverse impacts are not expected to the Gulf Stream as dredged material must undergo liquid and suspended phase toxicity testing and must meet the applicable water quality criteria (see Section 3.1.1). Impacts to Sargassum are also not expected. Dredged material is discharged below the surface from the bottom of a barge or hopper barge which typically have drafts greater than 10 feet. Due to the suspended sediment load, the discharge plume is denser than water and mostly remains below the surface (Tsai et al., 1992).

3.3.3 Golden Tilefish

According to Grimes et. al. (1986), "Golden tilefish are shelter seeking and inhabit three more or less distinct habitats: (1) horizontal excavations in clay outcrops along the walls of submarine canyons (pueblo habitats); (2) scour depressions under rocks and boulders and ; (3) the primary habitat, funnel-shaped vertical burrows in horizontal clay substrates." The two critical habitat requirements are relatively warm stable bottom temperatures in the range of 9 to 14^{o} C and the availability of shelter or malleable substrate from which to construct shelter. (Grimes, et. al., 1986). Golden tilefish inhabits the outer continental shelf and upper continental slope along the entire east coast of the U.S. living at depths from 76 to 457 meters. (SAFMC, 1998). A deepwater survey off of Fort Lauderdale, FL for the proposed Tractebel Calypso Pipeline identified a zone characterized by distinctive craters, often exceeding 1 foot in diameter which are thought to have been excavated by tilefish. This zone was located in water depths from about 325 feet to 500 feet (100 to 152 meters) [FERC, 2004].

Bottom temperatures at the proposed ODMDS were measured at 8^{o}C during surveys conducted in April and May of 1998 (EPA, 1999) and at 12^{o} during surveys in February 1988 (CSA, 1989) indicating that temperatures at the proposed ODMDS are within ranges required by tilefish. Pueblo habitats are unlikely based on the surveys conducted at the proposed site (see Section 2.3.8). Samples collected from the proposed ODMDS indicated the material to be sand and silty sand with approximately 18 to 35% of the grains finer than sand (CSA, 1989; EPA, 1999). This appears to contain too much sand and silt for the creation of the funnel-shaped vertical burrows described above. In addition, two 3 meter beam trawl samples (10 minutes at 2-3 knotts) were conducted at three stations at the proposed ODMDS in 1988. No species from the snapper-grouper complex were collected. (CSA, 1989) EPA therefore believes that the proposed ODMDS is not essential fish habitat for the Golden tilefish as it does not contain sufficient malleable substrate from which to construct shelter.

EFH for the Golden tilefish also includes the water column, the Gulf Stream and Sargassum. As discussed in Section 3.3.2 above, adverse impacts to the Gulf Stream and/or Sargassum are not expected.

3.3.4 Blueline Tilefish

As discussed in Section 2.3.5, the Blueline tilefish occurs in water depths between 68 and 236 meters. The species frequent irregular bottom comprised of troughs and terraces inter-mingled with sand, mud, or shell hash bottom along the continental shelf break. Tilefish are epibenthic browsers, often feeding upon crabs, shrimps, snails, worms, sea urchins, and fish. Water temperatures for Blueline tilefish typically range from 15 to 23^{o}C (Parker and Mays, 1998) which is higher than that at the proposed ODMDS (see Section 3.3.3). In addition, two 3 meter beam trawl samples (10 minutes at 2-3 knotts) were conducted at three stations at the proposed ODMDS in 1988. No species from the snapper-grouper complex were collected. (CSA, 1989) EPA therefore believes that the benthos of the proposed ODMDS is not essential fish habitat for the Blueline tilefish as it does not contain trough and terraces typical of their habitat and water temperatures are too cold.

EFH for the Blueline tilefish also includes the water column, the Gulf Stream and Sargassum. As discussed in Section 3.3.2 above, adverse impacts to the Gulf Stream and/or Sargassum are not expected.

3.3.5 Highly Migratory and Coastal Migratory Species

EFH in the vicinity of the proposed ODMDS for highly migratory species is limited to the water column, the Florida Current (Gulf Stream) in particular, and Sargassum. As discussed in Section 3.3.2 above, adverse impacts to the Gulf Stream and/or Sargassum are not expected.

As the proposed ODMDS lies beyond the continental shelf, coastal migratory species EFH in the vicinity of the proposed ODMDS is limited to Dolphin habitat (see Section 2.3.6). The Gulf Stream and Sargassum are considered EFH for Dolphin. As discussed in Section 3.3.2 above, adverse impacts to the Gulf Stream and/or Sargassum are not expected.

3.3.6 Spiny Lobster

As discussed in Section 2.3.7, EFH in the vicinity of the proposed ODMDS for the spiny lobster includes oceanic waters, soft sediments, coral and live/hard bottom habitat, and the Gulf Stream. Areas which meet the criteria for habitat areas of particular concern for the spiny lobster in the vicinity of the proposed ODMDS include coral/hard bottom habitat. Adverse impacts are not expected to the Gulf Stream or oceanic waters as dredged material must undergo liquid and suspended phase toxicity testing and must meet the applicable water quality criteria (see Section 3.1.1). Impacts to the benthos is expected to be of short duration (see Section 3.1.2). Surveys conducted at the site are described in Section 2.3.8. The surveys indicate that there exists little potential for live/hard bottom within or adjacent to the proposed ODMDS. Therefore these categories of EFH are not expected to be affected by site designation.

3.3.7 Coral, Coral Reefs, and Live/Hard Bottom Habitat

As discussed in Section 2.3.8, EFH in the vicinity of the proposed ODMDS for coral, coral reefs and live/hardbottom includes rough, hard, exposed, stable substrate. Surveys conducted at the site are described in Section 2.3.8. The surveys indicate that there exists little potential for coral reefs, live/hard bottom, or medium to high profile outcroppings within or adjacent to the proposed ODMDS. Therefore, no direct impacts to EFH are expected.

Potential indirect effects include transport of disposal plumes shoreward towards the nearshore reefs in less than 30 meters (100ft) of water described in Section 2.3.8. These reefs are located approximately 2.6 nmi (4,800 meters) west of the proposed ODMDS. Oculina reefs have been documented 1.7 nmi (3,150 meters) west of the proposed site. As discussed in Section 3.1.1, the potential for turbidity plumes to reach these areas was evaluated by the Corps of Engineers. Extreme (99 percentile) westerly currents were modeled and silt-clay concentrations were predicted to diminish rapidly to less than 1 mg/l within 1,500 meters of the disposal location. Sand concentrations were predicted to diminish to less 1 mg/l within 2,400 meters (CERC, 1998). As part of the monitoring efforts associated with the Miami ODMDS, which lies approximately a similar distance offshore and has a similar relationship to the Florida current, currents were monitored for exceedence of a 12 cm/sec (1 hour average) shoreward threshold. The 12cm/sec threshold was determined as the velocity necessary to transport plumes to the nearshore reefs (Proni et. al., 1998). Review of more than a years worth of records revealed that the 12cm/sec threshold was exceeded 2.5% of the time. Most of these exceedences were of only short duration (<2hrs) and only 11 exceeded five hours (Proni et. al, 1998). Therefore, EPA believes the potential for indirect effects on the nearshore reefs is minimal.

3.3.8 Sargassum

EFH for Sargassum is simply surface shelf waters and the Gulf Stream (see Section 2.3.10). Adverse impacts are not expected to the surface shelf waters or the Gulf Stream as dredged material must undergo liquid and suspended phase toxicity testing and must meet the applicable water quality criteria (see Section 3.1.1). In addition, surface waters are expected to have the least amount of contact with the disposal plume. Dredged material is discharged below the surface from the bottom of a barge or hopper barge which typically have drafts greater than 10 feet. Due to the suspended sediment load, the discharge plume is denser than water and mostly remains below the surface (Tsai et al., 1992).

4.0 PROPOSED MITIGATION

Direct and indirect effects on the water column and Gulf Stream will be mitigated through adequate testing of the liquid and elutriate phases of the dredged material proposed for disposal at the proposed ODMDS. Direct and indirect effects on the benthos will be mitigated through adequate testing of the solid phase of the dredged material. Testing will assure that site use will present no significant damage to the resources of the marine environment and no unacceptable adverse effect on the marine ecosystem (40 CFR 227.4).

Disposed dredged material areal impact will be limited by utilization of a limited disposal zone (600 foot radius) as specified in the draft SMMP (EPA, 2004). Bathymetric surveys will be utilized following significant disposal events to monitor the extent of the disposal mound. In addition, EPA proposes modify the SMMP to include utilization of sediment profile imaging (SPI) to map the extent of the disposal mound beyond that which is detectable by acoustic measurements. EPA also proposes to include monitoring of the benthic recovery rate utilizing the SPI technique. SPI can be used to identify major changes in grain size and infaunal successional stage (Rhoads and Germano, 1982). As the three southeast Florida ODMDS (Port Everglades Harbor, Palm Beach Harbor and Miami) are of similar depths and under similar current regimes, monitoring may occur at one or more of the ODMDS with the understanding that results are likely to be applicable to all three ODMDSs. Monitoring will likely occur following a major disposal event as minor events (e.g. 50,000 cubic yards) are unlikely to result in measureable impacts. Results would provide information on the areal extent of benthic impact and on the rate of recovery from major disposal events.

5.0 IMPACT SUMMARY AND CONCLUSIONS FOR ESSENTIAL FISH HABITAT

Designation of the Palm Beach Harbor ODMDS may adversely affect essential fish habitat. However, EPA believes that any effect will be minor. Direct and indirect impacts to the water column and benthos will be mitigated through appropriate testing of the dredged material prior to disposal. The greatest potential for impact will likely occur as a result of accumulation of dredged material and associated changes in sediment characteristics that may cause impacts to benthic-dwelling organisms (see Section 3.1.2). EPA proposes to monitor the areal extent of impact and the rate of recovery. The greatest potential of impact due to cumulative impacts are associated with major navigation projects that would utilize the ODMDS (see Section 3.2.3). No new navigation projects are planned at Palm Beach Harbor. However, there are proposals for additional construction for volumes up to 1,000,000 cubic yards. The effect of any future project would be dependent on the volume of material to be disposed at the ODMDS.

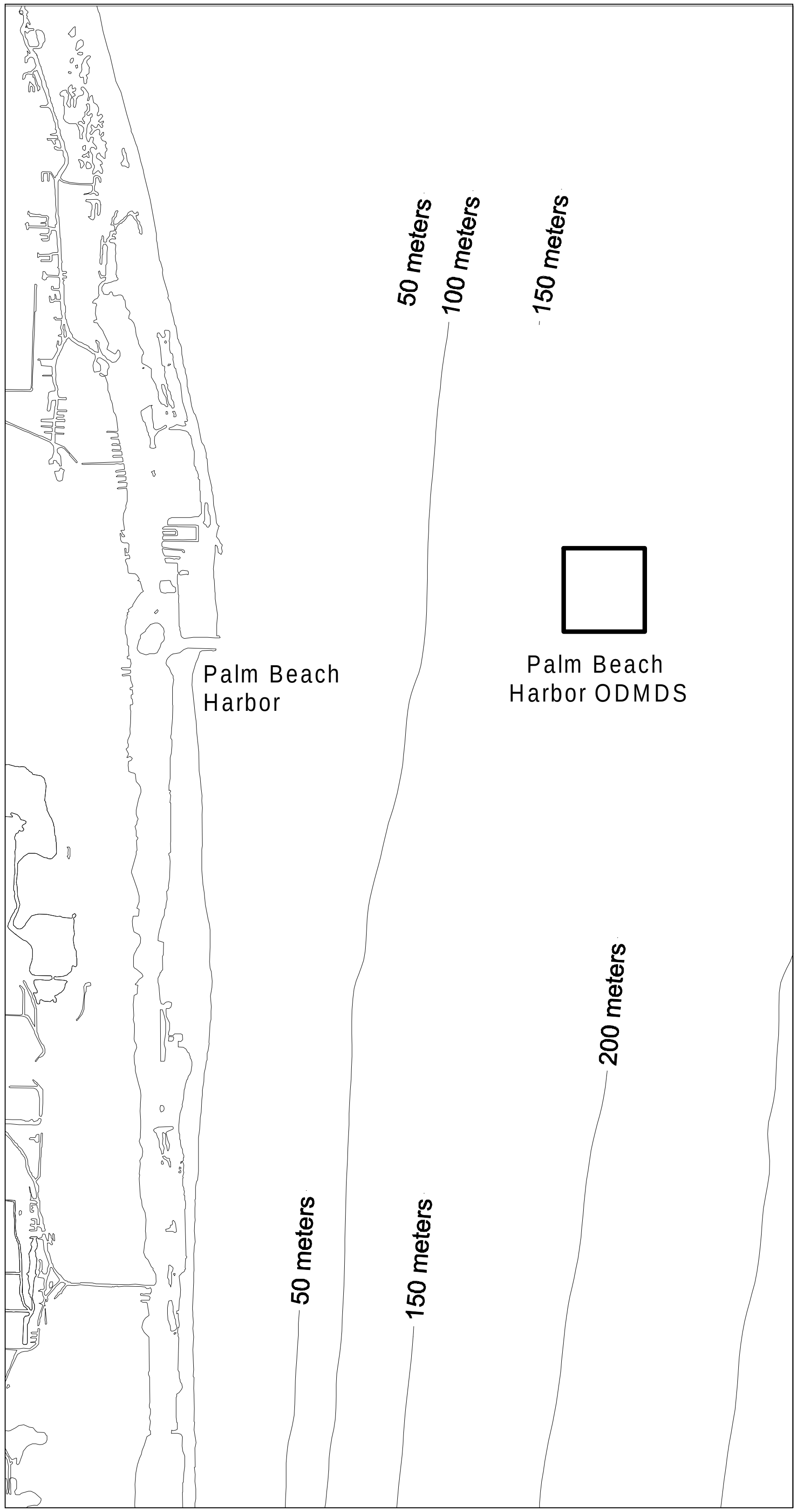

Figure 1: Proposed Palm Beach Harbor ODMDS Location

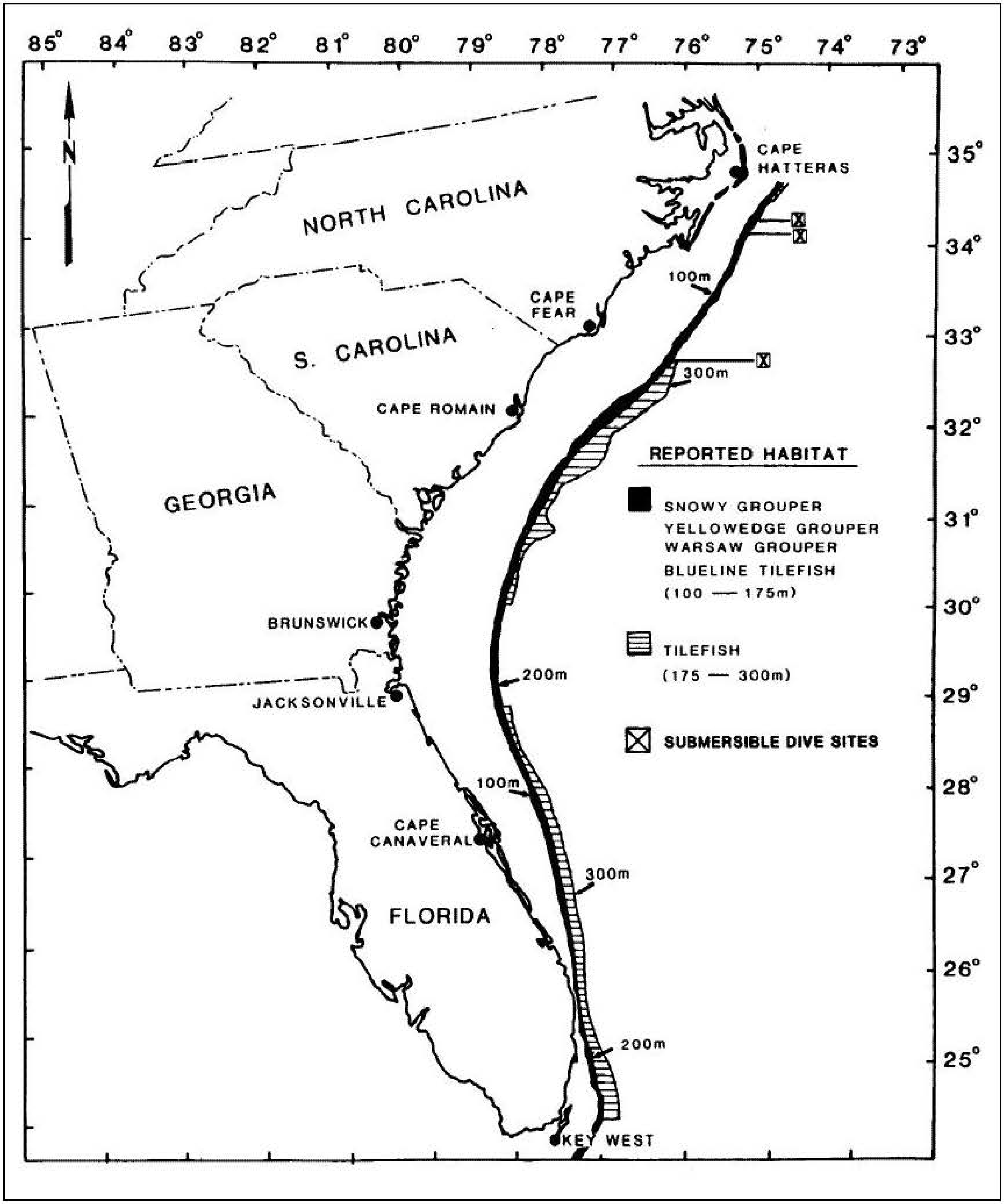

Figure 2: Deepwater reef fish habitat reported by commercial and recreational fisherman (Parker and Mays, 1998)

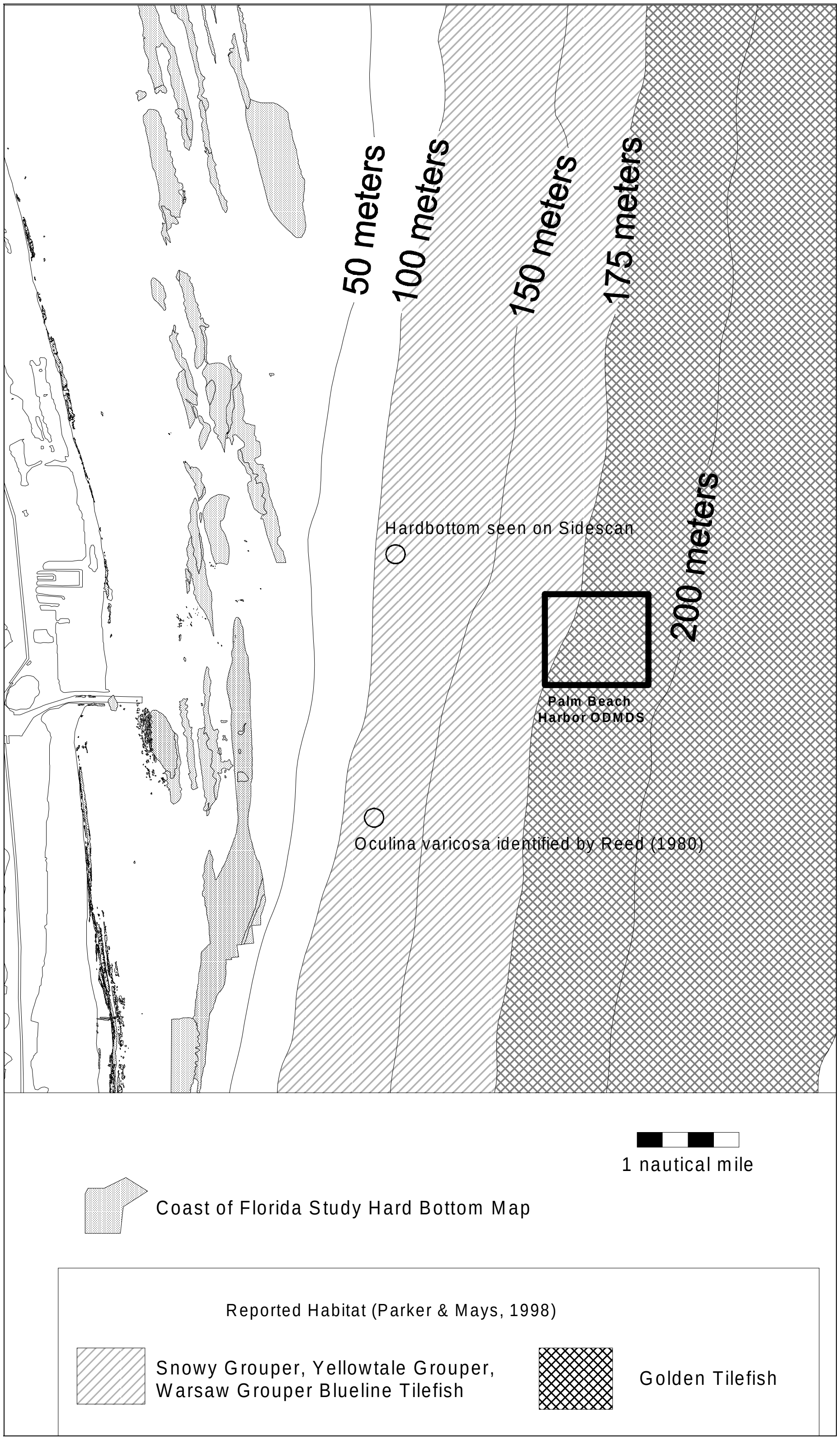

Figure 3: Benthic habitat in vicinity of proposed Palm Beach Harbor ODMDS

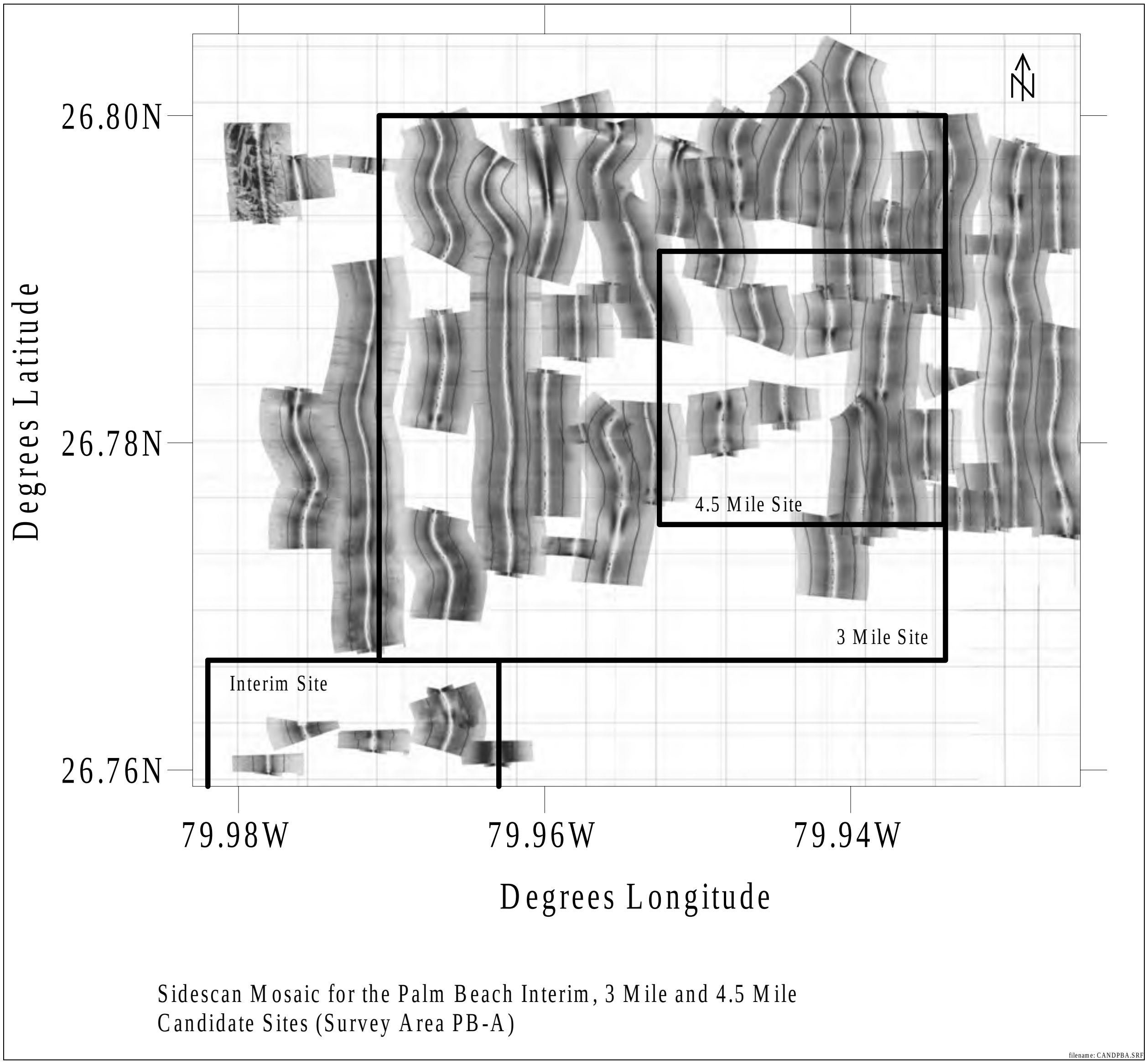

Figure 4: Mosaic of proposed ODMDS

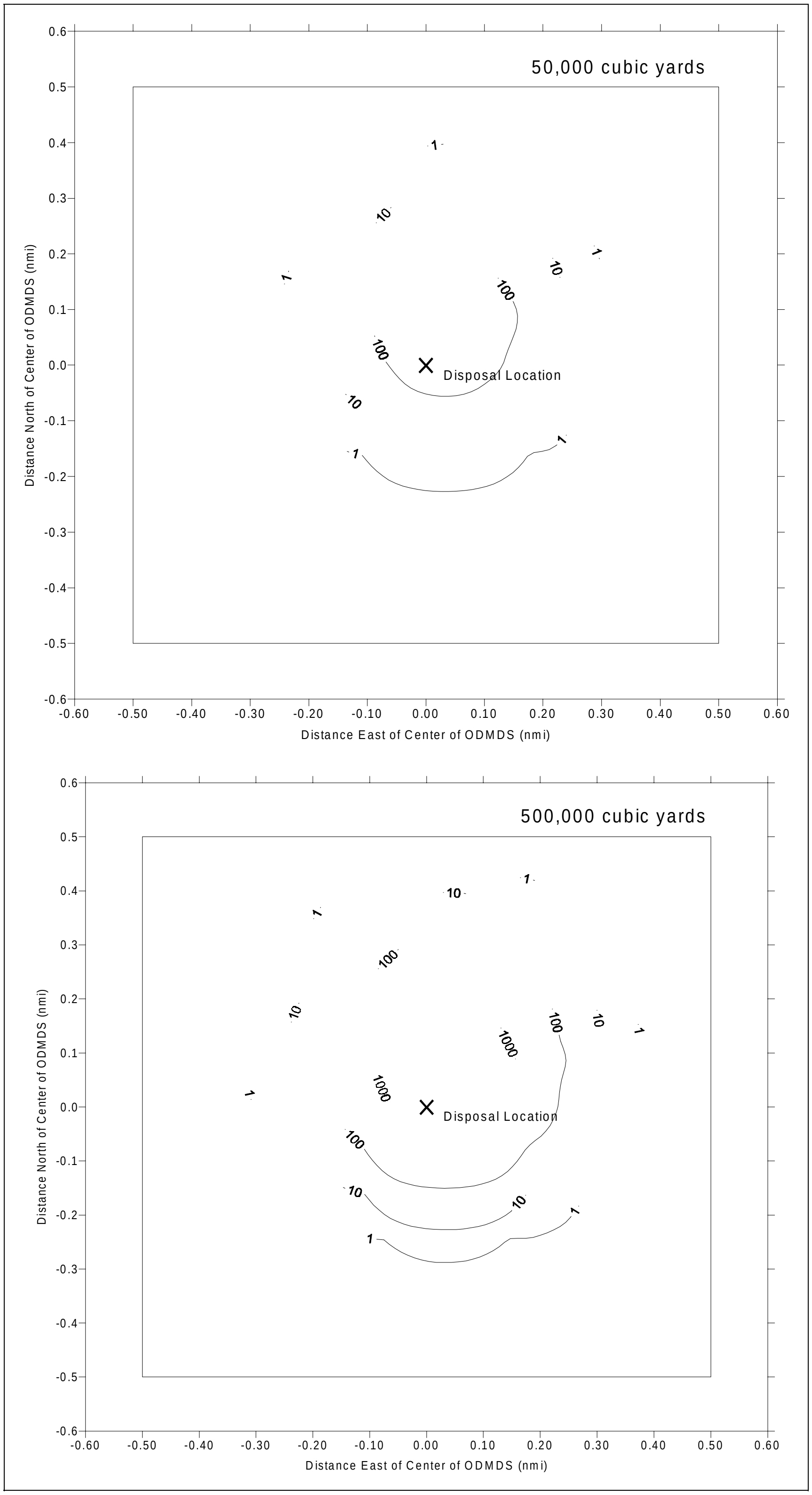

Figure 5: Disposal deposition (mm) for 50,000 and 500,000 cy of dredged material from STFATE model output.

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ESSENTIAL FISH HABITAT ASSESSMENT

Environmental Protection Agency Region 4
Designation of the Port Everglades Harbor, Florida
Ocean Dredged Material Disposal Site
pursuant to the
Marine Protection, Research, and Sanctuaries Act

July 2004

1.0 PROJECT DESCRIPTION

1.1 Overview

The U.S. Environmental Protection Agency Region 4 (EPA) is proposing to designate an Ocean Dredged Material Disposal Site (ODMDS) offshore Port Everglades Harbor, Florida. The Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA) Section 102(c) authorizes EPA to designate recommended sites for ODMDSs. An ODMDS is a precise geographic area within which ocean disposal of dredged material can be 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 (40 CFR 228.5) and specific (40 CFR 228.6(a)) site evaluation criteria.

The transportation of dredged material for the purpose of disposal into ocean waters (ie. the actual use of the designated site) is permitted by the Corps of Engineers (COE) or authorized in the case of federal Civil Works navigation projects under Section 103 of the MPRSA after applying environmental criteria established in EPA's Ocean Dumping Regulations (40 CFR 227). Therefore, the proposed action is the selection and designation of the Port Everglades Harbor ODMDS and not the permitting or authorization for use of the site.

1.2 Location

The proposed ODMDS for Port Everglades Harbor is an area approximately one square nautical mile (nmi) located east northeast of Port Everglades and approximately 4 nmi offshore. The western edge of the site is located 3.8 nmi offshore. The preferred site for this new ODMDS near 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 feet (195 meters) to 705 feet (215 meters). The site location is shown in figure 1.

1.3 Dredged Material

As mentioned above, site designation does not authorize use or disposal of dredged material in the ODMDS. Each project will be required to be evaluated for its suitability for utilization of the ODMDS. This will include an analysis for the need for ocean disposal, compliance with the Ocean Dumping Criteria and compliance with the current approved Site Management and Monitoring Plan (SMMP). A draft SMMP was included with the Draft EIS for Designation of the Palm Beach Harbor ODMDS and the Port Everglades Harbor ODMDS previously submitted to NOAA Fisheries. Annual average shoaling rates of 30,000 cubic yards at Port Everglades Harbor have been projected (COE, 1994; Olsen & Associates, 2003). However, annual maintenance dredging and disposal events are unlikely. The COE has projected maintenance and ocean disposal intervals to be every 3 to 5 years. Historical maintenance dredging projects have ranged from 26,000 cubic yards to 144,000 cubic yards (Brodehl, 2003). Routine disposal volumes at the ODMDS are therefore likely to be within these ranges. In addition, the COE is evaluating proposed construction at Port Everglades Harbor (see Section 3.2.3). These maintenance volumes are relatively low in comparison to other ODMDS in the southeast. For example, the Jacksonville Harbor ODMDS receives approximately 300,000 cubic yards per year and the Canaveral Harbor ODMDS receives over 600,000 cubic yards per year. The Miami ODMDS received a project in the mid-1990's in excess of 3 million cubic yards (Ocean Disposal Database, 2002). Dredged material from maintenance dredging (turning basin) for Port Everglades Harbor has been characterized as silty sands, silts and clays with approximately 38% fine grained material (CERC, 1998). Computer model simulations of the sediment movement of a disposal mound consisting of up to 500,000 cubic yards during storm events was conducted and concluded that insignificant erosion would occur (CERC, 2001). Larger projects were not evaluated. Therefore, the SMMP limits project size to 500,000 cubic yards until additional studies are conducted.

1.4 Transport and Disposal Methods

There are no restrictions on the types of vessels to be used for disposal of dredged material at the Port Everglades Harbor ODMDS. Ocean disposal of dredged material typically utilizes either a self propelled hopper dredge or a disposal barge towed by a tug. Hydraulic dredges such as the hopper dredge typically results in a disposed material with a much higher water content (e.g. 80% water, 20% solids) as a result of slurrying the sediments with water in a one-part sediment to four-parts water mixture (Herbich, 1992). The COE has determined that the most effective method for dredging Port Everglades Harbor is utilization of a hydraulic (hopper) dredge (COE, 1994).

The SMMP provides requirements for disposal operations. These include a disposal zone (within 600 feet of the center of the ODMDS) and disposal monitoring requirements.

2.0 FISH HABITAT OVERVIEW

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 the National Marine Fisheries Service (NMFS) in association with regional fishery management councils (FMC). Essential Fish Habitat 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 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.

2.1 Managed Species

The area proposed for designation as an ODMDS for Port Everglades Harbor falls 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. In addition, the NMFS, has prepared a FMP for Highly Migratory Species (tunas, billfishes, sharks, and swordfish) which includes associated essential fish habitat. A list of species managed by the SAFMC and South Atlantic species managed under the Federally-Implemented Fishery Management Plans can be found in Table 1.

Table 1. Essential Fish Habitat (EFH) Species for Marine Waters Managed by the South Atlantic Fishery Management Council.

Species	Life Stage Ecotype	EFH	Potential for EFH within ODMDS
Brown shrimp Greatest abundance from NC-FL Keys	eggs larvae adults	13.7-110m, demersal <110m, planktonic <110m, silt sand, muddy sand	No Yes No
White shrimp Greatest abundance from NC-St. Lucie Inlet	eggs larvae adults	nearshore & 6.1-24.4m, demersal <24.4m, planktonic <27m, silt, soft mud	No Yes No
Pink shrimp Greatest abundance in NC & Florida	eggs larvae adults	3.7-16m, demersal <16m, planktonic <100m, hard sand/shell substrate	No Yes No
Rock Shrimp	adults	terrigenous & biogenic sand 18-182m	No
Royal red Shrimp Greatest abundance in NC-FL	adults	180-730m, mud/sand substrate	Yes
Red drum Greatest abundance from NC-FL Keys	eggs larvae adults	tidal inlets, planktonic tidal inlets, planktonic inlets & surf zone - 50m; mud bottoms, oyster reefs	Yes Yes No
Snowy grouper Greatest abundance in NC-FL	eggs/larvae adults	pelagic <180m, boulders & relief features	Yes No
Yellowedge grouper Greatest abundance in NC-FL	eggs/larvae adults	pelagic 190-220m, rocky outcrops & hardbottom	Yes Yes
Warsaw grouper Greatest abundance in NC-FL Keys	eggs adults	pelagic 76-219m, cliffs, notches & rocky ledges	Yes Yes
Scamp Greatest abundance in NC-FL	adults	hard bottoms, rock outcrops, 20-100m	No
Speckled hind Greatest abundance in NC-FL	adults	27-122m, hardbottom	No
Jewfish Greatest abundance in FL	adults	<50m, hardbottom, ledges, reefs	No

Table 1. Essential Fish Habitat (EFH) Species for Marine Waters Managed by the South Atlantic Fishery Management Council.			
Species	**Life Stage Ecotype**	**EFH**	**Potential for EFH within ODMDS**
Wreckfish Greatest abundance in NC-FL(Black Plateau)	adults	<1000m, high relief features	Yes
Red snapper Greatest abundance in NC-FL	larvae postlarvae/juv adults	planktonic pelagic hardbottom; 10-190m	Yes Yes No
Vermilion snapper Greatest abundance in NC-FL	juvenile adults	reefs, hard bottom, 20-200m reefs, hard bottom, 20-200m	Yes Yes
Mutton snapper Greatest abundance in FL	egg/larvae juvenile adults	planktonic SAV, mangrove, sand, mud reefs/hardbottom, sand; <100m	Yes Yes No
Blackfin snapper Greatest abundance in NC-FL	juvenile adults	hardbottom; 12-40m shelf edge, 40-300m	No Yes
Silk snapper Greatest abundance in NC-FL	juvenile adults	structure, hardbottom, 12-242m cliffs/ledges, 64-242m	Yes Yes
White grunt Greatest abundance in NC-FL	eggs/larvae adults	planktonic shore-35m, reefs/hardbottom, SAV, mangrove	Yes No
Greater amberjack Greatest abundance in NC-FL	juvenile adults	floating plans (Sargassum), debris pelegic over reefs/wrecks	Yes Yes
Blueline tilefish Greatest abundance in NC-FL	eggs adults	planktonic shelf edge, 68-236	Yes Yes
Golden tilefish Greatest abundance in NC-FL	adults	burrows in rough bottom; 76-457m	Yes
King mackerel Greatest abundance in NC-FL	juvenile adults	pelagic, S. Atlantic Bight pelagic, S. Atlantic Bight	Yes Yes
Spanish mackerel Greatest abundance in NC-FL	larvae juvenile adults	offshore <50 meter isobath offshore, beach, estuarine pelagic	No No Yes
Cobia Greatest abundance in NC-FL	eggs larvae postlarvae/juv adults	pelagic estuarine & shelf estuarine & shelf coastal & shelf	Yes Yes Yes Yes

Table 1. Essential Fish Habitat (EFH) Species for Marine Waters Managed by the South Atlantic Fishery Management Council.			
Species	**Life Stage Ecotype**	**EFH**	**Potential for EFH within ODMDS**
Dolphin Greatest abundance in NC-FL	larvae postlarvae/juv adults	epipelagic, Sargassum epipelagic, Sargassm epipelagic	Yes Yes Yes
Golden crab Greatest abundance in NC-FL	adults	mud, dead coral, pebble; 367-549m	No
Spiny lobster Greatest abundance in FL	larvae juvenile adults	planktonic sponge, algae, coral, hardbottom sponge, algae, coral, hardbottom, crevices	Yes Yes Yes
Coral Greatest abundance in FL	all stages		Yes
Albacore tuna	adult	Blake Plateau & Spur Area(FL),>100m	No
Atlantic bigeye tuna	juvenile/adult	Blake Plateau & Spur Area(FL),>100m	No
Atlantic bluefin tuna	eggs/larvae juve/subadult adult	nearshore to 200 m isobath nearshore, south of 27^{o}N Blake Plateau & nearshore to 200m	No No No
Atlantic skipjack tuna	eggs/larvae juvenile to adult	south of 28.25^{o}N, 200m to EEZ 25-200m isobath	Yes No
Atlantic yellowfin tuna	eggs/larvae juvenile to adult	south of 28.25^{o}N, 200m to EEZ north of 31^{o}N, 500-2000m isobath; Blake Plateau	Yes No
Swordfish	eggs/larvae juvenile to subadult adult	south of Hatteras, 200m to EEZ south of 31.5N, 25-2000m& south of 29N from 100m-EEZ 100-2000m isobath	Yes Yes Yes
Blue marlin	eggs/larvae juvenile adult	south of 29.5^{o}N, 100m-EEZ south of 30^{o}N, 200-2000m south of 29.5^{o}N, 100m to 50mi	Yes Yes Yes

Table 1. Essential Fish Habitat (EFH) Species for Marine Waters Managed by the South Atlantic Fishery Management Council.

Species	Life Stage Ecotype	EFH	Potential for EFH within ODMDS
White marlin	juvenile adult	north of 25.25°N, 200-2000m north of 33.75°N, 200-2000m; Charleston Bump; south of 29°N, 200m-EEZ	No Yes
Sailfish	eggs/larvae juvenile adult	south of 28.25°N, 5 mi offshore-EEZ south of 32°N, 5-125 mi offshore south of 36°N, 5-125mi offshore	No No No
Longbill spearfish	juvenile adults	36.5°-35°N, 200m-EEZ Charleston Bump	No No
White shark	juvenile	28°-29.5°N, 25-100m	No
Bignose shark	juvenile	north of 32°N & south of 30N, 100-500m	Yes
Caribbean reef shark		<25 m off Miami & Cape Canaveral	No
Night shark	juvenile adult	north of 33.5°N, 100-2000m 36°-25.5°N, 100m-EEZ/100mi/2000m	No Yes
Silky shark	juvenile	25m(FL) or 100m-2000m	Yes
Longfin mako shark	all stages	north of 35°N, 110m-EEZ; 35°N-28.25°N, 100-500m; south of 28.25°N, 200m-EEZ	Yes
Shortfin mako shark	all stages	north of Onslow Bay, NC, 25-200m	No
Blue shark	late juvenile/adult	north of 35°N, 25m-EEZ	No
Oceanic whitetip shark	early juvenile late juvenile adult	Charleston Bump 26°-32°N, 200m-EEZ 30°-36°N, 200m-EEZ	No Yes No
Bigeye thresher shark	all stages	34°-36.5°N, 200-2000m	No
Great hammerhead shark	juvenile/adult	coastal waters to 100m, south of 30°N	No
Nurse shark	juvenile/adult	south of 30.5°N, shoreline to 25m	No
Blacktip shark	juvenile adult	north of 28.5°N, coastal to 25m Outer Banks, NC, shore to 200m; 28.5°N-30°N, coastal-50m	No No

Table 1. Essential Fish Habitat (EFH) Species for Marine Waters Managed by the South Atlantic Fishery Management Council.			
Species	**Life Stage Ecotype**	**EFH**	**Potential for EFH within ODMDS**
Bull shark	juvenile	south of 32°N, inlets, estuaries, waters<25m FL	No
Lemon shark	juvenile adult	Bulls Bay, SC-28°N & south of 25.5°N, inlets, estuaries, waters<25m 30°-31°N & south of 27°N, inlets, estuaries, waters<25m	No No
Blacknose shark	juvenile adult	SC-Cape Canaveral to 25m St. Augustine to Canaveral, FL <25m	No No
Finetooth shark	all stages	30°-33°N, coastal waters to 25m	No
Scalloped hammerhead shark	juvenile adult	shoreline to 200m north of 28°N, 25-200m	No No
Dusky shark	juvenile adults	north of 33°N & south of 30°N, inlets, estuaries, waters <200m north of 28°N, 25-200m	No No
Sandbar shark	juvenile adults	north of 27.5°N, coastal waters-25m coastal waters to 25m	No No
Spinner shark	early juvenile juvenile/adult	south of 32.25°N, coastal waters- 25m 30.7°-28.5°N, coastal waters-200m	No No
Tiger shark	early juvenile late juvenile adults	north of Cape Canaveral, coastal-200m shore-100m, except GA to Cape Lookout where EFH is 25-100m north of Ft. Lauderdale, coastal-Gulf Stream	No No Yes
Sand tiger shark	juvenile adults	north of Cape Canaveral, coastal-25m St. Augustine to Cape Canaveral, coastal to 25m	No No
Bonnethead shark	juvenile adults	Cape Fear to W. Palm Beach, inlets, estuaries & waters<25m Cape Fear to W. Palm Beach, inlets, estuaries & shallow coastal waters	No No

Table 1. Essential Fish Habitat (EFH) Species for Marine Waters Managed by the South Atlantic Fishery Management Council.			
Species	**Life Stage Ecotype**	**EFH**	**Potential for EFH within ODMDS**
Atlantic sharpnose shark	juvenile	Daytona Beach-Cape Hatteras, bays & waters to 25m	No
	adult	NC& St. Augustine-C. Canaveral, to 100m	No

Source: Essential Fish Habitat: A Marine Fish Habitat Conservation Mandate for Federal Agencies, NMFS, St. Petersburg, FL, October 2000.

2.2 Essential Fish Habitat and Habitat Areas of Concern

Table 2 shows the categories of Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC) for managed species which were identified in the Fishery Management Plan Amendments of the South Atlantic Fishery Management Council and the NMFS and which may occur in marine waters of the southeastern states.

Table 2: Categories of Essential Fish Habitat and Habitat Areas of Concern in Southeastern States.

ESSENTIAL FISH HABITAT - MARINE AREAS	Potentially present in vicinity of ODMDS
Artificial / Manmade Reefs	Yes
Coral & Coral Reefs	Yes
Live / Hard Bottoms	Yes
Sargassum	Yes
Water Column	Yes

ESSENTIAL FISH HABITAT - MARINE AREAS	Potentially present in vicinity of ODMDS
GEOGRAPHICALLY DEFINED HABITAT AREAS OF PARTICULAR CONCERN	
Area Wide	
Council-designated Artificial Reef Special Management Zones	No
Hermatypic (reef-forming) Coral Habitat & Reefs	Yes
Hard Bottoms	Yes
Hoyt Hills	No
Sargassum habitat	Yes
State-designated areas of importance to managed species	No
Submerged aquatic vegetation	No
Florida	
Blake Plateau (manganese outcroppings)	No
Biscayne Bay	No
Biscayne National Park	No
Card Sound	No
Florida Bay	No
Florida Keys National Marine Sanctuary	No
Jupiter Inlet Point	No
Mangrove Habitat	No
Marathon Hump	No
Oculina Bank	No
Phragmatopoma (worm) reefs	No
The Wall (Florida Keys)	No

Source: Essential Fish Habitat: A Marine Fish Habitat Conservation Mandate for Federal Agencies, NMFS, St. Petersburg, FL, October 2000.

2.3 Fishery Resources in vicinity of the Port Everglades Harbor ODMDS

Based on the information provided in Tables 1 and 2 above, the following managed species and EFH warrant further discussion:

- Penaied Shrimp (larvae)
- Royal Red Shrimp
- Red Drum
- Snapper-Grouper Complex
- Highly Migratory and Coastal Migratory Species
- Spiny Lobster
- Coral and Coral Reefs and Live/Hard Bottom
- Artificial Reefs
- Sargassum
- Water Column

<u>2.3.1 Penaied Shrimp (larvae)</u>

White Shrimp range from Fire Island, New York to St. Lucie Inlet, Florida. White shrimp are generally concentrated in water of 27 meters or less, although occasionally found much deeper, up to 270ft. (SAFM,C 1998) The proposed Port Everglades Harbor ODMDS is south and deeper than this range.

Brown shrimp range from Massachusetts to Key West, Florida. The species may occur in commercial quantities in waters as deep as 110 meters, but they are most abundant in waters less than 55 meters. (SAFMC, 1998) These ranges are inshore of the proposed Port Everglades Harbor ODMDS.

Pink shrimp range from Chesapeake Bay to the Florida keys and around into the Gulf of Mexico. Pink shrimp are common in the estuaries and shallow marine waters surrounding southern Florida and within the Dry Tortugas shrimping grounds and Florida Bay. Adult pink shrimp congregate in deep water off the Dry Tortugas to spawn. One route larvae take to estuarine nursery areas is by way of the Florida Current. The larvae are swept soutwesterly into the Florida Current by way of the Loop Current and are carried northeasterly along the outer edge of the Florida Reef Tract or of east coast of Florida. Larval periods for pink shrimp are in the order of 15-25 days. (SAFMC, 1998) The potential exists for Pink shrimp larvae to be transported in the water column through the proposed Port Everglades Harbor ODMDS. The offshore waters are considered habitat for larval shrimp. No essential fish habitat-habitat areas of particular concern in the project area have been identified.

<u>2.3.2 Royal Red Shrimp</u>

Royal red shrimp are found in large concentrations in the South Atlantic primarily offshore northeast Florida. They inhabit the upper regions of the continental slope from 180 to 730 meters, with concentrations usually found at depths between 250 and 475 meters over blue/black mud, sand, muddy sand, or white calcareous mud. These areas are considered EFH for royal red shrimp as well as the Gulf Stream as it provides a mechanism to disperse larvae. (SAFMC, 1998) The proposed Port Everglades Harbor ODMDS lies near the shallower limits of the royal red shrimp habitat.

2.3.3 Red Drum

For red drum, EFH includes habitats to a depth of 50 meters offshore (SAFMC, 1998). The proposed Port Everglades Harbor ODMDS lies far beyond the 50 meter contour. No essential fish habitat-habitat areas of particular concern in the project area have been identified.

2.3.4 Snapper Grouper Complex

The SAFMC Snapper-Grouper Management Unit consists of 73 species from 10 families (SAFMC 1983; 1998a). Members of this management unit inhabit reefs and hard bottom areas as adults and are very important components of commercial and recreational fisheries of the area. Because of their affinity for hard bottom and reefs, members of the Snapper-Grouper Management Unit are collectively referred to as reef fishes. Although snappers (Lutjanidae) and groupers (Serranidae) are the most valuable members of the group, species from other families including grunts (Haemulidae), jacks (Carangidae), porgies (Sparidae), spadefishes (Ephippidae), temperate basses (Percichthyidae), tilefishes (Malacanthidae), triggerfishes (Balistidae), and wrasses (Labridae) are also represented. In deeper waters of the ODMDS, species such as yellowedge grouper, Warsaw grouper, scamp, and blackfin snapper will associate with hard substrates (SAFMC, 1998). Figures 2 and 3 show the deep reef fish habitat range.

Not strictly a reef species, tilefish will occur in water depths of the ODMDS where the substrate is muddy or clayey. Golden tilefish inhabits the outer continental shelf and upper continental slope along the entire east coast of the U.S. It is a bottom dweller, living in burrows of clay substrate at depths from 76 to 457 meters. Blueline tilefish occurs from Virginia to Mexico in water depths between 68 and 236 meters. The species frequents irregular bottom comprised of troughs and terraces inter-mingled with sand, mud, or shall hash bottom along the continental shelf break. Tilefish are epibenthic browsers, often feeding upon crabs, shrimps, snails, worms, sea urchins, and fish (SAFMC, 1998). Tilefish habitat range is shown in figures 2 and 3.

Most reef fishes (and invertebrates) have a two-phase life cycle that greatly influences habitat use by individuals throughout their development. The early phase of the life cycle consists of planktonic or demersal eggs and planktonic larvae capable of considerable spatial transport by currents, tides, and winds. This transport can be advective or retentive. The second phase begins when larvae settle to the seafloor and begin life as benthic juveniles inhabiting shallow water habitats such as patch reefs, seagrass beds, mangroves, and other structurally complex features. As these young individuals grow, they gradually migrate offshore to adult habitat where they develop to maturity.(SAFMC, 1998)

There are 19 economically important species of reef fish in the deepwater (100-300m) which is where the proposed Port Everglades Harbor ODMDS is located. The five species that make up over 97% of the catch by weight are tilefish, snowy grouper, yellow grouper and warsaw grouper. EFH for these species include coral reefs, live/hard bottom, submerged aquatic vegetation, artificial reefs and medium to high profile outcroppings. EFH includes the spawning area above the adult habitat and the additional pelagic environment, including Sargasum, required for larval survival and growth up to and including settlement. In addition, the Gulf Stream is an essential fish habitat because it provides a mechanism to disperse snapper grouper larvae. Areas which meet the criteria for essential fish habitat-habitat areas of particular concern in the vicinity of the proposed ODMDS include medium to high profile offshore hardbottoms where spawning normally occurs; Sargassum; and all hermatypic coral habitats and reefs. (SAFMC, 1998)

2.3.5 Highly Migratory and Coastal Migratory Species

Highly migratory species typically range throughout the open ocean, however, many species move inshore, including coastal estuaries, at some time during their life cycles. Associations with particular bottom types are undefined. Tuna and swordfish distributions are most frequently associated with hydrographic features such as density fronts between different water masses (e.g. edge of Florida Current). *Sargassum* is important habitat for various life stages of the swordfish and tunas. (NMFS, 1999)

The habitat of adults in the coastal pelagic management unit, except dolphin, is the coastal waters out to the edge of the continental shelf (SAFMC, 1998). The proposed ODMDS lies beyond the continental shelf. EFH in the vicinity of the proposed ODMDS includes Sargassum and the Gulf Stream. The Gulf Stream is EFH as it provides a mechanism to disperse larvae. Many Dolphin prey are associated with Sargassum, and most of the fishes that were found associated with Sargassum in the Florida Current are eaten by dolphin. (SAFMC, 1998)

2.3.6 Spiny Lobster

EFH in the vicinity of the proposed ODMDS for the spiny lobster includes oceanic waters, soft sediments, coral and live/hard bottom habitat, and the Gulf Stream as it provides a mechanism to disperse spiny lobster larvae. Areas which meet the criteria for habitat areas of particular concern for the spiny lobster in the vicinity of the proposed ODMDS include coral/hard bottom habitat. (SAFMC, 1998)

2.3.7 Coral, Coral Reefs and Live/Hard Bottom Habitat

Shallow water (<200m) species include octocorallia (sea fans, sea whips, etc), milleporina and scleractinaia (fire corals, stinging corals, and stony corals), and antipatharia (black corals). EFH for hermatypic stony corals includes rough, hard, exposed, stable substrate from Palm Beach County south through the Florida reef tract in subtidal to 30 meter depth contour. The proposed ODMDS is much deeper than this range. EFH for ahermatypic stony corals, which are not light restricted, extends to outer shelf depths (SAFMC, 1998). EFH for black corals includes rough, hard, exposed, stable substrate, offshore in high salinity waters in depths exceeding 18 meters. EFH for octocorals includes rough, hard, exposed, stable substrate in subtidal to outer shelf depths within a wide range of salinity and light penetration. (SAFMC, 1998)

Areas which meet the criteria for EFH-habitat areas of particular concern for coral, coral reefs, and live/hard bottom in the vicinity of the proposed ODMDS include offshore (5 to 30 meter) hard bottom off the east coast of Florida from Palm Beach County to Fowey Rocks (SAFMC, 1998). This is considerably shallower and inshore of the proposed ODMDS.

The classic reef distribution pattern described for southeast Florida reefs north of Key Biscayne consists of an inner reef in approximately 15 to 25 ft (5 to 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 to 100 ft (18 to 30 m) of water. 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).

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. The 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.

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 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 *Oculina* in general extend north from Palm Beach and parallel the break between the edge of the continental shelf and the Florida-Hatteras slope, which parallels the 80W meridian and are therefore not in the vicinity of the proposed Port Everglades Harbor ODMDS.

The regional hardbottom habitat and locations of hard bottom natural reefs in the project vicinity is shown in Figure 3. Video, still-camera, and side-scan sonar surveys were conducted at the proposed ODMDS in March 1986 and September/October 1986 by Continental Shelf Associates, Inc. for EPA. In March, side-scan sonar and bathymetry data were collected along five north-south transects and five east-west transects spaced at 0.25 nautical miles. A single video and still camera north/south transect was completed along the western site boundary. In September/October, data were collected along two north-south transects along the eastern and western sides of the proposed ODMDS extending north. Underwater video and still camera coverage was obtained for 7.5 nmi along the eastern survey transect and 7.3 nmi along the western survey transect. The sidescan sonar transects extended 10.7 nmi and 10.5 nmi along the eastern and western transects, respectively. Sidescan lateral coverage was approximately 150 meters (500ft) on each side providing a total coverage of 300 meters (1000 feet) for each transect. (CSA, 1986) The proposed ODMDS was subsequently moved one half mile to the north following these surveys in order to avoid the South Florida Testing Facility. Therefore, only the northern half of the March survey area is within the proposed ODMDS, but the September/October survey area still borders the proposed ODMDS and still extends a substantial distance north of the proposed ODMDS.

For the March survey, no high-relief ledges, rock outcrops,or steep slopes were detected within the survey area. Interpretation of the side-scan sonar data indicated that sediments within the survey area ranged from fine- to coarse-grained sand. Side-scan sonar signatures indicative of rubble or cobbles were occasionally observed within the area. There was also the suggestion of a low-relief rock outcrop within the survey area (south of the proposed ODMDS). Underwater video and still camera data revealed fine-to-coarse sand substrate. Areas of bioturbation (small mounds, burrows, and trails) were evident along the transect, and detritus (primarily detached blades of *Thalassia testudinum*) was scattered throughout the area. Two small areas of coralline rock rubble were observed south of the proposed ODMDS. A few epifauna, including unidentified anemones, portunid crabs, and scopionfish were associated with these rubble areas. Aside from these animals, all epifauna observed along the transect were typical soft-bottom species (anemones, galatheid anomurans, majid crab, portunid crab, xanthid crab, hermit crab, bothidae (flounder), and Rajidae (skate)). (CSA 1986)

For the September/October survey, no steep slopes or high-relief ledges were noted on the fathometer traces. On the inshore transect, the bottom consisted of firmly packed sand with intermittent ridges or bands of coarser sediments. These bands of coarse sediments rose three to five feet above the surrounding bottom and were composed of larger-grain sand and shell hash, and contained scattered areas of rock rubble. Large rocks or small boulders with diameters up to five feet were occasionally observed. They appeared to be scattered and there was no evidence of extensive rock outcroppings. On the offshore transect, the bottom consisted of generally fine, well-compacted sand with occasional ridges or band of coarser sediments and rubble running perpendicular to shore. Large areas of sand ripples or small sand waves were also observed along the transect. Scattered rocks were present and appeared to be isolated boulders rather than outcrops of an underlying structure. A small degree of bioturbation (evidenced by burrows and trails) was present along both transects. Epifauna observed in the sand bottom areas included hermit crabs, portunid crabs, large spider crabs, galatheid crabs, dense patches of brittle stars, eels, sea robins, skates, and torpedo rays. The scattered rock outcrops and areas of rock rubble had attached anemones, hyrozoans, occasional octocoral fans, hake, and scorpionfish. (CSA, 1986).

Due to the limited coverage of the video survey, EPA conducted a sidescan sonar survey of the proposed Port Everglades Harbor ODMDS as well as alternative ocean sites in 1998. Sidescan sonar data was collected along north/south transects spaced at 250 meters (areas greater than a mile from the proposed ODMDS were surveyed at greater spacing) at a speed of three knotts. A range of 250 meters was utilized providing 100% overlap (200% coverage). These settings provided a transverse resolution of 1 meter. 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). Transects extended greater than two nautical miles to the north and south of the site and one nautical mile to the east and west. Benthic photography for ground-truthing was unsuccessful due to high currents. A mosaic of the survey is shown in figure 4. Note, although data gaps are shown in the mosaic, data was recorded in both electronic and on thermal paper. Frequent digitizing system crashes caused data gaps in the electronic data. Full coverage was recorded on thermal paper and analyzed. The side scan sonar data indicated a relatively uniform sandy bottom throughout the site with an east/west running low relief ridge through the middle of the site and an east/west running low relief ridge to the northwest of the site. Numerous (~7) rubble areas with an east/west orientation were also observed within the proposed ODMDS (see Figure 5). These areas were small and of low-relief (<0.5m) [EPA, 2000]. This is consistent with the results from CSA discussed above. Grab samples were collected to ground-truth the general characteristics of the bottom. Grab samples showed sediments to consist of grey silty fine sand with shell fragments. The mean grain size for the area range was 0.20 mm to 0.21 mm with 15.5 to 17.5 percent silts and clays (EPA, 1999). The bottom types encountered during the 1998 sidescan sonar survey were similar to that encountered by the 1986 sidescan and video surveys conducted by CSA. Therefore, the benthic biota is expected to be similar.

2.3.8 Artificial Reefs

The species most often present on artificial reefs are predominately the adult and/or sub-adult stages of virtually all species within the Snapper-Grouper complex, as well as all species managed within the Coastal Migratory Pelagics. Red drum and spiny lobster, as well as some of the managed shrimp species may be found on and around specific reefs at different times of the year, depending on the exact location and design of the reef. (SAFMC, 1998)

There are several documented artificial reefs located in the vicinity of the proposed Port Everglades ODMDS. Table 3 provides amplifying information on artificial reefs in the vicinity (within 5 miles) of the proposed Port Everglades Harbor ODMDS. One cluster of 17 structures is located approximately 2.25 nmi (14.2 km) northwest of the proposed site. Another cluster of three structures is located 2 nmi (3.7 km) west of the southwestern edge of the proposed site.

Table 3. Artificial Reef Locations in the Vicinity of the Proposed Port Everglades Harbor ODMDS

Name	Latitude	Longitude	Depth (ft)	Distance to ODMDS (mi)	Composition
Houseboat	26˚08’51”N	80˚05’00”W	95	4.2	Vessels
Bud Krohn	26˚08’51”N	80˚05’00”W	440	4.2	Freighter
Trio Bravo	26˚08’51”N	80˚05’00”W	145	4.2	Tug
FL League of Anglers	26˚08’51”N	80˚05’00”W	388	4.2	Minesweeper
Rebel	26˚08’51”N	80˚05’00”W	110	4.2	Freighter
Jim Atria	26˚08’51”N	80˚05’00”W	110	4.2	Freighter
Robert Edmister	26˚08’51”N	80˚05’00”W	70	4.2	Cutter
River Bend	26˚08’51”N	80˚05’00”W	98	4.2	Vessels

Bill Boyd Reef	26˚08’51”N	80˚05’00”W	265	4.2	Freighter
Hog Heaven	26˚08’51”N	80˚05’00”W	64	4.2	Barges, lighthouse
Jay Scutti	26˚08’51”N	80˚05’00”W	67	4.2	Schooner
Qualmann Barge	26˚08’51”N	80˚05’00”W	145	4.2	Barge
Osborne	26˚08’51”N	80˚05’00”W	73	4.2	Barge
Grouper Grotto	26˚08’51”N	80˚05’00”W	150	4.2	Tanks, pipes, concrete
Powell Barge, DB 24	26˚08’51”N	80˚05’00”W	314	4.2	Barge, concrete
Mariott Reef	26˚08’51”N	80˚05’00”W	71	4.2	Airplane
Mercedes	26˚08’51”N	80˚05’00”W	97	4.2	Freighter
Tracor/Navy Drydock	26˚06’48”N	80˚04’10”W	210	2.8	Vessels, drydock
Powell Barges	26˚06’48”N	80˚04’10”W	270	2.8	Barges
TE AMO	26˚06’48”N	80˚04’10”W	215	2.8	Vessel
Erojacks	26˚06’43”N	80˚05’43”W	14	4.4	Concrete erojacks
Bruce Mueller	26˚10’07”N	80˚04’42”W	45	4.8	Vessel
Chevron 1”	26˚07’24”N	80˚04’33”W	73	4.8	Vessel
Chevron 3”	26˚08’06”N	80˚04’06”W	190	3.0	Vessel
Chris Coffman Reefball	26˚07’30”N	80˚04’24”W	22	3.1	Reefballs (11)
Corky M.	26˚10’05”N	80˚04’43”W	65	4.9	Vessel
Eagle Scout Reef	26˚07’30”N	80˚05’53”W	22	4.6	Reedfballs (25)
Merci Jesus	26˚09’38”N	80˚04’45”W	72	4.6	Vessel
Reef Balls (Deep)	26˚07’48”N	80˚04’25”W	144	3.2	Prefab Concrete
Reef Balls (Shallow)	26˚07’31”N	80˚04’25”W	23	3.1	Prefab Concrete
Wendy Rossheim	26˚09’11”N	80˚04’49”W	65	4.3	Vessel
NSWC	26˚10’30”N	80˚03’13”W	150	4.4	Cable Spools
Joe’s Nightmare	26˚06’48”N	80˚04’13”W	217	2.8	Barge
Port Everglades Reef	26˚06’45”N	80˚04’02”W	150	2.6	Concrete Piers
Hollywood Reef	26˚07’30”N	80˚05’53”W	73	4.6	Reefballs, Pipe, & Barges

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

2.3.9 Sargassum

Throughout the world’s tropical and temperate oceans, there are many species of brown algae of the genus *Sargassu*m. Typically, *Sargassum* is brushy with a highly branched thallus or stem sporting many leaf-like blades. It also has small, bladder-like pnuematocysts providing the algae with its buoyant nature. Although they can reach up to several meters in length, they are typically much shorter. *Sargassum* circulates between 20˚ and 40˚ N latitude and 30˚ W longitude and the western edge of the Florida Current/ Gulf Stream. The proposed ODMDS falls within this range. The greatest concentrations are found within the North Atlantic Central Gyre in the Sargasso Sea. Sargassum mats often float in linear patches created by forcing winds or shear currents along frontal boundaries. (SAFMC, 1998)

Sargassum supports a diverse marine community including micro- and macro-epiphytes, fungi, more than 100 species of invertebrates, over 100 species of fishes and four species of sea turtles. Some organisms, unique to Sargassum habitats, have evolved unique shapes and coloration to take advantage of the additional camouflage among the algal mats. Others use the habitat for protection from predators and/or foraging. Community structures are variable and are influenced by the season, geographic location and algal "age." (SAFMC, 1998)

2.3.10 Water Column

The marine water column is defined as the open water (ocean) environment. It extends vertically from the ocean bottom to the water surface. That portion of the study area that contains marine water or open water habitat includes the water column area proposed for ODMDS designation.

The water column provides habitat for phytoplankton to carry out the processes of primary production. Zooplankton also utilizes the water column as habitat thus creating the foundation of the ocean food web and ecosystem. Some benthic invertebrates filter the surrounding water to collect food particles that are suspended within the water column. Higher vertebrates, such as fishes, marine mammals, and sea turtles use the water column for foraging, migration as well as spawning and breeding.

3.0 EFH IMPACTS

3.1 Overview of Dredged Material Disposal

Impacts related to the ocean disposal of dredged material are confined mainly to temporary water column impacts and longer term benthic impacts.

3.1.1 Water Column Impacts

Water quality impacts of concern with regard to dredged material disposal include those associated with increased turbidity, decreased dissolved oxygen levels, and the release of sediment-bound contaminants. Dredged material disposal typically has a short term (several hours to days) impact on the water column following discharges of solids and solutes from a barge (e.g., Gordon 1974). The greatest proportion of dredged material consists of negatively buoyant solids that sink as a turbid suspension through the water column to the sea floor. Dissolved constituents of dredged material are entrained in the turbulent water associated with the convective descent.

Turbidity plumes were evaluated be the Corps of Engineers at the proposed Port Everglades ODMDS (CERC 1998, CERC 2001). Acoustic Doppler Current Profiler (ADCP) data obtained from the National Oceanographic Data Center (NODC) for a location (26^{o}04.00'N, 80^{o}03.50'W) in the vicinity of the project site was analyzed to determine potential velocity profiles that disposed material might be subject to. The depth at the ADCP deployment site was 110 meters. NODC provided velocity data at 4 meter depth intervals and 20 minute time intervals for the 1995 to 1997 time period. Current profiles with the greatest shore directed currents and highest currents were evaluated (CERC 1998) as well as a typical current profile (CERC, 2001). Under typical conditions the disposal plume is transported to the north and the northeast. Suspended sediment concentrations drop below 10 mg/l within one hour of disposal and less than 2 mg/l within 2 hours. The plume is expected to be transported 4,000 meters (2 nmi) to the north/northeast within the first 2 hours.

Chemically reduced inorganic compounds associated with particles sinking through the upper water column may be oxidized, causing a transient increase in the chemical oxygen demand. Oxidation of labile organic material consequently may reduce dissolved oxygen concentrations in the water. However, because the water column is well oxygenated, offsite impacts are not expected and any onsite impacts should be of short duration.

The significant release of sediment-bound contaminants is not expected. All material proposed for ocean disposal must comply with EPA's Ocean Dumping Criteria (40 CFR 227). Chemical analyses are performed for contaminants that may be released from dredged material in dissolved form and the results are compared against the applicable water quality criteria (40 CFR 227.31) after making allowance for initial mixing. In addition, the material remaining in the water column after mixing has to be shown to be nontoxic through the application of bioassays on appropriate sensitive marine organisms (phytoplankton, zooplankton, crustacean or mollusk and fish species; see 40 CFR 227.27(c)). Initial mixing rates are expected to be greater than 15,000 to 1 (EPA, 2004).

3.1.2 Benthic Impacts

Dredged material disposal at the proposed ODMDS is not expected to result in any significant changes in regional bottom topography or sediment transport processes or adverse environmental impact. Dredged material must undergo whole-sediment bioassays to demonstrate compliance with the Ocean Dumping Criteria (40 CFR 2277) prior to ocean disposal. Bioassays are used to determine the biological availability of and potential for impact of contaminants associated with dredged material. Therefore, no adverse impacts associated with contaminants in the dredged material is anticipated. However, accumulation of dredged material, and associated changes in the sediment characteristics may cause impacts to benthic-dwelling organisms. The grain size of the ambient sediment at the proposed ODMDS consisted of grey silty fine sand with shell fragments and is approximately 85% sand. Dredged material disposed at the proposed ODMDS is likely to be finer (40% fines). As dredged material accumulates on the sea floor, benthic organisms in the area of initial deposition may be impacted. An idealized disposal mound for projects of 50,000 and 500,000 cubic yards of dredged material at the proposed ODMDS under typical conditions is shown in figure 6. Frequencies of disturbance that are more frequent than once per year tend to keep the colonizing benthos in an early successional stage while burial frequencies of less than one year allow colonization of higher order successional species (Rhoads et. al. 1978). In situ burial experiments by Nichols et al. (1978) indicated that overburden thickness of 5 to 10 cm did not cause significant mortality to "mud-dwelling" invertebrates as most of these motile infauna could initiate "escape" responses by burrowing upward, while organisms covered with overburdens of 30 cm could not initiate escape responses. The amount bottom expected to be covered by more than 10 cm for a 50,000 and 500,000 cubic yard projects (see figure 6) is expected to be approximately 0.07 nmi^2 (34 acres) and 0.16 nmi^2 (76 acres), respectively. The colonization process of a disposal mound can begin within a few days following cessation of dumping (Germano and Rhoades, 1984). For thin overburden layers

(<10cm), buried adults have an upward escape response. The thicker part of the deposit primarily is colonized through larval recruitment or immigration of organisms from adjacent, undisturbed areas. Three phases of macroinfaunal recolonization have been described by Rhoads and Germano (1986): 1) small opportunistic polychaetes; 2) dense aggregations of tubiculous amphipods and tellinid bivalves; and 3) deep burrowing polychaetes, caudate holothurians, infaunal ophiuroids, or burrowing urchins. Larval recruitment and establishment through all stages following disposal can require several years (Rhoads et al., 1978). However, Cruz-Motta and Collins (2004) have documented that tropical soft-bottom macrobenthic assemblages respond quickly (3 months) to the disturbance associated with the dumping of dredged material. They hypothesized that the rapid rates of recovery was driven by migration of organisms from adjacent non-affected patches within the disposal area.

For epifauna, following dredged material disposal, it is likely that relatively motile pelagic megafauna would be most affected by suspended sediments causing displacement through avoidance of, or escape behavior from, the disposal plume. Slow moving epifaunal invertebrates may become buried and smothered as dredged material is deposited, while more motile benthic taxa may be displaced as a result of escape response. Recovery and recolonization of an impacted area will depend on the frequency and severity of the disturbance and the species involved. Some recovery may occur within hours to days, but full recovery could require a few years. (EPA, 1993)

3.2 Overview of Cumulative Impacts

Cumulative impacts in the vicinity of the proposed ODMDS were discussed in the Draft Environmental Impact Statement for Designation of the Palm Beach Harbor ODMDS and the Port Everglades Harbor ODMDS (EPA, 2004). These included impacts from navigational dredging projects, beach re-nourishment projects, wastewater outfalls, and subsea cable and pipeline projects. Of these, only the subsea pipeline projects and the navigation projects which would utilize the ODMDS are likely to have impacts to the EFH potentially impacted by this disposal site designation. In addition, other ODMDSs in the area are likely to have similar impacts.

<u>3.2.1 Ocean Express Pipeline Project</u>

According the Ocean Express Pipeline Project Final EIS (FERC, 2003), impacts to offshore and hardbottom habitat include:

- Sargassum: adverse impact unlikely
- Coral/Hardbottom Habitat:
    - 2.91 acres of hardbottom transition areas affected by construction. Transition areas consist of sand/rubble and/or low or no relief hardbottom with sand veneer.
    - Direct and indirect impacts to coral reefs in area resulting from increased turbidity and sedimentation.
- Pelagic species:
    - temporary localized disturbance of feeding and spawning activity
    - lethal and sublethal effects to eggs, larvae, juveniles and sub-adults

- Demersal species:
  - limited deposition of suspended sediments could smother eggs and larvae

3.2.2 Tractebel Calypso Pipeline Project

According to the Tractebel Calypos Pipeline Project Final EIS (FERC, 2004) impacts to offshore and hardbottom habitat include:

- 7.7 acres of direct impacts in federal waters (water depths greater than 585 feet) to seafloor
  - hardbottom respresent 16% of substrate
- 0.5 acres of direct impacts to state waters from water depth 200 feet to 585 feet.
  - 0.2 acres of impact to Crater Zone/White Cerianthid Zone
  - less than 0.1 acres of direct impacts to hardbottom
- minimal impacts to black corals or other significant solitary features
- minimal impacts to fish
  - short term displacement
  - potential creation of habitat (pipeline)

3.2.3 Port Everglades Harbor Deepening Project

A feasibility study is currently underway for improving the Federal navigation project at Port Everglades Harbor. The project has not been approved so no firm dredged material volumes are available. It is expected that total dredged material volumes from the project could exceed 5 million cubic yards. However, a significant portion of the dredged material could be used beneficially or be suitable for disposal alternatives other than ocean disposal. It is expected that some of the material will likely need to be disposed at the proposed Port Everglades Harbor ODMDS. Impacts from ocean disposal would be similar to that as described in Section 3.1 with the exception of the total seafloor area to be impacted. This will be a function of the total volume of material that needs to be disposed at the ODMDS.

3.2.4 Palm Beach Harbor Construction

Up to 1,000,000 cubic yards of dredged material may result from dredging from a proposed construction dredging project at Palm Beach Harbor. This proposed construction dredging has been proposed at the recommendation of a recent reconnaissance study by the COE which stated that deepening of the existing Federal project at Palm Beach Harbor was justified. The COE will perform a feasibility study to examine the plan in greater detail and evaluate disposal alternatives. Impacts from ocean disposal would be similar to that as described in Section 3.1 with the exception of the total seafloor area to be impacted. This will be a function of the total volume of material that needs to be disposed at the ODMDS.

3.2.4 Other Ocean Dredged Material Disposal Sites

Other ODMDSs in southeast Florida off the continental shelf include the Miami ODMDS and the proposed Palm Beach Harbor ODMDS. Monitoring following disposal from the Miami Harbor Deepening Project at the Miami ODMDS showed a shift in grain size at the site to a coarser material (Collins and Pruitt, 2001). The median grain size of native sediments was in the range of 0.01 mm to 0.04 mm. Following disposal, the median grain size increased to the 0.05 to

0.1 mm range. Impacts at the Palm Beach Harbor ODMDS are expected to be similar to that described in Section 3.1. All sites are designed to limit impacts to the area within the ODMDS boundaries. The actual extent of impact will mostly depend on the volume of the disposal project. Of the three sites, Miami is expected to receive the most material.

3.3 Effects of Site Designation on EFH

As discussed in Section 1.1, disposal site designation does not itself allow ocean disposal of dredged material. The transportation of dredged material for the purpose of disposal into ocean waters (ie. the actual use of the designated site) is permitted by the Corps of Engineers (COE) or authorized in the case of federal Civil Works navigation projects under Section 103 of the MPRSA. Therefore, the evaluation of potential effects is limited to "typical" disposal site use. Effects of activities beyond the scope of this evaluation (ie. large new work projects) should be evaluated separately.

Based on the discussion in section 2.3 above, effects on the habitats of following managed species will be addressed:

- Royal Red Shrimp
- Snapper Grouper Complex
    - Yellowedge Grouper
    - Warsaw Grouper
    - Scamp
    - Blackfin Snapper
    - Golden Tilefish
    - Blueline Tilefish
- Highly Migratory and Coastal Migratory Species
- Spiny Lobster
- Coral, Coral Reefs, and Live/Hard Bottom Habitat
- Sargassum

3.3.1 Royal Red Shrimp

As noted in Section 2.3.2, the proposed ODMDS lies within the shallower limit of the royal red shrimp habitat. Concentrations are typically found much deeper than the proposed ODMDS. Dredged material disposal is likely to change the sediment characteristics at the proposed site to a less sandy bottom and result in burial or displacement of existing ocean bottom. Changes to a siltier bottom is not expected to adversely affect the royal red shrimp habitat if present as the shrimp can utilize a variety of bottom types including muddy sand or sand (see Section 2.3.2). Recovery and recolonization from burial will likely occur (see Section 3.1.2). Whole sediment testing and evaluation of dredged material prior disposal will insure that no adverse impacts to benthic communities occur.

Royal red shrimp larvae utilize the Gulf Stream. Adverse impacts are not expected as dredged material must undergo liquid and suspended phase toxicity testing and must meet the applicable water quality criteria (see Section 3.1.1).

3.3.2 Yellowedge Grouper, Warsaw Grouper, Scamp and Blackfin Snapper

EFH for these species include coral reefs, live/hard bottom, submerged aquatic vegetation, artificial reefs and medium to high profile outcroppings. EFH includes the spawning area above the adult habitat and the additional pelagic environment, including Sargasum, required for larval survival and growth up to and including settlement. In addition, the Gulf Stream is an essential fish habitat because it provides a mechanism to disperse snapper grouper larvae. Areas which meet the criteria for essential fish habitat-habitat areas of particular concern in the vicinity of the proposed ODMDS include medium to high profile offshore hardbottoms where spawning normally occurs; Sargassum; and all hermatypic coral habitats and reefs. (SAFMC, 1998)

Surveys conducted at the site are described in Section 2.3.7. The surveys indicate that there exists little potential for coral reefs, submerged aquatic vegetation, artificial reefs or medium to high profile outcroppings within or adjacent to the proposed ODMDS. Some hard bottom/live bottom or patch reefs are possible within the limited rubble areas. With the exemption of the rubble areas, these categories of EFH are not expected to be affected by site designation. The habitat associated with the ridge-like feature identified in the center of the proposed ODMDS and the rubble areas will likely be significantly affected by site designation through burial. However, any dredged material that consists of rock or gravel that may be disposed in association with construction projects (e.g. Port Everglades Harbor Deepening Project) may replace the buried structure.

Adverse impacts are not expected to the Gulf Stream as dredged material must undergo liquid and suspended phase toxicity testing and must meet the applicable water quality criteria (see Section 3.1.1). Impacts to Sargassum are also not expected. Dredged material is discharged below the surface from the bottom of a barge or hopper barge which typically have drafts greater than 10 feet. Due to the suspended sediment load, the discharge plume is denser than water and mostly remains below the surface (Tsai et al., 1992).

3.3.3 Golden Tilefish

According to Grimes et. al. (1986), “Golden tilefish are shelter seeking and inhabit three more or less distinct habitats: (1) horizontal excavations in clay outcrops along the walls of submarine canyons (pueblo habitats); (2) scour depressions under rocks and boulders and ; (3) the primary habitat, funnel-shaped vertical burrows in horizontal clay substrates.” The two critical habitat requirements are relatively warm stable bottom temperatures in the range of 9 to 14^{o} C and the availability of shelter or malleable substrate from which to construct shelter. (Grimes, et. al., 1986). Golden tilefish inhabits the outer continental shelf and upper continental slope along the entire east coast of the U.S. living at depths from 76 to 457 meters. (SAFMC, 1998). A deepwater survey off of Fort Lauderdale, FL for the proposed Tractebel Calypso Pipeline identified a zone characterized by distinctive craters, often exceeding 1 foot in diameter which are thought to have been excavated by tilefish. This zone was located in water depths from about 325 feet to 500 feet (100 to 152 meters) [FERC, 2004]. The location of this zone has been estimated and shown relative to the proposed ODMDS in figure 3.

Bottom temperature at the proposed ODMDS were measured at 7°C during surveys conducted in April and May of 1998 (EPA, 1999) indicating that temperatures at the proposed ODMDS are near the range required by tilefish. Pueblo habitats are unlikely based on the surveys conducted at the proposed site (see Section 2.3.7). Samples collected from the proposed ODMDS indicated the material to be silty fine sand with approximately 15% of the grains finer than sand (EPA, 1999). This appears to contain too much sand and silt for the creation of the funnel-shaped vertical burrows described above. The only potential habitat for the Golden tilefish is therefore the widely scattered rubble areas. The habitat associated with the ridge-like feature identified in the center of the proposed ODMDS and the rubble areas will likely be significantly affected by site designation through burial. However, any dredged material that consists of rock or gravel that may be disposed in association with construction projects (e.g. Port Everglades Harbor Deepening Project) may replace the buried structure and provide new habitat for Golden tilefish that may be present. EPA therefore believes that the designation of the proposed ODMDS would only have a minor affect on potential Golden tilefish benthic habitat.

EFH for the Golden tilefish also includes the water column, the Gulf Stream and Sargassum. As discussed in Section 3.3.2 above, adverse impacts to the Gulf Stream and/or Sargassum are not expected.

3.3.4 Blueline Tilefish

As discussed in Section 2.3.4, the Blueline tilefish occurs in water depths between 68 and 236 meters. The species frequent irregular bottom comprised of troughs and terraces inter-mingled with sand, mud, or shell hash bottom along the continental shelf break. Tilefish are epibenthic browsers, often feeding upon crabs, shrimps, snails, worms, sea urchins, and fish. Water temperatures for Blueline tilefish typically range from 15 to 23°C (Parker and Mays, 1998) which is higher than that at the proposed ODMDS (see Section 3.3.3). The sand and shell hash bottom and the rubble areas are possible habitat for the Blueline tilefish. However, the cold water at the proposed ODMDS make the area less than ideal habitat for the Blueline tilefish. EPA therefore believes that the designation of the proposed ODMDS is unlikely to adversely affect Blueline tilefish benthic habitat.

EFH for the Blueline tilefish also includes the water column, the Gulf Stream and Sargassum. As discussed in Section 3.3.2 above, adverse impacts to the Gulf Stream and/or Sargassum are not expected.

3.3.5 Highly Migratory and Coastal Migratory Species

EFH in the vicinity of the proposed ODMDS for highly migratory species is limited to the water column, the Florida Current (Gulf Stream) in particular, and Sargassum. As discussed in Section 3.3.2 above, adverse impacts to the Gulf Stream and/or Sargassum are not expected.

As the proposed ODMDS lies beyond the continental shelf, coastal migratory species EFH in the vicinity of the proposed ODMDS is limited to Dolphin habitat (see Section 2.3.5). The Gulf Stream and Sargassum are considered EFH for Dolphin. As discussed in Section 3.3.2 above, adverse impacts to the Gulf Stream and/or Sargassum are not expected.

3.3.6 Spiny Lobster

As discussed in Section 2.3.6, EFH in the vicinity of the proposed ODMDS for the spiny lobster includes oceanic waters, soft sediments, coral and live/hard bottom habitat, and the Gulf Stream. Areas which meet the criteria for habitat areas of particular concern for the spiny lobster in the vicinity of the proposed ODMDS include coral and live/hard bottom habitat. Adverse impacts are not expected to the Gulf Stream or oceanic waters as dredged material must undergo liquid and suspended phase toxicity testing and must meet the applicable water quality criteria (see Section 3.1.1). Impacts to the benthos is expected to be of short duration (see Section 3.1.2). Surveys conducted at the site are described in Section 2.3.7. The surveys indicate that there exists little potential for significant amounts of live/hard bottom within or adjacent to the proposed ODMDS. Only small areas of rubble that could be habitat for the spiny lobster were detected. The habitat associated with the ridge-like feature identified in the center of the proposed ODMDS and the rubble areas will likely be significantly affected by site designation through burial. However, any dredged material that consists of rock or gravel that may be disposed in association with construction projects (e.g. U.S. Navy berth and Port Everglades Harbor Deepening Project) may replace the buried structure and provide new habitat for Golden tilefish that may be present. EPA therefore believes that the designation of the proposed ODMDS would only have a minor affect on potential spiny lobster benthic habitat.

3.3.7 Coral, Coral Reefs, and Live/Hard Bottom Habitat

As discussed in Section 2.3.7, EFH in the vicinity of the proposed ODMDS for coral, coral reefs and live/hardbottom includes rough, hard, exposed, stable substrate. Surveys conducted at the site are described in Section 2.3.7. The surveys indicate that there exists little potential for coral reefs, or medium to high profile outcroppings within or adjacent to the proposed ODMDS. However, possible live/hard bottom associated with rubble areas present within the proposed ODMDS is possible. Therefore, direct impacts are limited to these areas. The rubble areas will likely be significantly affected by site designation through burial.

Potential indirect effects include transport of disposal plumes shoreward towards the nearshore reefs in less than 30 meters (100ft) of water described in Section 2.3.7. These reefs are located approximately 3.0 nmi (5,500 meters) west of the proposed ODMDS. As discussed in Section 3.1.1, the potential for turbidity plumes to reach these areas was evaluated by the Corps of Engineers. Extreme (99 percentile) westerly currents were modeled and silt-clay concentrations were predicted to diminish rapidly to less than 1 mg/l within 1,500 meters of the disposal location. Sand concentrations were predicted to diminish to less 1 mg/l within 2,400 meters (CERC, 1998). As part of the monitoring efforts associated with the Miami ODMDS, which lies approximately a similar distance offshore and has a similar relationship to the Florida current, currents were monitored for exceedence of a 12 cm/sec (1 hour average) shoreward threshold. The 12cm/sec threshold was determined as the velocity necessary to transport plumes to the nearshore reefs (Proni et. al., 1998). Review of more than a years worth of records revealed that the 12cm/sec threshold was exceeded 2.5% of the time. Most of these exceedences were of only short duration (<2hrs) and only 11 exceeded five hours (Proni et. al, 1998). Therefore, EPA believes the potential for indirect effects on the nearshore reefs is minimal.

3.3.8 Sargassum

EFH for Sargassum is simply surface shelf waters and the Gulf Stream (see Section 2.3.9). Adverse impacts are not expected to the surface shelf waters or the Gulf Stream as dredged material must undergo liquid and suspended phase toxicity testing and must meet the applicable water quality criteria (see Section 3.1.1). In addition, surface waters are expected to have the least amount of contact with the disposal plume. Dredged material is discharged below the surface from the bottom of a barge or hopper barge which typically have drafts greater than 10 feet. Due to the suspended sediment load, the discharge plume is denser than water and mostly remains below the surface (Tsai et al., 1992).

4.0 PROPOSED MITIGATION

Direct and indirect effects on the water column and Gulf Stream will be mitigated through adequate testing of the liquid and elutriate phases of the dredged material proposed for disposal at the proposed ODMDS. Direct and indirect effects on the benthos will be mitigated through adequate testing of the solid phase of the dredged material. Testing will assure that site use will present no significant damage to the resources of the marine environment and no unacceptable adverse effect on the marine ecosystem (40 CFR 227.4).

Disposed dredged material areal impact will be limited to the ODMDS by utilization of a limited disposal zone (600 foot radius) as specified in the draft SMMP (EPA, 2004). Bathymetric surveys will be utilized following significant disposal events to monitor the extent of the disposal mound. In addition, EPA proposes to modify the SMMP to include utilization of sediment profile imaging (SPI) to map the extent of the disposal mound beyond that which is detectable by acoustic measurements. EPA also proposes to include monitoring of the benthic recovery rate utilizing the SPI technique. SPI can be used to identify major changes in grain size and infaunal successional stage (Rhoads and Germano, 1982). As the three southeast Florida ODMDS (Port Everglades Harbor, Palm Beach Harbor and Miami) are of similar depths and under similar current regimes, monitoring may occur at one or more of the ODMDS with the understanding that results are likely to be applicable to all three ODMDSs. Monitoring will likely occur following a major disposal event as minor events (e.g. 50,000 cubic yards) are unlikely to result in measurable impacts. Results would provide information on the areal extent of benthic impact and on the rate of recovery from major disposal events.

In addition, burial of the small rubble zones may be unintentionally mitigated through dredged material disposal. New work construction projects such as those currently proposed (Port Everglades Harbor Deepening Project) typically have significant amounts of rubble limestone associated with them. Larger material is typically used for beneficial uses. However, smaller material or material that can not be economically separated from the dredged material must be disposed. In the case of the Miami Harbor Deepening Project, numerous mounds of limestone gravel were created at the Miami ODMDS as a result of dredged material disposal (McArthur, 1998; Collins and Pruitt, 2001). Such disposal could create additional hard substrate replacing that buried by routine maintenance events.

5.0 IMPACT SUMMARY AND CONCLUSIONS FOR ESSENTIAL FISH HABITAT

Designation of the Port Everglades Harbor ODMDS may adversely affect essential fish habitat. However, EPA believes that any effect will be minor. Direct and indirect impacts to the water column and benthos will be mitigated through appropriate testing of the dredged material prior to disposal. The greatest potential for impact will likely occur as a result of accumulation of dredged material and associated changes in sediment characteristics that may cause impacts to benthic-dwelling organisms (see Section 3.1.2) and the burial of rubble zones within the proposed ODMDS boundaries. Burial of the rubble areas could impact habitat of the Snapper Grouper Complex (yellowedge grouper, warsaw grouper, scamp, blackfin snapper, golden tilefish, blueline tilefish), spiny lobster and hard/live bottom. EPA proposes to monitor the areal extent of impact and the rate of recovery. The greatest potential of impact due to cumulative impacts are associated with major navigation projects that would utilize the ODMDS (see Section 3.2.3). The effect of any future project would be dependent on the volume of material to be disposed at the ODMDS.

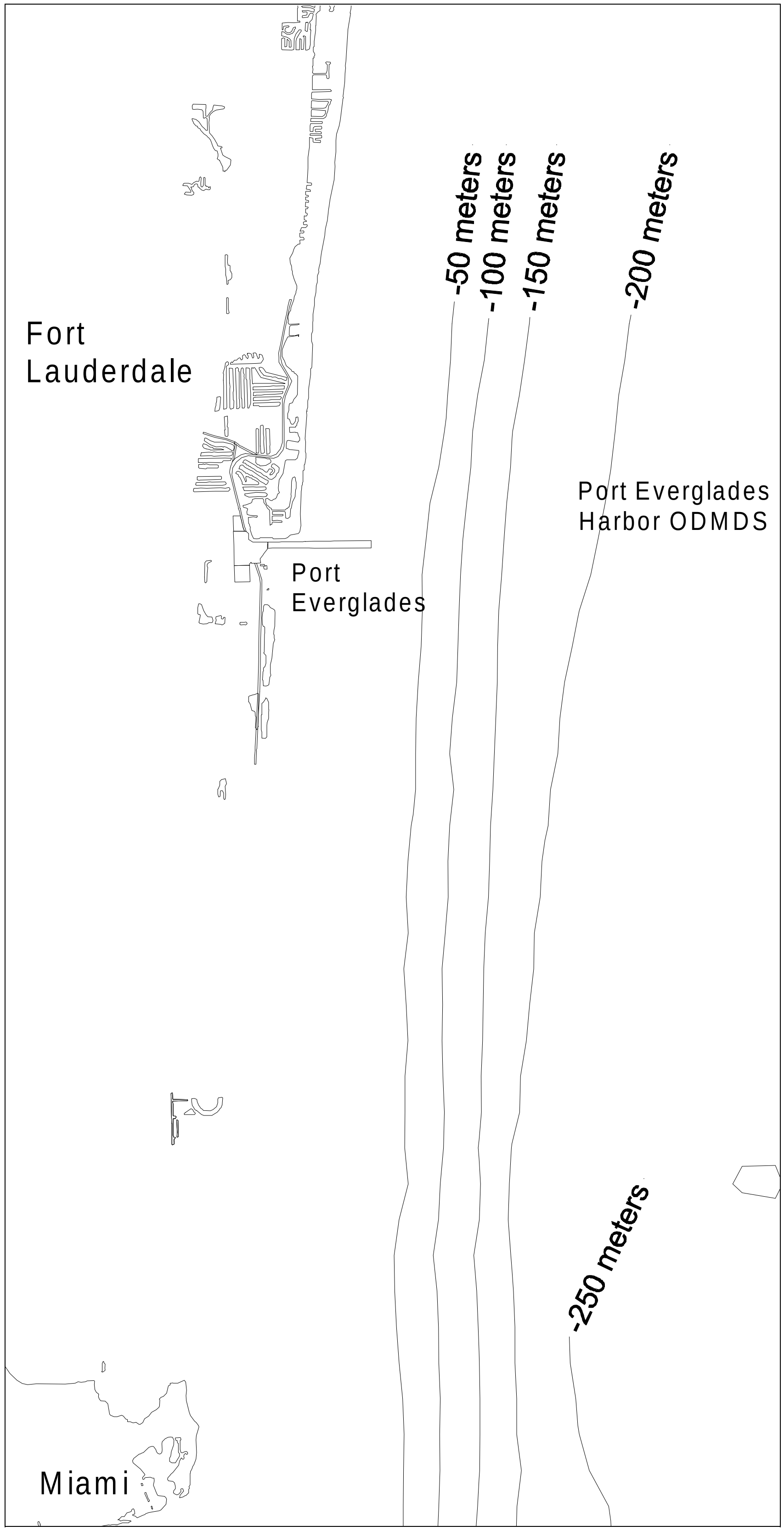

Figure 1: Proposed Palm Beach Harbor ODMDS Location

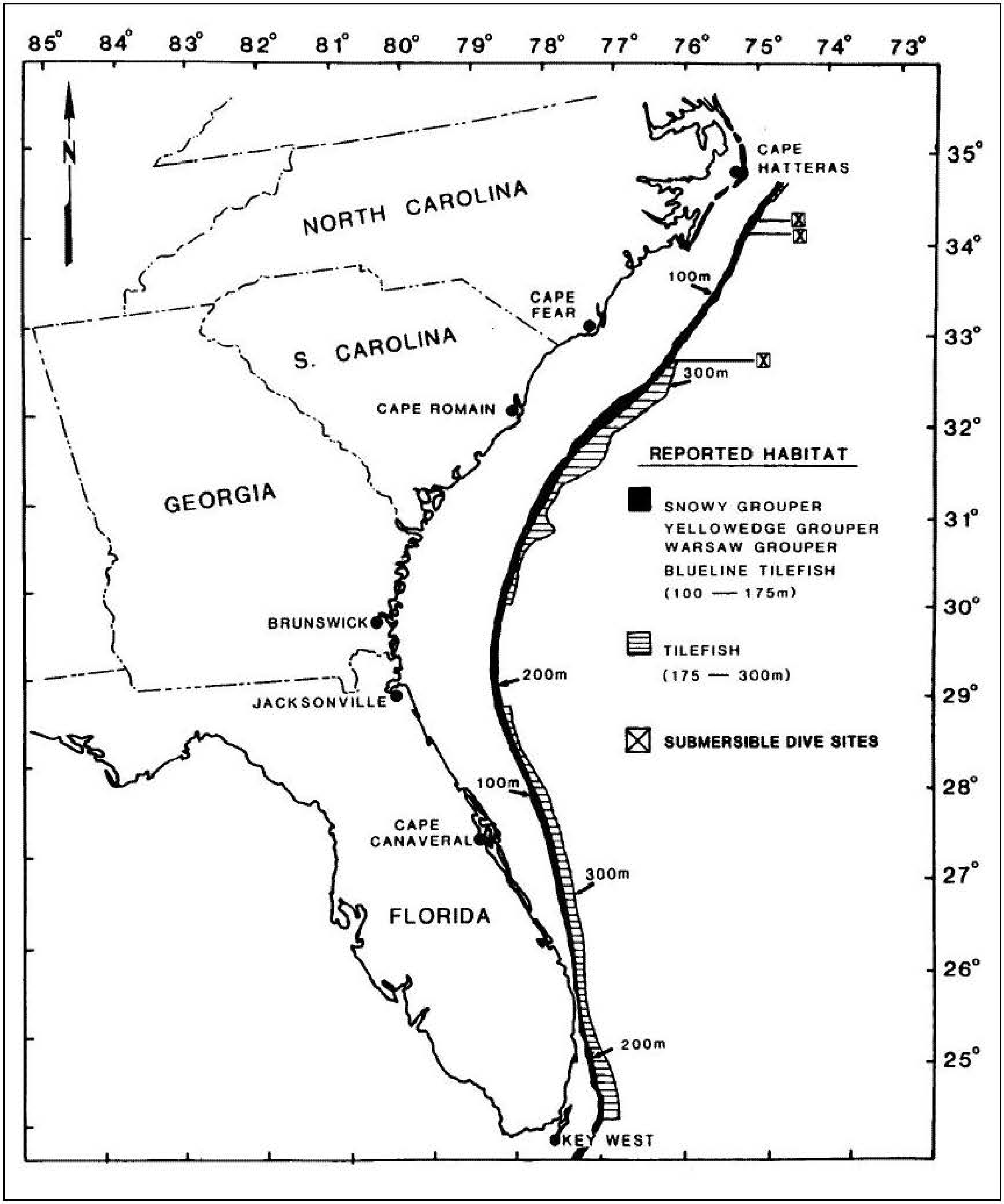

Figure 2: Deepwater reef fish habitat reported by commercial and recreational fisherman (Parker and Mays, 1998)

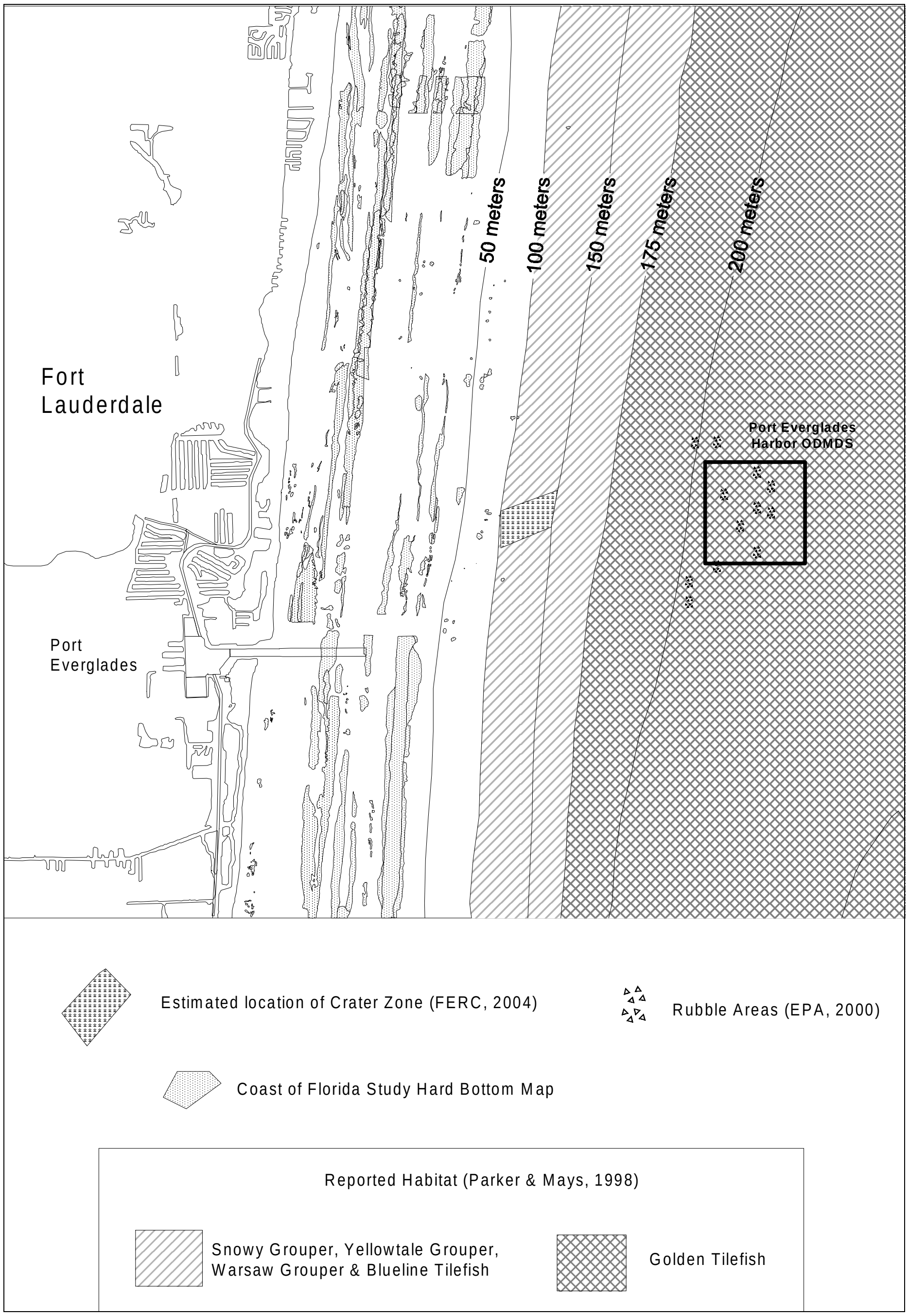

Figure 3: Benthic habitat in vicinity of proposed Port Everglades Harbor ODMDS

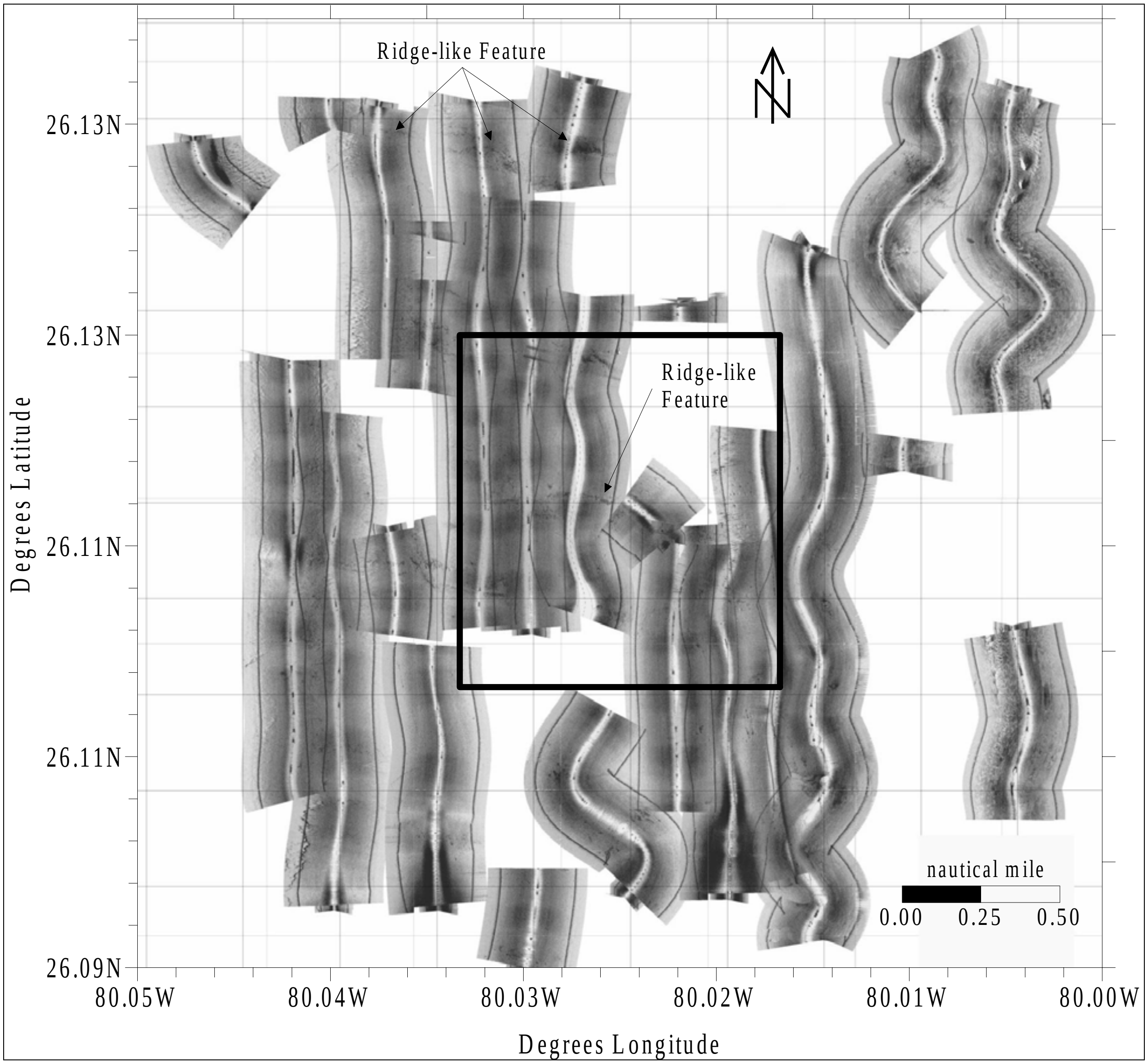

Figure 4: Sidescan Sonar Mosaic of proposed ODMDS

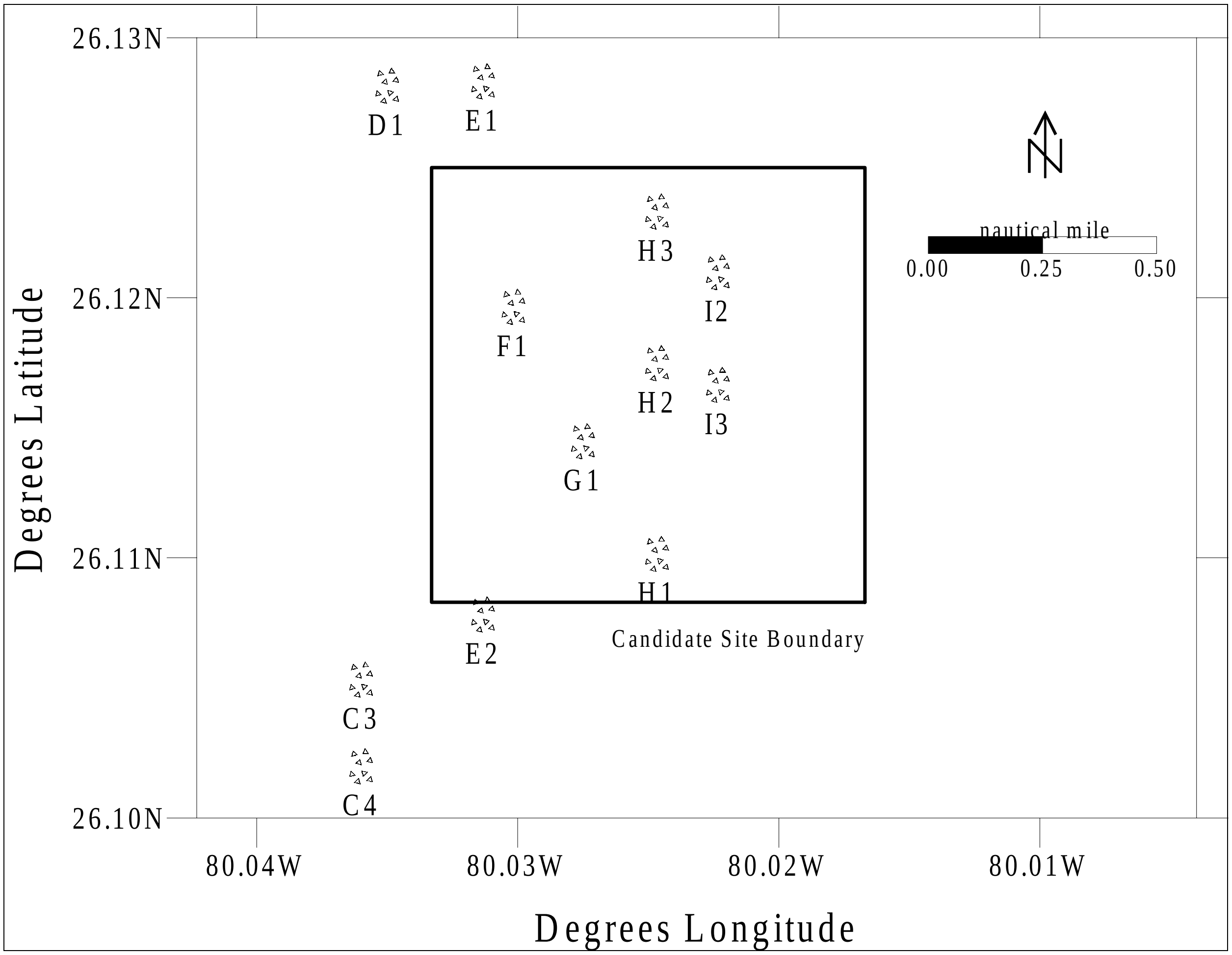

Figure 5: Areas of Scattered Low-Relief In and Near the Port Everglades Harbor Proposed ODMDS. Labels correspond to images presented in EPA (2000).

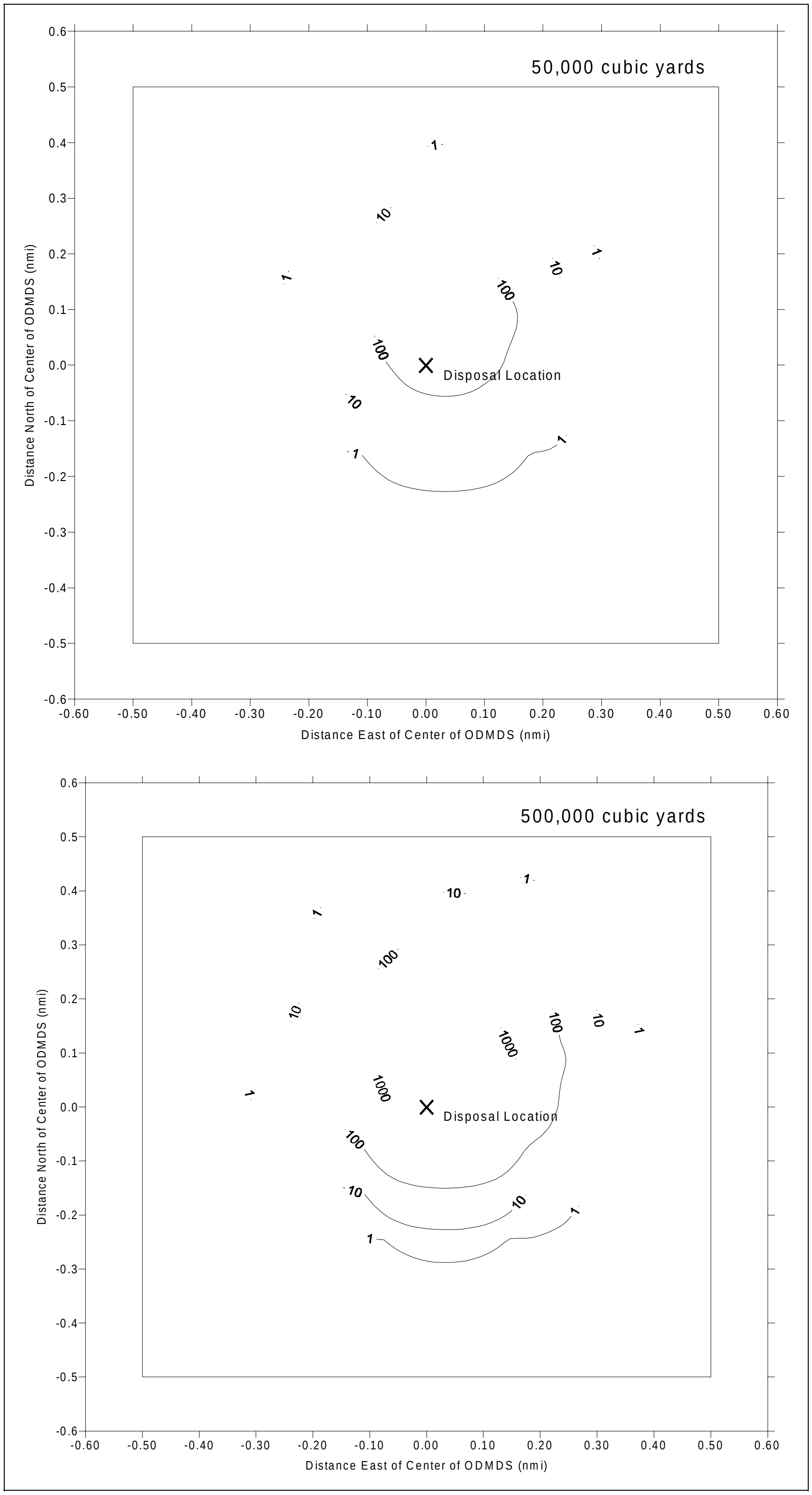

Figure 6: Disposal deposition (mm) for 50,000 and 500,000 cy of dredged material from STFATE model output.

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Appendix J

USACE ERDC, WES WIS SOUTH ALTLANTIC REGION

USACE ENGINEER RESEARCH AND DEVELOPMENT CENTER (ERDC),

WATER EXPERIMENT STATION (WES)

WAVE INFORMATION STUDY (WIS) SOUTH ATLANTIC REGION

Army Corps of Engineers WES, Coastal Hydraulics Laboratory (CHL), WIS has produced a major archieve of wave information near U.S. coastlines. WIS Atlantic data covers wave climate information for a 20 year period, 1976-1995 including hurricanes. Station locations in the region are seen in Figure 1. Stations 9-13 are close to the project sites. The summary of wave data belong to those stations are supplied from WES, CHL webpage and presented in this appendix.

NOTES:
1976-1995 Atlantic update hindcast includes hurricanes
0.25-deg computational grid
Station number
Latitude (degrees to hundredths)
Longitude (degrees to hundredths)
Water depth (meters)
Return period interval (years)
Significant wave height (meters)
EITHER Fisher-Tippet Type I or Fisher-Tippet Type II provided the "best fit" for the tropical/non-tropical events.

1976-1995 WIS ATLANTIC UPDATE -- WITH HURRICANES

STATION 9 (26.00N, 80.00W) DEPTH: 220 Meters

	RETURN PERIOD (Years)					
	2	5	10	20	25	50
TYPE I	5.31	5.98	6.44	6.89	7.04	7.48
TYPE II	5.37	6.14	6.75	7.41	7.63	8.36

STATION 10 (26.25N, 80.00W) DEPTH: 183 Meters

	RETURN PERIOD (Years)					
	2	5	10	20	25	50
TYPE I	5.21	5.87	6.32	6.77	6.91	7.34
TYPE II	5.25	6.02	6.63	7.28	7.50	8.22

STATION 11 (26.50N, 80.00W) DEPTH: 90 Meters

	RETURN PERIOD (Years)					
	2	5	10	20	25	50
TYPE I	5.06	5.62	6.00	6.38	6.50	6.87
TYPE II	5.13	5.81	6.34	6.91	7.10	7.72

STATION 12 (26.75N, 80.00W) DEPTH: 45 Meters

	RETURN PERIOD (Years)					
	2	5	10	20	25	50
TYPE I	5.00	5.44	5.75	6.05	6.14	6.44
TYPE II	5.03	5.55	5.95	6.36	6.50	6.95

STATION 13 (27.00N, 80.00W) DEPTH: 45 Meters

	RETURN PERIOD (Years)					
	2	5	10	20	25	50
TYPE I	5.27	5.77	6.12	6.46	6.57	6.90
TYPE II	5.29	5.94	6.46	7.01	7.19	7.79

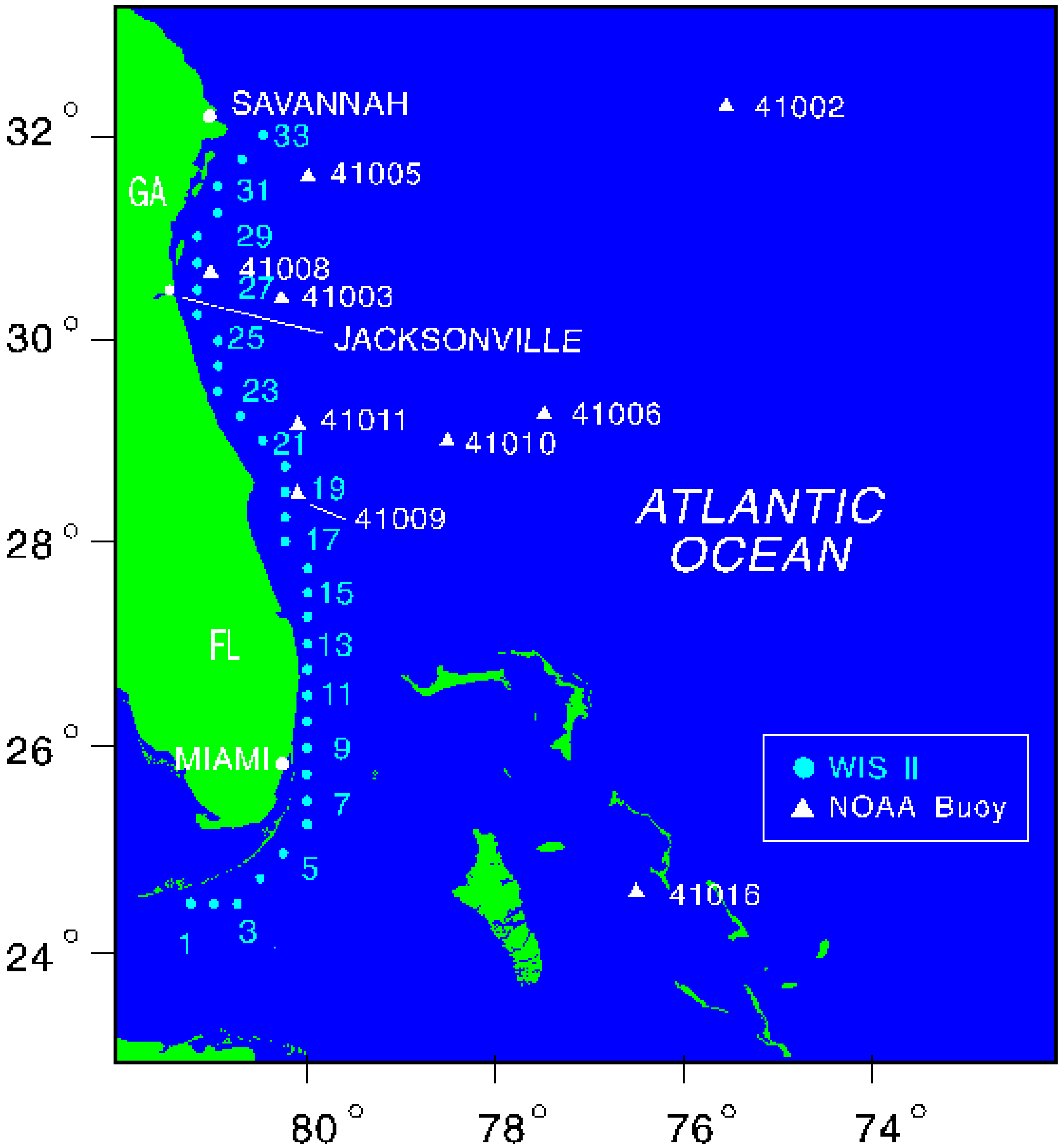

Figure 1. WIS, South Atlantic Region Stations (http://bigfoot.wes.army.mil/c414.html).

WIS ATLANTIC UPDATE -- WITH HURRICANES

1976 - 1995

LAT: 26.00 N, LONG: 80.00 W, DEPTH: 220 M

STATION: 9

SUMMARY OF WAVE INFORMATION BY MONTH

OCCURRENCES OF WAVE HEIGHT BY MONTH FOR ALL YEARS

Hmo(m)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0.00 - 0.49	275	280	416	570	940	1699	2171	2030	990	593	233	289	10486
0.50 - 0.99	2043	1804	1945	2174	2475	2406	2413	2272	2658	1907	1717	2005	25819
1.00 - 1.49	1506	1327	1249	1276	1048	490	291	450	759	1305	1422	1356	12479
1.50 - 1.99	610	628	677	433	372	151	60	120	221	715	807	678	5472
2.00 - 2.49	298	258	372	204	86	33	15	48	74	287	347	332	2354
2.50 - 2.99	101	108	177	83	26	17	9	13	50	101	141	180	1006
3.00 - 3.49	62	66	75	30	10	4	.	4	30	41	76	63	461
3.50 - 3.99	24	31	28	24	3	.	1	5	8	11	23	30	188
4.00 - 4.49	17	13	14	6	.	.	.	8	3	.	20	16	97
4.50 - 4.99	9	4	4	.	.	.	.	7	1	.	5	8	38
5.00 - 5.49	8	1	2	.	.	.	.	1	3	.	4	3	22
5.50 - 5.99	4	.	1	.	.	.	.	.	2	.	3	.	10
6.00 - 6.49	2	.	.	.	.	.	.	.	.	.	.	.	2
6.50 - 6.99	1	.	.	.	.	.	.	2	1	.	2	.	6
7.00 - 7.49	.	.	.	.	.	.	.	.	.	.	.	.	0
7.50 - 7.99	.	.	.	.	.	.	.	.	.	.	.	.	0
8.00 - 8.49	.	.	.	.	.	.	.	.	.	.	.	.	0
8.50 - 8.99	.	.	.	.	.	.	.	.	.	.	.	.	0
9.00 - 9.49	.	.	.	.	.	.	.	.	.	.	.	.	0
9.50 - 9.99	.	.	.	.	.	.	.	.	.	.	.	.	0
10.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

9

Tp(sec)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
3.0 - 3.9	161	134	209	195	368	656	938	892	354	90	119	118	4234
4.0 - 4.9	694	556	601	600	807	894	1423	1052	556	384	449	616	8632
5.0 - 5.9	861	832	759	915	922	690	710	663	650	652	894	732	9280
6.0 - 6.9	820	758	772	726	763	826	533	530	607	855	981	842	9013
7.0 - 7.9	478	497	566	399	436	443	390	438	492	648	620	550	5957
8.9	327	332	446	318	331	326	293	400	484	473	378	441	4549
9.9	285	269	244	201	303	222	173	194	443	468	290	316	3408
	189	228	217	173	200	201	130	162	281	292	222	203	2498
	178	112	205	213	212	221	151	147	207	224	164	151	2185
	209	99	189	315	301	135	131	198	216	216	178	176	2363
	147	126	194	322	147	88	54	136	196	205	130	216	1961

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
14.0 - 14.9	137	114	223	192	76	55	17	61	137	193	150	191	1546
15.0 - 15.9	120	91	119	89	60	28	9	37	113	112	52	164	994
16.0 - 16.9	149	144	67	68	13	10	6	21	34	66	80	80	738
17.0 - 17.9	99	117	49	20	12	5	2	20	16	39	38	55	472
18.0 - 18.9	65	56	45	16	4	.	.	8	11	21	22	40	288
19.0 - 19.9	27	22	36	27	3	.	.	1	3	11	20	25	175
20.0 - LONGER	14	33	19	11	2	.	.	.	.	11	13	44	147
TOTAL	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

9

OCCURRENCES OF PEAK DIRECTION BY MONTH FOR ALL YEARS

Dp(deg) DIRECTION BAND & CENTER	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
348.75 - 11.24 (0.0)	535	347	272	197	74	45	11	45	52	115	289	394	2376
11.25 - 33.74 (22.5)	980	844	548	493	474	369	184	408	787	1064	974	1166	8291
33.75 - 56.24 (45.0)	1495	1255	1635	1738	1556	1199	828	1265	1973	2384	1541	1609	18478
56.25 - 78.74 (67.5)	311	355	377	365	488	400	257	383	573	645	631	400	5185
78.75 - 101.24 (90.0)	396	449	512	686	870	690	1156	1093	636	357	676	474	7995
101.25 - 123.74 (112.5)	225	307	369	375	573	726	1062	682	315	126	265	280	5305
123.75 - 146.24 (135.0)	218	243	384	408	459	620	1015	636	231	98	172	161	4645
146.25 - 168.74 (157.5)	205	198	301	194	247	437	316	281	127	63	69	112	2550
168.75 - 191.24 (180.0)	139	131	172	60	107	196	63	96	80	42	49	64	1199
191.25 - 213.74 (202.5)	43	34	27	16	16	46	34	21	10	9	11	25	292
213.75 - 236.24 (225.0)	26	11	35	9	8	18	19	28	5	8	13	17	197
236.25 - 258.74 (247.5)	19	18	28	20	13	34	12	3	2	4	5	10	168
258.75 - 281.24 (270.0)	20	31	52	27	33	15	2	4	.	5	11	16	216
281.25 - 303.74 (292.5)	83	60	76	52	21	2	1	2	.	4	7	23	331
303.75 - 326.24 (315.0)	101	113	81	81	12	1	.	5	.	10	27	92	523
326.25 - 348.74 (337.5)	164	124	91	79	9	2	.	8	9	26	60	117	689
TOTAL	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

9

STATION:

Hmo(m)		5.0- 6.9	7.0- 8.9	9.0- 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 20.9	21.0- LONGER	TOTAL
- 0.99	11897	7419	5194	3795	3488	2612	1252	491	140	17	36305
- 1.99	969	10587	2438	1427	903	812	426	248	127	14	17951
- 2.99	.	287	2585	205	114	71	54	20	24	.	3360
- 3.99	.	.	278	343	16	11	.	1	.	.	649
- 4.99	.	.	11	118	6	.	.	.	.	.	135

TOTAL

- 5.99	.	.	.	15	17	.	.	.	.	.	32
- 6.99	.	.	.	3	4	1	.	.	.	.	8
- 7.99	.	.	.	.	.	.	.	.	.	.	0
- 8.99	.	.	.	.	.	.	.	.	.	.	0
- GREATER	.	.	.	.	.	.	.	.	.	.	0
	12866	18293	10506	5906	4548	3507	1732	760	291	31	58440

9

5.00
6.00
7.00
8.00
9.00

TOTAL

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
- 2.49	242	336	301	469	670	949	950	1087	902	768	226	291	7191
- 4.99	1170	938	1138	1300	1568	2134	2298	2141	1905	1282	1056	1190	18120
- 7.49	2107	1885	1982	1945	2003	1426	1574	1457	1534	1754	1984	1992	21643
- 9.99	877	766	835	731	572	233	107	187	291	780	953	844	7176
- 12.49	457	501	585	313	142	56	30	62	134	355	495	562	3692
- 14.99	76	82	96	41	5	2	1	11	22	18	63	62	479
- 17.49	28	11	20	1	.	.	.	11	7	1	19	18	116
- 19.99	2	1	3	.	.	.	.	1	3	1	2	1	14
- GREATER	1							3	2	1	2		9
	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

WS(m/sec)

0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00

9

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
- 22.49 (0.0)	872	605	538	399	199	99	95	151	199	631	702	796	5286
- 67.49 (45.0)	998	783	746	686	629	440	246	370	902	1757	1412	1250	10219
- 112.49 (90.0)	1060	1079	1240	1493	1916	1587	2007	2225	2131	1413	1469	1317	18937
- 157.49 (135.0)	654	706	1004	959	1155	1307	1513	1232	865	468	569	554	10986
- 202.49 (180.0)	354	370	493	339	496	741	540	454	376	202	194	254	4813
- 247.49 (225.0)	234	209	265	230	247	388	307	275	139	150	105	147	2696
- 292.49 (270.0)	215	249	287	297	193	155	174	122	94	111	99	176	2172
- 337.49 (315.0)	573	519	387	397	125	83	78	131	94	228	250	466	3331
	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

DIRECTION BAND & CENTERED

OCCURRENCES OF WIND SPEED BY MONTH FOR ALL YEARS

TOTAL

337.50
WD(deg)
22.50
67.50
112.50
157.50
STATION:
202.50
247.50
292.50

1976 - 1995

OCCURRENCES OF WIND DIRECTION BY MONTH FOR ALL YEARS

9

TOTAL

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
1976	1.30	1.08	1.01	0.95	0.85	0.67	0.42	0.66	0.42	1.35	1.30	1.53	0.96
1977	1.15	1.02	1.10	1.50	0.95	0.42	0.53	0.94	0.61	0.92	1.38	1.21	0.98
1978	1.22	1.25	1.04	0.90	0.68	0.64	0.58	0.55	0.77	1.42	1.25	1.41	0.98
1979	1.70	1.28	1.34	1.35	0.94	0.78	0.64	0.48	1.34	0.90	1.59	1.34	1.14
1980	1.05	1.44	1.16	0.91	0.74	0.55	0.43	0.79	0.60	0.80	1.33	1.33	0.93
1981	1.03	1.70	1.43	1.09	0.69	0.66	0.47	0.81	0.79	1.06	1.17	0.99	0.98
1982	0.96	0.88	1.04	0.78	0.86	0.72	0.46	0.52	0.62	1.08	1.18	1.27	0.86
1983	0.91	1.41	1.17	1.11	0.89	0.57	0.53	0.47	0.93	1.12	0.98	1.37	0.95
1984	1.61	1.19	1.17	0.93	1.06	0.70	0.60	0.51	1.17	1.48	1.72	1.30	1.12
1985	0.98	1.40	1.08	1.07	0.55	0.52	0.53	0.69	1.33	1.03	1.33	1.25	0.97
1986	1.22	0.97	1.50	0.86	1.08	0.57	0.44	0.75	0.89	1.05	1.16	1.32	0.99
1987	1.21	1.10	1.67	0.88	0.87	0.65	0.63	0.55	0.47	1.31	1.37	0.98	0.97
1988	1.42	1.06	1.04	0.89	0.83	0.77	0.58	0.54	0.96	0.99	0.93	0.90	0.91
1989	0.90	0.97	1.04	0.74	0.63	0.55	0.45	0.44	0.75	0.93	0.74	0.85	0.75
1990	0.89	1.32	1.25	1.04	0.86	0.64	0.60	0.40	0.67	0.96	1.15	1.12	0.90
1991	0.88	0.98	1.02	1.00	0.94	0.56	0.40	0.48	0.60	1.07	1.14	1.03	0.84
1992	0.97	0.93	0.87	1.02	0.81	0.61	0.65	0.65	0.71	1.02	1.36	1.07	0.89
1993	1.31	1.14	1.23	1.09	0.96	0.73	0.41	0.55	0.72	0.78	1.25	1.08	0.94
1994	1.38	1.19	1.03	1.06	0.79	0.58	0.72	0.65	0.78	0.92	1.33	1.25	0.97
1995	1.02	0.94	1.29	0.91	0.74	0.74	0.63	0.91	0.84	1.26	1.14	1.10	0.96
MEAN	1.15	1.16	1.17	1.00	0.84	0.63	0.53	0.62	0.80	1.07	1.24	1.18	

MAX Hmo(m)*10 WITH ASSOCIATED Tp(sec) AND Dp(deg/10) BY MONTH AND YEAR

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAX
1976	39 9 3	37 9 7	38 8 4	29 8 8	32 813	12 510	8 511	1911 3	8 4 8	35 9 3	33 8 1	40 9 2	40 9 2
1977	24 7 1	24 736	33 9 4	41 9 7	30 8 6	12 516	11 510	25 7 8	21 613	27 7 0	43 9 1	31 8 4	43 9 1
1978	31 817	37 8 3	31 717	27 712	24 817	32 8 7	19 7 9	14 6 8	17 610	39 9 5	40 9 2	5210 7	5210 7
1979	5710 1	28 8 9	43 9 8	421014	27 7 4	29 8 8	29 711	14 5 7	6610 2	27 8 9	4110 4	3810 4	6610 2
1980	26 717	4910 1	30 8 6	30 817	23 7 8	19 7 7	14 610	48 9 9	14 6 8	20 7 5	33 8 5	30 8 3	4910 1
1981	36 9 0	5110 5	29 812	35 9 5	18 614	17 6 5	15 613	441017	17 6 7	32 8 5	34 8 5	29 7 1	5110 5
1982	32 819	30 811	44 917	22 711	21 7 7	28 715	17 612	11 514	11 5 9	2416 4	34 9 5	31 810	44 917
1983	24 7 7	42 914	50 919	32 8 0	22 7 9	12 511	19 7 9	24 735	29 8 5	39 9 6	34 9 4	5211 1	5211 1
1984	6713 2	35 9 4	38 819	20 615	28 8 5	18 6 9	14 612	23 713	5110 5	30 9 4	5211 1	37 9 8	6713 2
1985	30 7 0	39 8 7	4110 5	40 9 8	12 8 3	20 712	36 817	23 7 8	36 9 4	24 7 6	6611 8	35 9 2	6611 8
1986	4710 5	32 9 0	4110 1	2015 4	25 7 8	16 6 8	14 510	20 6 9	19 7 7	36 9 4	30 8 6	41 913	4710 5
1987	4510 3	28 818	5610 8	23 7 0	37 915	27 916	16 5 8	15 5 9	815 4	37 918	37 9 9	34 8 9	5610 8
1988	43 9 9	27 7 7	24 8 9	[illegible]	24 7 7	25 8 5	14 510	20 6 5	35 914	25 8 5	21 618	21 6 8	43 9 9
1989	2111 3	22 7 8	37 8 1	14 8 3	17 611	11 514	10 510	18 6 9	21 736	23 635	16 6 9	1915 4	37 8 1
1990	23 7 1	32 8 6	35 9 7	27 8 8	19 714	13 511	15 5 9	9 4 9	11 510	23 717	35 8 3	36 9 4	36 9 4
1991	28 7 9	20 7 7	34 818	27 8 5	36 811	16 9 3	10 511	1211 3	16 6 7	28 8 5	22 7 8	4110 4	4110 4
1992	25 714	20 717	26 8 9	2710 3	16 6 8	12 517	12 511	6910 5	14 610	32 8 4	30 8 5	21 7 4	6910 5
1993	35 936	25 7 5	50 918	25 814	20 6 9	19 7 8	10 512	14 611	21 7 3	28 819	23 7 4	35 9 5	50 918

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1994	32 8 2	39 8 7	37 917	21 710	2610 3	12 513	15 713	15 611	16 6 8	28 7 4	5912 5	36 914	5912 5
1995	32 914	17 7 7	28 8 1	19 710	13 614	20 717	26 7 5	25 8 6	13 9 3	27 816	19 7 0	25 7 1	32 914
MAX	6713 2	5110 5	5610 8	421014	37 915	32 8 7	36 817	6910 5	6610 2	39 9 6	6611 8	5211 1	

MAX Hmo(m): 6.9 MAX Tp(sec): 10. MAX Dp(deg): 54. DATE(gmt): 1992082409

MAX WIND SPEED(m/sec): 29. MAX WIND DIRECTION(deg): 65. DATE(gmt): 1992082409

MEAN Hmo(m): 0.9 MEAN Tp(sec): 7.

STANDARD DEVIATION Hmo(m): 0.6 STANDARD DEVIATION Tp(sec): 3.5

WIS ATLANTIC UPDATE -- WITH HURRICANES

STATION: 10 LAT: 26.25 N, LONG: 80.00 W, DEPTH: 183 M

SUMMARY OF WAVE INFORMATION BY MONTH

OCCURRENCES OF WAVE HEIGHT BY MONTH FOR ALL YEARS 1976 - 1995

Hmo(m)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0.00 - 0.49	263	259	377	471	870	1676	2226	1989	852	463	184	270	9900
0.50 - 0.99	1954	1718	1930	2167	2501	2418	2379	2299	2671	1887	1670	1942	25536
1.00 - 1.49	1557	1393	1260	1382	1107	501	281	461	844	1352	1467	1410	13015
1.50 - 1.99	644	635	720	444	355	157	50	118	245	782	851	700	5701
2.00 - 2.49	314	289	363	198	90	29	14	53	73	313	359	346	2441
2.50 - 2.99	100	114	187	83	27	16	7	14	68	107	143	173	1039
3.00 - 3.49	60	67	76	25	9	3	2	5	27	40	72	61	447
3.50 - 3.99	26	28	28	25	1	.	.	5	10	15	22	29	189
4.00 - 4.49	17	16	12	5	.	.	1	9	3	1	19	19	102
4.50 - 4.99	10	1	4	.	.	.	.	4	2	.	5	8	34
5.00 - 5.49	10	.	3	.	.	.	.	1	2	.	5	2	23
5.50 - 5.99	3	.	.	.	.	.	.	.	1	.	1	.	5
6.00 - 6.49	2	.	.	.	.	.	.	2	.	.	2	.	6
6.50 - 6.99	.	.	.	.	.	.	.	.	1	.	.	.	1
7.00 - 7.49	.	.	.	.	.	.	.	.	1	.	.	.	1
7.50 - 7.99	.	.	.	.	.	.	.	.	.	.	.	.	0
8.00 - 8.49	.	.	.	.	.	.	.	.	.	.	.	.	0
8.50 - 8.99	.	.	.	.	.	.	.	.	.	.	.	.	0
9.00 - 9.49	.	.	.	.	.	.	.	.	.	.	.	.	0
9.50 - 9.99	.	.	.	.	.	.	.	.	.	.	.	.	0
10.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	0
	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

10

Tp(sec)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
3.0 - 3.9	159	128	170	162	346	548	904	815	296	59	79	98	3764
4.0 - 4.9	627	540	542	550	736	854	1391	999	468	290	407	563	7967
5.0 - 5.9	784	732	678	861	874	662	607	620	621	566	843	650	8498
6.0 - 6.9	765	730	715	680	686	747	457	527	594	806	893	793	8393
7.0 - 7.9	497	482	562	381	412	440	379	447	499	668	618	545	5930
8.0 - 8.9	326	348	469	354	344	362	323	435	541	524	392	432	4850
9.0 - 9.9	297	286	245	203	333	300	241	223	465	506	322	356	3777
10.0 - 10.9	205	239	246	187	253	250	162	202	328	319	263	213	2867
11.0 - 11.9	189	120	247	261	272	251	200	184	225	270	186	184	2589
12.0 - 12.9	249	117	231	366	352	177	186	219	234	252	214	201	2798
13.0 - 13.9	170	138	232	348	163	98	73	132	202	228	156	236	2176
14.0 - 14.9	156	135	253	207	83	63	20	70	151	204	168	219	1729
15.0 - 15.9	139	103	137	95	71	32	10	34	112	117	65	188	1103
16.0 - 16.9	169	163	73	65	14	10	3	23	36	68	87	99	810
17.0 - 17.9	108	121	53	24	11	6	3	21	13	38	41	61	500
18.0 - 18.9	71	71	45	17	5	.	1	7	10	21	27	47	322
19.0 - 19.9	31	27	35	25	2	.	.	2	5	11	22	23	183
20.0 - LONGER	18	40	27	14	3	.	.	.	.	13	17	52	184
TOTAL	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

Dp(deg) DIRECTION BAND & CENTER	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
348.75 - 11.24 (0.0)	486	328	236	185	67	44	5	44	42	94	268	343	2142
11.25 - 33.74 (22.5)	874	720	486	439	426	340	164	386	710	835	880	1042	7302
33.75 - 56.24 (45.0)	1736	1522	1876	1944	1788	1436	1033	1386	2120	2653	1727	1889	21110
56.25 - 78.74 (67.5)	318	355	416	365	499	528	370	470	657	714	653	382	5727
78.75 - 101.24 (90.0)	330	380	424	580	709	563	908	906	550	311	634	442	6737
101.25 - 123.74 (112.5)	228	281	349	410	587	618	1098	689	313	107	241	254	5175
123.75 - 146.24 (135.0)	179	215	352	357	400	532	838	586	193	90	161	141	4044
146.25 - 168.74 (157.5)	204	191	289	200	251	416	363	324	112	57	73	112	2592
168.75 - 191.24 (180.0)	158	157	175	70	122	202	75	102	78	38	42	70	1289
191.25 - 213.74 (202.5)	37	27	21	15	15	51	47	17	12	9	14	25	290
213.75 - 236.24 (225.0)	27	13	36	11	10	18	29	27	4	11	8	20	214
236.25 - 258.74 (247.5)	19	13	26	20	14	33	21	4	2	.	4	9	165
258.75 - 281.24 (270.0)	24	31	44	14	38	16	8	6	.	5	10	18	214
281.25 - 303.74 (292.5)	88	62	75	48	17	.	1	3	.	3	8	24	329
303.75 - 326.24 (315.0)	93	109	65	74	9	1	.	3	.	12	23	79	468
326.25 - 348.74 (337.5)	159	116	90	68	8	2	.	7	7	21	54	110	642
TOTAL	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

OCCURRENCES OF PEAK DIRECTION BY MONTH FOR ALL YEARS

STATION: 10

OCCURRENCES OF WIND SPEED BY MONTH FOR ALL YEARS

WS(m/sec)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0.00 - 2.49	252	352	316	479	690	956	984	1136	894	779	231	303	7372
2.50 - 4.99	1191	953	1153	1319	1620	2190	2377	2180	1968	1285	1091	1234	18561
5.00 - 7.49	2072	1873	1994	1948	1972	1375	1478	1383	1481	1747	1992	1974	21289
7.50 - 9.99	881	771	820	717	542	236	93	174	282	780	949	834	7079
10.00 - 12.49	457	483	561	297	132	43	25	60	144	341	457	534	3534
12.50 - 14.99	73	78	93	39	4	.	2	14	18	25	61	63	470
15.00 - 17.49	32	10	20	1	.	.	1	10	8	2	15	17	116
17.50 - 19.99	1	.	3	.	.	.	.	.	3	.	3	1	11
20.00 - GREATER	1							3	2	1	1		8
TOTAL	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

STATION: 10

OCCURRENCES OF WIND DIRECTION BY MONTH FOR ALL YEARS

DIRECTION BAND & CENTER

WD(deg)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
337.50 - 22.49 (0.0)	865	590	532	397	192	98	94	158	198	621	704	783	5232
22.50 - 67.49 (45.0)	974	767	736	681	643	443	246	365	910	1728	1389	1230	10112
67.50 - 112.49 (90.0)	999	1054	1172	1433	1817	1465	1824	2099	2107	1400	1401	1236	18007
112.50 - 157.49 (135.0)	670	672	999	966	1184	1335	1585	1288	857	481	604	593	11234
157.50 - 202.49 (180.0)	372	413	530	361	512	785	606	508	382	215	203	266	5153
202.50 - 247.49 (225.0)	243	212	280	251	274	428	341	289	151	147	115	163	2894
247.50 - 292.49 (270.0)	244	272	302	305	204	159	188	121	103	120	109	198	2325
292.50 - 337.49 (315.0)	593	540	409	406	134	87	76	132	92	248	275	491	3483
TOTAL	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

1976 - 1995

STATION: 10

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
1976	1.31	1.09	1.02	0.98	0.86	0.67	0.42	0.69	0.46	1.41	1.30	1.55	0.98
1977	1.18	1.03	1.11	1.48	0.93	0.41	0.51	0.93	0.64	0.95	1.41	1.23	0.99
1978	1.23	1.32	1.06	0.90	0.69	0.64	0.57	0.55	0.82	1.50	1.28	1.45	1.00
1979	1.74	1.32	1.36	1.36	0.96	0.80	0.62	0.48	1.35	0.94	1.60	1.35	1.15

1980	1.09	1.48	1.18	0.94	0.75	0.55	0.42	0.79	0.61	0.86	1.39	1.34	0.95
1981	1.02	1.69	1.51	1.04	0.71	0.66	0.47	0.80	0.85	1.08	1.16	0.99	0.99
1982	0.95	0.88	1.05	0.80	0.85	0.73	0.44	0.52	0.65	1.14	1.21	1.25	0.87
1983	0.94	1.49	1.18	1.13	0.87	0.60	0.52	0.47	0.97	1.17	1.03	1.40	0.98
1984	1.66	1.19	1.18	0.96	1.07	0.70	0.60	0.49	1.23	1.50	1.76	1.27	1.13
1985	1.00	1.41	1.08	1.08	0.57	0.53	0.53	0.69	1.40	1.05	1.36	1.28	0.99
1986	1.25	1.01	1.51	0.89	1.11	0.57	0.44	0.76	0.92	1.09	1.17	1.35	1.01
1987	1.26	1.11	1.71	0.91	0.88	0.64	0.62	0.56	0.49	1.34	1.34	0.97	0.99
1988	1.43	1.05	1.03	0.92	0.84	0.77	0.58	0.53	0.95	1.02	0.94	0.90	0.91
1989	0.91	0.96	1.06	0.77	0.64	0.56	0.44	0.47	0.81	0.99	0.75	0.87	0.77
1990	0.88	1.31	1.24	1.06	0.85	0.63	0.59	0.41	0.70	0.99	1.14	1.14	0.91
1991	0.89	1.00	1.02	1.00	0.93	0.58	0.41	0.49	0.65	1.12	1.15	1.02	0.85
1992	0.98	0.94	0.86	1.03	0.83	0.60	0.61	0.63	0.72	1.05	1.38	1.11	0.89
1993	1.34	1.18	1.27	1.12	0.96	0.74	0.40	0.56	0.73	0.82	1.27	1.11	0.96
1994	1.39	1.22	1.04	1.07	0.81	0.58	0.69	0.65	0.78	0.97	1.33	1.30	0.98
1995	1.01	0.95	1.31	0.93	0.77	0.74	0.63	0.94	0.88	1.28	1.15	1.11	0.98
MEAN	1.17	1.18	1.19	1.02	0.84	0.63	0.53	0.62	0.83	1.11	1.26	1.20	

MAX Hmo(m)*10 WITH ASSOCIATED Tp(sec) AND Dp(deg/10) BY MONTH AND YEAR

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAX
1976	39 9 3	36 9 7	37 8 5	27 736	31 813	12 512	8 511	2111 3	9 7 3	37 9 4	32 8 1	39 9 2	39 9 2
1977	25 7 1	23 736	34 9 5	41 9 7	29 8 6	12 516	11 511	25 7 8	21 7 8	25 7 0	42 9 1	32 9 4	42 9 1
1978	32 817	37 8 3	32 815	26 712	25 817	32 7 7	19 7 9	13 5 7	1711 4	4210 4	35 9 2	50 9 8	50 9 8
1979	5610 1	28 8 9	44 9 8	42 913	25 8 4	28 7 7	26 713	12 5 8	7311 5	28 7 9	4110 4	37 9 4	7311 5
1980	27 718	44 9 1	29 8 6	28 817	22 7 8	18 6 7	14 6 8	46 9 9	14 6 8	21 7 5	34 8 5	30 8 4	46 9 9
1981	34 9 1	48 9 4	3220 5	34 9 5	18 615	17 6 5	14 613	411017	16 6 7	30 8 5	32 8 5	26 7 3	48 9 4
1982	30 819	27 710	41 817	25 718	18 6 5	27 715	17 612	12 514	12 5 9	2716 5	32 9 5	31 811	41 817
1983	27 7 7	43 914	521018	32 836	21 710	12 511	19 710	27 8 1	29 8 5	36 9 6	33 9 5	5111 1	521018
1984	6412 2	34 9 5	40 819	21 713	29 8 4	18 6 9	13 612	23 713	5110 5	30 9 5	5111 1	34 9 9	6412 2
1985	30 8 1	4110 6	41 9 6	39 9 9	13 8 3	19 713	40 816	22 7 8	36 9 4	24 7 6	6210 9	38 9 2	6210 9
1986	4710 5	33 9 0	4010 1	2115 5	2514 5	15 6 6	13 510	21 6 9	19 7 7	36 9 4	31 9 5	41 912	4710 5
1987	47 9 1	28 818	5210 8	22 7 0	34 814	26 916	16 513	14 5 9	915 5	33 918	34 8 9	33 8 9	5210 8
1988	40 9 9	26 8 6	23 7 9	25 710	21 7 7	29 8 5	14 6 7	20 7 8	34 813	24 8 5	25 620	2116 5	40 9 9
1989	2311 9	20 6 6	37 8 1	14 6 8	18 612	11 514	9 511	18 6 9	22 736	24 9 3	16 6 9	2015 5	37 8 1
1990	22 7 1	31 9 6	34 8 8	26 8 8	19 714	12 5 6	14 5 9	9 410	11 510	24 817	34 8 4	35 9 4	35 9 4
1991	26 7 9	21 6 7	33 818	25 8 9	35 912	17 9 3	10 411	1310 3	17 6 7	28 8 6	22 7 8	4010 5	4010 5
1992	25 714	18 717	27 8 9	2711 3	16 6 8	13 516	11 512	6110 9	13 610	30 8 4	31 7 7	21 7 4	6110 9
1993	39 9 0	25 7 5	51 918	25 814	20 6 9	18 7 9	9 513	1613 5	21 7 2	28 819	23 7 4	35 9 5	51 918
1994	31 8 2	40 9 6	36 917	20 710	2710 3	12 513	14 612	15 611	16 6 9	2810 3	5712 5	36 913	5712 5
1995	31 814	18 7 7	28 815	19 710	13 8 3	19 717	26 8 6	25 8 6	14 9 3	27 815	19 636	25 7 1	31 814
MAX	6412 2	48 9 4	5210 8	42 913	35 912	32 7 7	40 816	6110 9	7311 5	4210 4	6210 9	5111 1	

STATION: 7.3 MAX Tp(sec): 11. MAX Dp(deg): 50. DATE(gmt): 1979090312

MAX WIND DIRECTION(deg): 55. DATE(gmt): 1992082409

WIS ATLANTIC UPDATE -- WITH HURRICANES

STATION: 11 1976 - 1995

LAT: 26.50 N, LONG: 80.00 W, DEPTH: 90 M

SUMMARY OF WAVE INFORMATION BY MONTH

OCCURRENCES OF WAVE HEIGHT BY MONTH FOR ALL YEARS

Hmo(m)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0.00 - 0.49	228	241	356	397	808	1601	2335	1957	713	344	171	252	9403
0.50 - 0.99	1895	1641	1870	2108	2510	2487	2284	2325	2688	1829	1542	1831	25010
1.00 - 1.49	1585	1471	1289	1524	1192	521	274	466	929	1451	1566	1531	13799
1.50 - 1.99	686	619	708	444	309	146	40	118	263	790	905	656	5684
2.00 - 2.49	316	306	408	198	107	27	18	53	91	357	334	398	2613
2.50 - 2.99	119	137	191	83	28	15	5	12	67	128	157	161	1103
3.00 - 3.49	63	56	80	31	6	3	2	10	31	42	73	78	475
3.50 - 3.99	23	31	45	11	.	.	1	8	8	17	21	28	193
4.00 - 4.49	17	17	9	4	.	.	1	7	3	1	22	13	94
4.50 - 4.99	14	1	2	.	.	.	.	2	3	1	8	11	42
5.00 - 5.49	9	.	1	.	.	.	.	.	2	.	1	1	14
5.50 - 5.99	4	.	1	.	.	.	.	2	.	.	.	.	7
6.00 - 6.49	1	.	.	.	.	.	.	.	.	.	.	.	1
6.50 - 6.99	.	.	.	.	.	.	.	.	2	.	.	.	2
7.00 - 7.49	.	.	.	.	.	.	.	.	.	.	.	.	0
7.50 - 7.99	.	.	.	.	.	.	.	.	.	.	.	.	0
8.00 - 8.49	.	.	.	.	.	.	.	.	.	.	.	.	0
8.50 - 8.99	.	.	.	.	.	.	.	.	.	.	.	.	0
9.00 - 9.49	.	.	.	.	.	.	.	.	.	.	.	.	0
9.50 - 9.99	.	.	.	.	.	.	.	.	.	.	.	.	0
10.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

MEAN Hmo(m): 1.0 MEAN Tp(sec): 8.

STANDARD DEVIATION Hmo(m): 0.6 STANDARD DEVIATION Tp(sec): 3.6

STATION: 11

Tp(sec)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
3.9	148	98	139	136	300	446	850	708	212	32	42	87	3198
4.9	560	480	473	461	653	753	1267	921	387	210	359	449	6973
5.9	696	647	588	798	795	632	543	523	532	490	733	595	7572
6.9	701	737	751	672	669	675	429	539	590	747	876	789	8175
7.9	453	429	527	331	375	451	403	457	557	645	483	486	5597

8.0 - 8.9	343	344	420	342	362	419	351	511	558	574	432	424	5080
9.0 - 9.9	306	298	266	199	396	362	317	271	502	560	387	364	4228
10.0 - 10.9	210	244	256	222	305	326	200	254	353	380	303	248	3301
11.0 - 11.9	221	126	267	319	314	291	246	246	267	295	228	204	3024
12.0 - 12.9	272	158	284	416	374	196	213	230	249	279	244	222	3137
13.0 - 13.9	195	160	254	383	189	116	89	132	214	246	189	248	2415
14.0 - 14.9	190	155	296	232	95	72	31	70	171	202	190	274	1978
15.0 - 15.9	163	123	162	124	84	38	9	37	117	123	80	232	1292
16.0 - 16.9	192	172	84	70	25	17	6	23	45	80	92	114	920
17.0 - 17.9	131	152	52	32	10	5	3	18	25	47	74	74	623
18.0 - 18.9	91	93	55	17	8	1	3	12	14	22	36	57	409
19.0 - 19.9	53	48	42	23	2	.	.	3	7	11	32	32	253
20.0 - LONGER	35	56	44	23	4	.	.	5	.	17	20	61	265
TOTAL	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

11

OCCURRENCES OF PEAK DIRECTION BY MONTH FOR ALL YEARS

DIRECTION BAND & CENTER Dp(deg)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
348.75 - 11.24 (0.0)	401	309	200	158	56	39	3	42	27	81	247	310	1873
11.25 - 33.74 (22.5)	706	586	424	364	360	292	146	349	567	586	714	819	5913
33.75 - 56.24 (45.0)	1603	1427	1767	1838	1871	1542	1202	1449	2132	2606	1637	1913	20987
56.25 - 78.74 (67.5)	865	830	878	852	787	831	562	734	1071	1162	1181	822	10575
78.75 - 101.24 (90.0)	238	260	306	408	506	389	589	683	364	218	416	291	4668
101.25 - 123.74 (112.5)	205	218	287	386	539	498	1022	600	254	78	201	231	4519
123.75 - 146.24 (135.0)	156	208	316	313	374	480	850	573	181	88	171	107	3817
146.25 - 168.74 (157.5)	198	187	300	196	232	381	366	354	106	53	79	127	2579
168.75 - 191.24 (180.0)	173	173	181	76	132	221	79	103	76	35	41	68	1358
191.25 - 213.74 (202.5)	27	25	14	11	11	55	59	22	13	7	12	22	278
213.75 - 236.24 (225.0)	27	11	31	13	11	26	34	22	4	9	6	24	218
236.25 - 258.74 (247.5)	17	11	27	14	12	27	31	8	2	1	2	7	159
258.75 - 281.24 (270.0)	24	27	32	17	38	14	15	6	.	5	8	15	201
281.25 - 303.74 (292.5)	88	61	60	37	17	.	1	4	.	4	5	22	299
303.75 - 326.24 (315.0)	88	90	60	60	9	1	1	3	.	9	25	78	424
326.25 - 348.74 (337.5)	144	97	77	57	5	4	.	8	3	18	55	104	572
TOTAL	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

11

	5.0- 6.9	7.0- 8.9	9.0- 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 20.9	21.0- LONGER	TOTAL
TOTAL										

STATION:

WS(m/sec)											TOTAL
0.00 - 0.99	9291	5862	5506	4525	4313	2813	1313	579	172	39	34413
1.00 - 1.99	880	9138	3027	2148	1589	1360	762	358	197	24	19483
2.00 - 2.99	.	747	1846	447	198	193	129	91	52	13	3716
3.00 - 3.99	.	.	280	306	34	19	8	4	17	.	668
4.00 - 4.99	.	.	18	94	13	7	.	.	4	.	136
5.00 - 5.99	.	.	.	8	13	.	.	.	.	.	21
6.00 - 6.99	.	.	.	1	1	1	.	.	.	.	3
7.00 - 7.99	.	.	.	.	.	.	.	.	.	.	0
8.00 - 8.99	.	.	.	.	.	.	.	.	.	.	0
9.00 - GREATER	.	.	.	.	.	.	.	.	.	.	0
TOTAL	10171	15747	10677	7529	6161	4393	2212	1032	442	76	58440

11

OCCURRENCES OF WIND SPEED BY MONTH FOR ALL YEARS

WS(m/sec)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0.00 - 2.49	269	358	339	490	706	996	1046	1207	930	762	260	328	7691
2.50 - 4.99	1201	1001	1166	1350	1686	2207	2440	2209	1996	1314	1095	1284	18949
5.00 - 7.49	2040	1815	1983	1944	1952	1336	1362	1295	1423	1763	2012	1963	20888
7.50 - 9.99	898	783	831	688	484	214	83	166	265	780	922	788	6902
10.00 - 12.49	445	487	523	288	130	47	25	55	155	305	438	502	3400
12.50 - 14.99	70	67	94	38	2	.	2	18	17	33	59	77	477
15.00 - 17.49	35	9	21	2	.	.	2	7	10	2	11	17	116
17.50 - 19.99	2	.	3	.	.	.	.	1	1	1	3	1	12
20.00 - GREATER	.	.	.	.	.	.	.	2	3	.	.	.	5
TOTAL	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

11

STATION:

OCCURRENCES OF WIND DIRECTION BY MONTH FOR ALL YEARS

DIRECTION BAND & CENTER

WD(deg)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
337.50 - 22.49 (0.0)	869	600	533	424	196	121	94	172	202	624	709	773	5317
22.50 - 67.49 (45.0)	929	748	727	635	666	434	245	341	942	1697	1361	1207	9932
67.50 - 112.49 (90.0)	[illegible]	881	1093	1355	1710	1311	1585	1965	2027	1390	1355	1175	16885
112.50 - 157.49 (135.0)	668	673	979	980	1199	1351	1650	1307	825	475	623	590	11320
157.50 - 202.49 (180.0)	404	451	587	392	521	833	706	588	422	217	213	308	5642
202.50 - 247.49 (225.0)	252	227	283	278	307	496	409	321	169	157	126	173	3198
247.50 - 292.49 (270.0)	275	299	320	320	218	167	197	123	118	123	127	206	2493
292.50 - 337.49 (315.0)	625	541	438	416	143	87	74	143	95	277	286	528	3653
TOTAL	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

OCCURRENCES OF WIND DIRECTION BY MONTH FOR ALL YEARS

TOTAL

1976 - 1995

WIS ATLANTIC UPDATE -- WITH HURRICANES

STATION: 11

LAT: 26.50 N, LONG: 80.00 W, DEPTH: 90 M

OCCURRENCES OF WAVE HEIGHT AND PEAK PERIOD FOR 22.5 DEG DIRECTION BANDS

SUMMARY OF MEAN Hmo(m) BY MONTH AND YEAR

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
1976	1.34	1.10	1.03	1.02	0.86	0.67	0.41	0.72	0.53	1.48	1.30	1.57	1.00
1977	1.24	1.03	1.14	1.45	0.90	0.41	0.50	0.91	0.67	0.99	1.45	1.27	1.00
1978	1.24	1.43	1.09	0.89	0.70	0.65	0.56	0.54	0.87	1.59	1.31	1.49	1.03
1979	1.79	1.37	1.37	1.38	0.99	0.80	0.61	0.48	1.35	0.98	1.59	1.38	1.17
1980	1.15	1.54	1.23	0.98	0.77	0.56	0.42	0.78	0.64	0.93	1.49	1.37	0.99
1981	1.02	1.70	1.65	1.00	0.74	0.66	0.47	0.78	0.92	1.11	1.16	1.00	1.01
1982	0.96	0.87	1.06	0.81	0.84	0.76	0.41	0.53	0.69	1.23	1.24	1.22	0.88
1983	0.97	1.57	1.20	1.17	0.85	0.63	0.51	0.48	1.01	1.24	1.08	1.45	1.01
1984	1.72	1.18	1.22	1.00	1.06	0.69	0.59	0.48	1.27	1.52	1.80	1.26	1.15
1985	1.02	1.43	1.09	1.10	0.59	0.54	0.53	0.69	1.48	1.06	1.39	1.31	1.01
1986	1.28	1.04	1.52	0.93	1.13	0.56	0.42	0.77	0.96	1.13	1.18	1.39	1.03
1987	1.34	1.11	1.76	0.96	0.89	0.62	0.61	0.57	0.54	1.39	1.31	0.96	1.01
1988	1.42	1.05	1.01	0.97	0.85	0.77	0.57	0.53	0.94	1.07	0.95	0.90	0.92
1989	0.92	0.95	1.09	0.79	0.66	0.57	0.44	0.49	0.88	1.08	0.76	0.91	0.79
1990	0.87	1.32	1.23	1.09	0.84	0.62	0.59	0.44	0.74	1.01	1.13	1.16	0.92
1991	0.90	1.01	1.03	0.99	0.91	0.62	0.41	0.49	0.71	1.18	1.15	1.03	0.87
1992	0.98	0.96	0.86	1.03	0.85	0.60	0.58	0.62	0.72	1.10	1.39	1.16	0.90
1993	1.37	1.21	1.32	1.15	0.96	0.73	0.40	0.57	0.72	0.86	1.29	1.15	0.98
1994	1.36	1.22	1.03	1.03	0.82	0.56	0.65	0.63	0.76	1.00	1.30	1.34	0.97
1995	1.01	0.95	1.30	0.94	0.80	0.73	0.60	0.95	0.90	1.27	1.16	1.12	0.98
MEAN	1.20	1.20	1.21	1.03	0.85	0.64	0.51	0.62	0.87	1.16	1.27	1.22	

STATION: 11

MAX Hmo(m)*10 WITH ASSOCIATED Tp(sec) AND Dp(deg/10) BY MONTH AND YEAR

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAX
1976	39 9 3	36 9 7	36 9 4	28 8 1	31 813	12 512	8 512	2211 4	1013 6	39 9 4	32 7 2	39 9 2	39 9 2
1977	25 7 1	24 8 4	35 9 5	3910 5	29 8 5	13 516	11 511	23 7 8	20 6 8	24 7 0	41 9 1	34 9 4	41 9 1
1978	32 817	37 8 3	33 815	25 713	26 817	32 9 7	18 6 9	12 5 8	1811 4	4510 4	31 8 2	4610 7	4610 7
1979	5510 1	29 7 4	36 7 8	44 913	25 8 4	28 7 4	26 713	11 5 8	6810 4	27 7 9	4110 4	37 9 4	6810 4
1980	28 718	41 9 1	27 8 7	27 817	20 6 7	17 6 6	15 6 8	43 813	14 5 8	21 7 4	36 8 5	3011 4	43 813
1981	34 9 1	47 9 5	4120 6	33 9 6	18 615	17 6 5	13 613	401017	15 5 6	29 8 5	31 7 5	24 7 4	47 9 5
1982	29 819	24 611	38 817	27 719	18 5 6	27 716	17 612	12 514	12 5 9	3116 5	30 8 5	30 712	38 817
1983	30 8 5	43 914	551018	32 836	20 610	13 517	18 610	30 8 0	30 8 5	34 9 6	33 9 5	5011 2	551018
1984	6213 3	33 9 5	41 918	22 616	29 8 4	19 610	13 514	24 713	5110 6	30 9 5	4910 1	30 8 1	6213 3
1985	30 8 1	4010 7	4110 6	33 7 8	15 8 3	19 613	43 917	22 619	3810 4	24 7 6	49 8 9	40 9 3	49 8 9
1986	4710 5	33 9 0	3910 1	2215 5	2514 5	16 6 6	12 511	21 6 9	21 6 8	3810 5	32 9 5	42 913	4710 5
1987	49 9 1	28 818	41 8 9	22 7 0	31 916	26 916	16 513	14 5 9	1016 5	29 818	31 8 4	30 7 3	49 9 1
1988	33 7 9	27 8 7	21 610	23 711	21 6 5	29 8 5	16 5 7	21 6 6	32 813	23 7 5	30 718	2216 5	33 7 9
1989	2511 4	2010 3	38 8 1	13 8 5	19 612	12 516	9 510	18 6 9	24 735	26 9 3	16 6 7	2115 5	38 8 1

	23 6 0	30 8 7	30 7 8	24 7 7	19 613	13 5 5	13 5 9	9 410	11 510	25 716	34 8 4	35 8 5	35 8 5
	25 7 9	21 7 7	32 818	24 7 9	34 912	18 9 3	10 517	1410 4	18 7 6	30 7 1	20 6 8	39 9 5	39 9 5
	25 714	1810 4	25 7 9	2811 4	15 9 4	13 517	11 513	5910 8	12 9 4	29 8 5	28 8 4	21 7 4	5910 8
	45 936	26 9 4	50 917	26 614	19 6 9	18 6 8	8 513	1813 5	21 7 2	29 819	2310 3	35 9 5	50 917
	3110 5	43 9 6	37 817	18 711	28 9 3	10 514	13 613	13 612	1713 4	2911 4	5111 6	3410 3	5111 6
1990	31 814	16 7 7	28 716	1810 3	14 8 3	18 717	27 8 6	26 9 7	15 9 3	25 816	19 636	24 7 0	31 814
1991													
1992													
1993	6213 3	47 9 5	551018	44 913	34 912	32 9 7	43 917	5910 8	6810 4	4510 4	5111 6	5011 2	
1994													
1995													
MAX													

MAX Hmo(m): 6.8 MAX Tp(sec): 10. MAX Dp(deg): 40. DATE(gmt): 1979090312

MAX WIND SPEED(m/sec): 23. MAX WIND DIRECTION(deg): 15. DATE(gmt): 1992082406

MEAN Hmo(m): 1.0 MEAN Tp(sec): 8.

STANDARD DEVIATION Hmo(m): 0.6 STANDARD DEVIATION Tp(sec): 3.7

WIS ATLANTIC UPDATE -- WITH HURRICANES 1976 - 1995

STATION: 12

LAT: 26.75 N, LONG: 80.00 W, DEPTH: 45 M

SUMMARY OF WAVE INFORMATION-BY MONTH

OCCURRENCES OF WAVE HEIGHT BY MONTH FOR ALL YEARS

Hmo(m)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0.00 - 0.49	203	203	295	333	697	1508	2355	1906	576	244	150	217	8687
0.50 - 0.99	1742	1529	1739	1901	2478	2519	2265	2333	2545	1611	1370	1659	23691
1.00 - 1.49	1613	1526	1365	1683	1305	567	270	465	1125	1577	1625	1608	14729
1.50 - 1.99	780	644	748	547	326	162	45	163	314	893	946	721	6289
2.00 - 2.49	331	339	474	210	112	27	15	56	114	402	404	423	2907
2.50 - 2.99	154	137	188	86	38	15	6	12	73	147	184	184	1224
3.00 - 3.49	61	87	86	25	4	2	.	13	31	60	54	90	513
3.50 - 3.99	29	32	42	10	.	.	3	6	11	22	37	30	222
4.00 - 4.49	17	20	11	5	.	.	1	3	5	3	24	13	102
4.50 - 4.99	16	2	4	.	.	.	.	1	1	1	6	12	43
5.00 - 5.49	12	1	8	.	.	.	.	.	3	.	.	3	27
5.50 - 5.99	2	.	.	.	.	.	.	2	.	.	.	.	4
6.00 - 6.49	.	.	.	.	.	.	.	.	2	.	.	.	2
6.50 - 6.99	.	.	.	.	.	.	.	.	.	.	.	.	0
7.00 - 7.49	.	.	.	.	.	.	.	.	.	.	.	.	0
7.50 - 7.99	.	.	.	.	.	.	.	.	.	.	.	.	0
8.00 - 8.49	.	.	.	.	.	.	.	.	.	.	.	.	0
8.50 - 8.99	.	.	.	.	.	.	.	.	.	.	.	.	0
9.00 - 9.49	.	.	.	.	.	.	.	.	.	.	.	.	0
9.50 - 9.99	.	.	.	.	.	.	.	.	.	.	.	.	0
10.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

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Tp(sec)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
3.0 - 3.9	137	68	107	94	257	400	821	603	151	22	21	74	2755
4.0 - 4.9	493	402	380	356	510	630	1151	808	307	143	257	347	5784
5.0 - 5.9	600	593	528	708	769	614	509	518	497	419	614	547	6916
6.0 - 6.9	638	657	651	531	490	631	383	493	539	631	711	705	7060
7.0 - 7.9	441	388	540	299	403	460	430	515	546	617	481	443	5563
8.0 - 8.9	329	335	409	387	393	431	357	551	578	619	520	453	5362
9.0 - 9.9	297	303	269	226	462	385	362	315	548	592	431	361	4551
10.0 - 10.9	229	271	240	261	344	360	240	273	380	426	346	252	3622
11.0 - 11.9	220	134	294	388	372	345	285	276	304	332	251	211	3412
12.0 - 12.9	329	179	333	453	410	241	229	255	252	331	259	258	3529
13.0 - 13.9	235	194	319	461	229	132	127	152	247	266	233	286	2881
14.0 - 14.9	234	186	326	274	133	86	42	96	192	215	231	326	2341
15.0 - 15.9	190	150	210	167	112	53	11	36	128	147	114	292	1610
16.0 - 16.9	218	208	115	89	41	22	6	24	64	87	125	134	1133
17.0 - 17.9	159	183	70	38	16	8	3	20	35	53	92	99	776
18.0 - 18.9	108	122	68	18	10	2	3	14	22	29	58	65	519
19.0 - 19.9	58	71	53	25	5	.	1	5	10	13	35	45	321
20.0 - LONGER	45	76	48	25	4	.	.	6	.	18	21	62	305
TOTAL	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

OCCURRENCES OF PEAK PERIOD BY MONTH FOR ALL YEARS

12

STATION:

DIRECTION BAND & CENTER Dp(deg)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
348.75 - 11.24 (0.0)	339	273	173	127	46	33	2	38	19	70	205	262	1587
11.25 - 33.74 (22.5)	522	444	327	270	289	220	115	297	408	358	551	663	4464
33.75 - 56.24 (45.0)	1521	1294	1725	1709	1928	1694	1313	1559	2152	2554	1592	1838	20879
56.25 - 78.74 (67.5)	1357	1363	1299	1422	1152	1108	778	973	1415	1576	1713	1283	15439
78.75 - 101.24 (90.0)	186	192	259	286	393	348	547	592	277	152	263	222	3717
101.25 - 123.74 (112.5)	161	141	202	298	402	320	782	485	175	50	135	164	3315
123.75 - 146.24 (135.0)	132	169	278	237	316	413	785	467	158	67	147	103	3272
146.25 - 168.74 (157.5)	164	180	278	196	201	283	358	371	98	51	60	112	2352
168.75 - 191.24 (180.0)	179	160	143	77	134	239	110	97	78	33	37	79	1366
191.25 - 213.74 (202.5)	27	28	19	16	12	64	61	25	14	5	9	16	296
213.75 - 236.24 (225.0)	26	17	28	11	7	36	46	26	3	7	7	23	237
236.25 - 258.74 (247.5)	22	14	27	11	11	25	40	8	2	3	4	6	173
258.75 - 281.24 (270.0)	31	27	31	11	39	12	21	7	.	4	2	11	196
281.25 - 303.74 (292.5)	77	58	55	34	17	.	1	3	.	4	4	27	280
303.75 - 326.24 (315.0)	99	78	50	55	6	1	1	7	.	11	19	72	399
326.25 - 348.74 (337.5)	117	82	66	40	7	4	.	5	1	15	52	79	468

4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

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OCCURRENCES OF WAVE HEIGHT AND PEAK PERIOD FOR ALL DIRECTIONS

Hmo(m)	Tp(sec) 3.0- 4.9	5.0- 6.9	7.0- 8.9	9.0- 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 20.9	21.0- LONGER	TOTAL
0.00 - 0.99	7652	5234	5303	4463	4506	2985	1385	618	192	40	32378
1.00 - 1.99	887	7973	3654	2701	2065	1874	1105	514	219	26	21018
2.00 - 2.99	.	768	1715	591	283	316	221	136	79	22	4131
3.00 - 3.99	.	1	241	326	57	22	32	24	31	1	735
4.00 - 4.99	.	.	12	79	18	22	.	3	11	.	145
5.00 - 5.99	.	.	.	12	11	3	.	.	5	.	31
6.00 - 6.99	.	.	.	1	1	.	.	.	.	.	2
7.00 - 7.99	.	.	.	.	.	.	.	.	.	.	0
8.00 - 8.99	.	.	.	.	.	.	.	.	.	.	0
9.00 - GREATER	.	.	.	.	.	.	.	.	.	.	0
TOTAL	8539	13976	10925	8173	6941	5222	2743	1295	537	89	58440

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STATION:

OCCURRENCES OF WIND SPEED BY MONTH FOR ALL YEARS

WS(m/sec)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0.00 - 2.49	306	369	386	504	737	1055	1134	1264	949	763	304	376	8147
2.50 - 4.99	1181	1009	1112	1323	1691	2161	2410	2189	1981	1327	1091	1277	18752
5.00 - 7.49	1991	1747	2008	1951	1957	1320	1299	1251	1413	1728	2024	1935	20624
7.50 - 9.99	903	821	805	697	442	218	87	171	263	801	876	768	6852
10.00 - 12.49	465	490	531	281	131	46	26	58	163	303	433	504	3431
12.50 - 14.99	74	71	90	41	2	.	2	20	15	35	59	82	491
15.00 - 17.49	38	13	25	3	.	.	2	4	10	2	12	17	126
17.50 - 19.99	2	.	3	.	.	.	.	1	3	1	1	1	12
20.00 - GREATER	.							2	3				5
TOTAL	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

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WD(deg) DIRECTION BAND & CENTER	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
337.50 - 22.49 (0.0)	849	593	551	425	194	123	96	149	199	633	728	750	5290
22.50 - 67.49 (45.0)	902	745	698	612	676	431	230	336	951	1678	1304	1177	9740
67.50 - 112.49 (90.0)	879	922	1053	1297	1643	1221	1386	1841	1962	1358	1314	1113	15989
112.50 - 157.49 (135.0)	636	649	928	955	1162	1277	1612	1283	806	467	651	594	11020

157.50	- 202.49 (180.0)	456	482	640	427	578	886	833	654	432	226	228	332	6174
202.50	- 247.49 (225.0)	274	246	310	311	322	587	511	396	211	168	143	200	3679
247.50	- 292.49 (270.0)	305	333	336	338	237	180	214	142	128	149	131	241	2734
292.50	- 337.49 (315.0)	659	550	444	435	148	95	78	159	111	281	301	553	3814
TOTAL		4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

OCCURRENCES OF WAVE HEIGHT AND PEAK PERIOD FOR 22.5 DEG DIRECTION BANDS

WIS ATLANTIC UPDATE - WITH HURRICANES 1976 - 1995

LAT: 26.75 N, LONG: 80.00 W, DEPTH: 45 M

STATION: 12

SUMMARY OF MEAN Hmo(m) BY MONTH AND YEAR

STATION: 12

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
1976	1.39	1.13	1.05	1.09	0.86	0.69	0.39	0.78	0.62	1.58	1.32	1.61	1.04
1977	1.32	1.07	1.18	1.45	0.89	0.41	0.48	0.90	0.71	1.04	1.53	1.34	1.03
1978	1.28	1.56	1.15	0.92	0.72	0.66	0.55	0.55	0.95	1.72	1.38	1.56	1.08
1979	1.84	1.47	1.42	1.41	1.04	0.83	0.61	0.49	1.37	1.06	1.62	1.44	1.21
1980	1.25	1.63	1.32	1.04	0.81	0.58	0.42	0.78	0.69	1.03	1.63	1.44	1.05
1981	1.04	1.77	1.86	0.98	0.78	0.68	0.49	0.76	1.02	1.18	1.22	1.02	1.06
1982	1.01	0.89	1.07	0.85	0.87	0.78	0.40	0.54	0.75	1.35	1.32	1.23	0.92
1983	1.02	1.69	1.21	1.21	0.87	0.67	0.50	0.49	1.07	1.36	1.16	1.51	1.06
1984	1.79	1.19	1.27	1.06	1.08	0.69	0.58	0.47	1.34	1.57	1.87	1.28	1.18
1985	1.07	1.47	1.10	1.15	0.62	0.56	0.53	0.70	1.58	1.10	1.46	1.36	1.05
1986	1.32	1.11	1.54	0.99	1.20	0.55	0.42	0.79	1.04	1.19	1.23	1.44	1.07
1987	1.46	1.12	1.85	1.04	0.93	0.62	0.61	0.60	0.59	1.46	1.33	0.97	1.05
1988	1.46	1.07	1.02	1.03	0.88	0.79	0.58	0.53	0.94	1.14	0.99	0.93	0.95
1989	0.96	0.95	1.13	0.83	0.69	0.58	0.44	0.53	0.98	1.19	0.81	0.98	0.84
1990	0.87	1.34	1.25	1.18	0.84	0.61	0.60	0.48	0.82	1.07	1.14	1.22	0.95
1991	0.93	1.06	1.04	1.02	0.90	0.67	0.42	0.51	0.79	1.27	1.20	1.05	0.90
1992	1.01	0.99	0.88	1.07	0.90	0.59	0.56	0.60	0.75	1.15	1.43	1.24	0.93
1993	1.42	1.26	1.40	1.20	0.98	0.74	0.40	0.60	0.75	0.94	1.35	1.20	1.02
1994	1.43	1.30	1.09	1.07	0.85	0.57	0.62	0.63	0.77	1.09	1.32	1.45	1.02
1995	1.04	1.00	1.37	1.01	0.85	0.76	0.63	1.00	0.97	1.31	1.19	1.15	1.02
MEAN	1.25	1.25	1.26	1.08	0.88	0.65	0.51	0.64	0.92	1.24	1.33	1.27	

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAX
1976	38 9 3	3610 7	34 9 5	29 7 0	30 713	13 512	812 5	2412 5	1313 7	4011 4	33 8 2	39 9 2	4011 4
1977	27 7 1	25 8 4	35 9 5	4310 7	28 8 5	13 516	11 511	23 6 8	20 6 8	24 8 5	39 9 1	34 9 4	4310 7
1978	33 817	37 8 3	33 814	23 713	27 818	30 9 7	17 6 9	12 5 8	1911 4	4610 5	30 7 3	5114 5	5114 5
1979	5210 2	30 7 4	3610 6	43 913	24 8 4	28 8 5	26 713	12 5 9	6411 5	27 8 7	3910 4	36 9 5	6411 5
1980	3118 6	37 9 2	2914 5	27 814	19 6 7	17 8 3	15 6 8	40 914	1415 6	2212 4	4019 6	3211 4	4019 6
1981	35 9 1	4413 5	5220 6	32 9 6	1710 4	18 7 5	13 7 4	36 816	1812 5	28 8 5	31 7 5	23 633	5220 6

WIS ATLANTIC UPDATE -- WITH HURRICANES

LAT: 27.00 N, LONG: 80.00 W, DEPTH: 45 M

SUMMARY OF WAVE INFORMATION BY MONTH

	27 819	22 714	33 818	31 816	18 9 4	26 715	16 612	14 612	13 5 8	3616 6	29 8 4	28 712	3616 6
	33 8 6	46 914	541019	32 836	20 6 9	14 617	17 610	32 9 3	31 9 5	31 8 7	33 9 5	4811 2	541019
	5712 3	32 9 5	42 918	22 716	28 8 5	19 7 1	13 514	23 714	50 9 6	30 9 5	4710 1	29 7 7	5712 3
	30 8 0	38 9 7	40 9 6	33 7 8	16 8 4	18 714	40 814	24 719	3910 4	2410 4	4411 7	41 9 3	4411 7
	46 9 5	32 936	39 9 1	2616 6	2715 5	16 6 6	11 512	20 6 8	22 6 8	3910 5	34 8 5	46 914	46 914
1982	5010 2	28 818	39 7 9	22 636	26 814	23 915	15 513	1615 5	1116 6	25 7 4	30 8 4	30 8 3	5010 2
1983	2916 7	26 8 7	20 610	22 612	21 6 5	28 8 5	17 8 4	24 7 7	30 813	22 7 5	35 818	2817 6	35 818
1984	2711 4	2110 3	39 8 1	16 8 3	20 612	13 517	9 411	17 6 9	2613 6	29 9 4	16 6 7	2315 5	39 8 1
1985	23 636	30 8 6	31 8 7	24 6 8	19 713	13 5 5	13 7 4	1012 5	1310 5	28 716	32 8 4	33 8 5	33 8 5
1986	24 611	22 7 7	30 817	25 6 9	33 913	20 9 4	10 517	1510 4	20 7 6	29 7 5	2415 5	37 9 5	37 9 5
1987	24 714	2110 5	24 610	2911 4	1712 5	13 616	11 513	5810 8	13 9 5	28 8 5	28 7 7	2414 5	5810 8
1988	47 935	27 9 4	50 918	26 814	17 6 9	18 613	8 513	2213 5	2213 5	30 818	2512 4	34 9 5	50 918
1989	3410 6	51 9 7	36 817	18 6 9	30 9 3	10 514	12 512	12 512	1813 4	3112 4	4911 6	40 9 3	51 9 7
1990	32 914	17 7 6	28 8 2	1910 3	15 8 3	18 618	25 8 6	24 8 6	16 9 3	26 716	19 736	24 7 0	32 914
1991													
1992													
1993													
1994													
1995													
MAX	5712 3	51 9 7	541019	43 913	33 913	30 9 7	40 814	5810 8	6411 5	4610 5	4911 6	5114 5	

MAX Hmo(m): 6.4 MAX Tp(sec): 11. MAX Dp(deg): 54. DATE(gmt): 1979090315

MAX WIND SPEED(m/sec): 23. MAX WIND DIRECTION(deg): 60. DATE(gmt): 1992082409

MEAN Hmo(m): 1.0 MEAN Tp(sec): 8.

STANDARD DEVIATION Hmo(m): 0.6 STANDARD DEVIATION Tp(sec): 3.8

OCCURRENCES OF WAVE HEIGHT BY MONTH FOR ALL YEARS 1976 - 1995

Hmo(m)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0.00 - 0.49	163	177	246	250	563	1312	2185	1764	433	161	99	175	7528
0.50 - 0.99	1556	1371	1561	1709	2344	2594	2404	2333	2247	1330	1189	1474	22112
1.00 - 1.49	1651	1545	1442	1721	1477	645	292	548	1396	1644	1602	1641	15604
1.50 - 1.99	873	708	783	742	398	189	54	197	407	1035	1009	810	7205
2.00 - 2.49	370	377	499	216	117	41	14	65	166	485	528	419	3297
2.50 - 2.99	162	161	255	103	54	18	7	26	82	186	228	249	1531
3.00 - 3.49	94	101	78	35	7	1	.	8	41	77	64	114	620
3.50 - 3.99	41	43	57	19	.	.	1	16	9	27	35	36	284
4.00 - 4.49	19	29	21	5	.	.	2	.	11	14	21	25	147
4.50 - 4.99	17	6	4	.	.	.	1	.	3	1	21	11	64
5.00 - 5.49	13	2	6	.	.	.	.	3	2	.	3	3	32
5.50 - 5.99	1	.	6	.	.	.	.	.	1	.	1	3	12
6.00 - 6.49	.	.	2	.	.	.	.	.	1	.	.	.	3
- 6.99	.	.	.	.	.	.	.	.	.	.	.	.	0
- 7.49	.	.	.	.	.	.	.	.	.	.	.	.	0
- 7.99	.	.	.	.	.	.	.	.	1	.	.	.	1
- 8.49	.	.	.	.	.	.	.	.	.	.	.	.	0
- 8.99	.	.	.	.	.	.	.	.	.	.	.	.	0

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
9.00 - 9.49	.	.	.	.	.	.	.	.	.	.	.	.	0
9.50 - 9.99	.	.	.	.	.	.	.	.	.	.	.	.	0
10.00 - GREATER	.	.	.	.	.	.	.	.	.	.	.	.	0
TOTAL	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

13

OCCURRENCES OF PEAK PERIOD BY MONTH FOR ALL YEARS

Tp(sec)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
3.0 - 3.9	117	50	67	69	192	331	773	535	116	14	11	51	2326
4.0 - 4.9	412	310	286	257	435	511	913	725	200	100	173	270	4592
5.0 - 5.9	514	502	403	536	596	538	446	441	405	329	454	432	5596
6.0 - 6.9	598	630	576	490	512	710	530	496	566	586	640	619	6953
7.0 - 7.9	482	417	611	325	459	514	497	536	612	644	507	533	6137
8.0 - 8.9	320	370	430	450	399	452	343	584	570	637	593	458	5606
9.0 - 9.9	308	313	279	254	501	418	405	381	598	621	478	369	4925
10.0 - 10.9	274	282	261	324	399	394	279	317	415	458	398	290	4091
11.0 - 11.9	220	164	328	411	442	361	307	296	333	361	282	240	3745
12.0 - 12.9	376	200	377	490	432	250	246	275	261	378	289	288	3862
13.0 - 13.9	268	203	368	507	233	142	143	174	248	261	253	319	3119
14.0 - 14.9	247	214	345	288	150	89	48	95	199	208	246	336	2465
15.0 - 15.9	211	168	240	183	121	55	14	38	133	153	130	312	1758
16.0 - 16.9	224	226	124	102	49	24	8	19	72	95	133	158	1234
17.0 - 17.9	173	185	90	44	21	9	4	23	41	56	90	103	839
18.0 - 18.9	108	136	70	21	9	2	3	12	20	28	64	68	541
19.0 - 19.9	61	66	53	25	5	.	1	7	9	13	36	47	323
20.0 - LONGER	47	84	52	24	5	.	.	6	2	18	23	67	328
TOTAL	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

13

STATION:

DIRECTION BAND & CENTER

Dp(deg)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
348.75 - 11.24 (0.0)	288	233	146	126	38	28	2	36	13	63	189	237	1399
11.25 - 33.74 (22.5)	426	390	253	196	230	176	109	251	291	248	444	525	3539
33.75 - 56.24 (45.0)	1501	1282	1683	1613	1877	1659	1296	1566	2035	2330	1510	1788	20140
56.25 - 78.74 (67.5)	1633	1586	1622	1789	1442	1285	947	1181	1748	1959	2016	1590	18798
78.75 - 101.24 (90.0)	191	203	285	298	397	488	801	630	284	156	272	250	4255
101.25 - 123.74 (112.5)	112	100	130	187	360	274	588	401	144	40	94	122	2552
123.75 - 146.24 (135.0)	104	138	218	202	233	293	551	337	126	50	114	68	2434
146.25 - 168.74 (157.5)	142	153	237	169	162	217	332	369	69	50	54	105	2059
168.75 - 191.24 (180.0)	187	164	158	77	122	218	136	105	73	25	27	76	1368
191.25 - 213.74 (202.5)	33	34	21	15	16	72	67	28	10	5	5	16	322
- 236.24 (225.0)	25	14	20	9	6	42	56	28	5	4	4	22	235

TOTAL

- 258.74 (247.5)	18	13	24	7	8	29	46	8	1	5	2	4	165
- 281.24 (270.0)	33	27	19	11	36	16	25	5	.	2	1	9	184
- 303.74 (292.5)	71	50	47	30	16	.	.	7	.	5	6	22	254
- 326.24 (315.0)	100	61	44	42	7	1	3	4	.	6	17	58	343
- 348.74 (337.5)	96	72	53	29	10	2	1	4	1	12	45	68	393
	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

236.25
258.75
281.25
303.75
326.25

STATION: 13

Hmo(m)	3.0- 4.9	5.0- 6.9	7.0- 8.9	9.0- 10.9	11.0- 12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 20.9	21.0- LONGER	TOTAL
- 0.99	6107	4890	4851	4469	4406	2828	1287	589	175	38	29640
- 1.99	811	7367	4372	3216	2647	2253	1332	554	226	31	22809
- 2.99	.	292	2227	855	433	421	301	183	99	17	4828
- 3.99	.	.	277	358	72	51	66	47	25	8	904
- 4.99	.	.	16	102	32	27	6	7	21	.	211
- 5.99	.	.	.	15	16	4	.	.	9	.	44
- 6.99	.	.	.	1	.	.	.	.	2	.	3
- 7.99	.	.	.	.	1	.	.	.	.	.	1
- 8.99	.	.	.	.	.	.	.	.	.	.	0
- GREATER	.	.	.	.	.	.	.	.	.	.	0
TOTAL	6918	12549	11743	9016	7607	5584	2992	1380	557	94	58440

0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00

TOTAL

Tp(sec)

13

OCCURRENCES OF WAVE HEIGHT AND PEAK PERIOD FOR ALL DIRECTIONS

WS(m/sec)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
- 2.49	362	380	427	570	782	1126	1243	1322	969	796	343	430	8750
- 4.99	1176	1018	1106	1272	1685	2101	2302	2171	1985	1308	1089	1304	18517
- 7.49	1917	1720	1988	1943	1942	1319	1302	1217	1380	1680	2023	1869	20300
- 9.99	890	819	791	701	416	202	85	157	242	827	837	750	6717
- 12.49	493	494	524	267	133	52	24	66	183	305	432	497	3470
- 14.99	78	73	90	44	2	.	.	19	24	42	59	83	514
- 17.49	43	16	31	3	.	.	3	5	12	2	15	26	156
- 19.99	1	.	3	.	.	.	1	2	2	.	2	1	12
- GREATER	.							1	3				4
	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00

13

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL

TOTAL

OCCURRENCES OF WAVE HEIGHT AND PEAK PERIOD FOR 22.5 DEG DIRECTION BANDS

WIS ATLANTIC UPDATE - WITH HURRICANES

STATION: 13

LAT: 27.00 N, LONG: 80.00 W, DEPTH: 45 M

1976 - 1995

DIRECTION BAND & CENTER													
337.50 - 22.49 (0.0)	827	597	535	419	195	121	88	142	190	627	738	738	5217
22.50 - 67.49 (45.0)	874	727	690	607	682	433	239	345	986	1641	1269	1145	9638
67.50 - 112.49 (90.0)	838	883	987	1230	1558	1118	1230	1740	1883	1329	1281	1067	15144
112.50 - 157.49 (135.0)	623	636	915	929	1158	1250	1570	1218	811	480	634	577	10801
157.50 - 202.49 (180.0)	492	517	665	472	614	911	942	735	430	236	249	366	6629
202.50 - 247.49 (225.0)	283	259	357	329	349	672	578	462	239	178	166	221	4093
247.50 - 292.49 (270.0)	331	371	354	376	263	197	236	166	150	163	141	276	3024
292.50 - 337.49 (315.0)	692	530	457	438	141	98	77	152	111	306	322	570	3894
TOTAL	4960	4520	4960	4800	4960	4800	4960	4960	4800	4960	4800	4960	58440

SUMMARY OF MEAN Hmo(m) BY MONTH AND YEAR

STATION: 13

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
1976	1.45	1.19	1.10	1.18	0.89	0.72	0.40	0.87	0.74	1.70	1.35	1.66	1.10
1977	1.40	1.09	1.22	1.49	0.92	0.41	0.48	0.94	0.77	1.11	1.65	1.42	1.08
1978	1.34	1.69	1.21	0.96	0.75	0.69	0.56	0.58	1.04	1.86	1.47	1.65	1.15
1979	1.93	1.57	1.55	1.51	1.11	0.88	0.62	0.51	1.42	1.16	1.71	1.53	1.29
1980	1.35	1.73	1.41	1.14	0.86	0.62	0.45	0.82	0.75	1.15	1.78	1.54	1.13
1981	1.07	1.88	2.02	1.02	0.84	0.70	0.53	0.77	1.14	1.28	1.30	1.05	1.13
1982	1.06	0.93	1.12	0.91	0.92	0.80	0.40	0.56	0.81	1.49	1.45	1.28	0.98
1983	1.09	1.82	1.25	1.27	0.92	0.74	0.51	0.51	1.14	1.48	1.27	1.59	1.13
1984	1.90	1.23	1.36	1.13	1.11	0.70	0.60	0.47	1.44	1.65	1.97	1.34	1.24
1985	1.11	1.54	1.14	1.23	0.66	0.60	0.54	0.72	1.71	1.17	1.61	1.43	1.12
1986	1.39	1.18	1.59	1.06	1.28	0.56	0.43	0.83	1.15	1.27	1.32	1.53	1.13
1987	1.60	1.17	1.98	1.13	1.01	0.64	0.62	0.64	0.66	1.55	1.41	1.02	1.12
1988	1.58	1.14	1.09	1.11	0.98	0.89	0.72	0.57	1.03	1.26	1.07	1.04	1.04
1989	1.00	0.97	1.18	0.87	0.74	0.62	0.44	0.59	1.11	1.32	0.88	1.03	0.90
1990	0.94	1.41	1.34	1.32	0.91	0.69	0.66	0.54	0.98	1.16	1.21	1.37	1.04
1991	0.97	1.12	1.06	1.06	0.91	0.73	0.43	0.54	0.88	1.41	1.25	1.10	0.95
1992	1.08	1.05	0.94	1.15	0.98	0.65	0.66	0.65	0.80	1.25	1.52	1.37	1.01
1993	1.50	1.31	1.50	1.27	1.02	0.77	0.40	0.64	0.79	1.03	1.45	1.28	1.08
1994	1.50	1.40	1.14	1.15	0.89	0.61	0.63	0.65	0.79	1.19	1.40	1.57	1.08
1995	1.08	1.06	1.45	1.07	0.92	0.80	0.67	1.06	1.04	1.40	1.26	1.20	1.08
MEAN	1.32	1.32	1.33	1.15	0.93	0.69	0.54	0.67	1.01	1.34	1.42	1.35	

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAX

1976	3810 3	3610 7	33 9 5	30 7 0	30 713	14 612	812 5	2713 6	1714 7	4211 4	35 8 2	40 8 3	4211 4
1977	29 7 2	27 8 4	36 9 5	4310 7	27 8 6	14 517	11 512	25 8 8	21 7 8	25 9 5	39 9 1	36 9 4	4310 7
1978	34 817	39 9 4	34 814	23 711	28 818	30 8 7	18 6 9	12 5 9	2112 5	4910 5	32 7 3	5614 6	5614 6
1979	5111 4	32 7 5	4410 7	44 913	25 8 4	29 8 7	27 713	12 5 9	7611 7	30 8 8	3910 5	36 9 5	7611 7
1980	3518 6	4118 6	3114 5	29 814	18 6 7	18 8 3	16 6 8	39 813	1515 6	2412 4	4619 6	3411 4	4619 6
1981	35 9 2	4613 5	6020 6	31 9 6	17 612	18 7 5	14 7 4	37 917	2112 5	29 7 1	32 7 5	23 632	6020 6
1982	26 818	22 714	32 817	34 818	19 9 4	25 715	16 612	15 612	13 5 8	4116 6	2814 7	27 712	4116 6
1983	35 8 6	4917 6	551019	33 836	20 7 9	15 618	18 7 9	35 9 3	33 9 5	29 8 7	33 9 5	4810 2	551019
1984	5612 3	31 817	43 918	24 717	28 8 5	20 7 9	13 515	23 714	5210 7	30 9 5	4710 2	30 8 7	5612 3
1985	31 7 1	37 9 7	40 9 6	39 8 8	17 8 4	18 714	47 912	27 719	4416 7	2710 4	5511 9	43 9 3	5511 9
1986	4810 5	32 936	39 9 1	2816 6	3015 5	17 6 7	11 512	22 6 8	24 7 8	4210 5	36 8 5	46 914	4810 5
1987	5210 3	29 818	4710 8	2312 5	25 7 7	22 915	15 513	1714 5	1216 6	26 8 9	30 8 4	30 8 3	5210 3
1988	3416 7	27 8 7	20 710	24 612	20 6 5	29 8 5	19 6 7	27 7 8	29 813	22 7 5	42 818	3217 6	42 818
1989	3011 4	23 9 3	43 8 1	17 8 3	19 612	13 516	9 5 9	18 6 9	3013 6	3215 5	1713 7	2415 5	43 8 1
1990	22 636	29 8 6	32 8 8	2510 6	19 613	1310 4	14 9 6	1112 5	1512 7	29 816	32 8 4	32 8 5	32 8 5
1991	26 7 8	2310 7	30 718	26 8 8	30 711	21 9 4	11 517	1710 5	21 7 7	2812 6	2715 5	36 9 5	36 9 5
1992	24 714	2410 5	27 8 8	3011 4	18 9 5	14 617	11 513	5410 8	15 9 5	28 8 7	31 8 7	2714 5	5410 8
1993	50 935	27 9 4	51 918	26 814	18 6 9	19 613	7 7 5	2513 5	2513 5	31 818	2812 4	35 9 5	51 918
1994	3610 6	5311 7	37 916	19 6 9	3210 3	9 514	12 516	12 511	1913 4	3312 5	5011 6	42 9 3	5311 7
1995	33 914	19 7 7	29 8 1	20 9 3	15 8 3	20 717	26 8 6	27 9 6	17 9 4	26 716	19 6 0	24 7 0	33 914
MAX	5612 3	5311 7	6020 6	44 913	3210 3	30 8 7	47 912	5410 8	7611 7	4910 5	5511 9	5614 6	

MAX Hmo(m): 7.6 MAX Tp(sec): 11. MAX Dp(deg): 72. DATE(gmt): 1979090315

MAX WIND SPEED(m/sec): 30. MAX WIND DIRECTION(deg): 45. DATE(gmt): 1979090315

MEAN Hmo(m): 1.1 MEAN Tp(sec): 9.

STANDARD DEVIATION Hmo(m): 0.7 STANDARD DEVIATION Tp(sec): 3.8

Appendix K

DISPERSION CHARACTERISTICS FOR PALM BEACH AND PORT EVERGLADES OCEAN DREDGED MATERIAL DISPOSAL SITES (ODMDSs)

Miscellaneous Paper CHL-98-xx
September 1998

**US Army Corps
of Engineers**
Waterways Experiment
Station

Dispersion Characteristics for Palm Beach and Port Everglades Ocean Dredged Material Disposal Sites (ODMDSs)

Compiled by Mary A. Cialone and Linda S. Lillycrop

Coastal and Hydraulics Laboratory

Approved for Public Release; Distribution is Unlimited

Prepared for U.S. Army Engineer District, Jacksonville

Preface

The study reported herein was conducted by the U.S. Army Engineer, Waterways Experiment Station (WES), Coastal and Hydraulics Laboratory (CHL) for the U.S. Army Engineer District, Jacksonville (SAJ). The work was conducted during the period July 1997 through May 1998 under the general supervision of Dr. James R. Houston, Mr. Charles C. Calhoun, Jr., Director and Assistant Director, CHL, Mr. Thomas R. Richardson, Chief, Coastal Sediments and Engineering Division, CHL, and Mr. Bruce A. Ebersole, Chief, Coastal Processes Branch, CHL. Principal Investigators for this study were Ms. Mary A. Cialone, Research Hydraulic Engineer, CHL, and Ms. Linda Lillycrop, Research Hydraulic Engineer, CHL. This report was prepared by Ms. Cialone and Ms. Lillycrop.

Acknowledgments are extended to the following for their contributions to this study: Don Fore, SAJ, for sponsoring this project; Chris McArthur, EPA, and Lynn Griffin, Florida DNREC for reviewing data analysis performed for this project; Doug Wilson, NOAA, for providing velocity data used in this project; Mary Claire Allison, CHL, for data analysis; and Paul Schroeder, EL, Norm Scheffner, Joe Gailani, and Jim Clausner, CHL, for assistance in model applications and interpretation of model results.

Director of WES during the investigation and publication of this report was Dr. Robert W. Whalin. Commander was COL Robin Cababa.

1 Introduction

Dredging of coastal inlets and harbors in the United States is often required to maintain navigable depths. The designation of acceptable disposal sites for this material is, however, becoming increasingly difficult. Open water disposal sites are often selected as a means of minimizing any adverse effects resulting from the disposal of material in the vicinity of the dredging operation. The designated open water site must be far enough removed from any environmentally-sensitive areas so that material leaving the site, if any, will not adversely impact these sensitive areas. The selection of an environmentally-acceptable placement location for the dredged material requires some means of predicting the fate of the disposed sediment. Numerical models can be used to simulate the short- and long-term fate of dredged material.

This report documents a technical study conducted by the U.S. Army Engineer Waterways Experiment Station (WES) for the U.S. Army Engineer District, Jacksonville (SAJ) to estimate the short- and long-term sediment dispersion characteristics of the Palm Beach Harbor and Port Everglades Harbor Ocean Dredged Material Disposal Sites (ODMDSs). Modeling of the short-term fate was performed with the STFATE model (Johnson et al., 1993) and modeling of the long-term fate was conducted with the LTFATE model (Scheffner et al., 1995). Entrainment and transport of material both during the disposal operation and following deposition of material within the ODMDSs will be discussed. Each site is expected to accommodate the annual disposal of 38,230 m^3 (50,000 c.y.) of material to be dredged for maintenance of both the Palm Beach Harbor Federal Project and the Port Everglades Harbor Federal Project.

The Environmental Protection Agency (EPA) has expressed concern regarding the fate of dredged material disposed at the ODMDSs due to its proximity to the Gulf Stream and its spin-off eddies. Apprehension arises from the belief that these eddies will cause material to be transported onto shore-parallel coral reefs located 1.9-3.7 km (1-2 n.m.) offshore of the barrier islands (5.3-6.1 km (2.9-3.3 n.m.) from the ODMDSs). The possibility of resuspension and material transport from the ODMDS during storm events is also an expressed concern.

Project Locations

Port Everglades Harbor, Florida. The ODMDS is located east-northeast of Port Everglades and approximately 7.4-9.2 km (4-5 n.m.) offshore (Figure 1). The 3.4 km^2 (1 square nautical mile) site is defined by the following corner points:

26° 07' 30"N, 80° 02' 00"W
26° 07' 30"N, 80° 01' 00"W
26° 06' 30"N, 80° 02' 00"W ok
26° 06' 30"N, 80° 01' 00"W

The site is centered at 26° 07' 00"N, 80° 01' 00"W. The ODMDS is located on the upper continental shelf with depths ranging from 176 to 217 m (577 to 712 ft) (Figure 2).

Palm Beach Harbor, Florida. The ODMDS is located east-northeast of Lake Worth Inlet and approximately 8.3 km (4.5 n.m.) offshore (Figure 3). The 3.4 km^2 (1 square nautical mile) site is defined by the following corner points:

26° 47' 30"N, 79° 57' 09"W
26° 47' 30"N, 79° 56' 02"W ok
26° 46' 30"N, 79° 56' 02"W
26° 46' 30"N, 79° 57' 09"W

The site is centered at 26°47'00"N, 79°56'33"W. The ODMDS is located on the upper continental slope with depths ranging from 155 to 185 m (509 to 607 ft) (Figure 4).

Previous Studies

Numerous investigators have examined sediment and current characteristics in the vicinity of the present project sites (Lee et al., 1977; Williams and Lee, 1987; Bane and Brooks, 1979). Lee et al. (1977) found that although the Florida Current has complex structure and variability, available data could be used to determine statistical mean and typical deviations of the horizontal distribution of currents and related quantities at several representative levels of depth. For a summary description of the Gulf Stream and Gulf Stream meanders, the reader is referred to Maritimes, Vol 35, No 1, February 1991 (this issue is devoted to Focus on the Gulf Stream) or Scheffner and Swain (1989).

Several studies of sediment dispersion characteristics have been accomplished as well (Scheffner and Swain, 1989; Thevenot and Johnson, 1994; Tsai et al., 1992; Proni et al., 1991). Scheffner and Swain (1989) investigated the suitability of sediment disposal sites off the coast of Miami and Fort Pierce and their potential impact on shore-parallel coral reefs located approximately 1.9-3.7 km (1-2 n.m.) offshore. Model simulations of disposal and sediment transport as a function of local velocity fields indicated little possibility of reef contamination from the proposed ODMDSs. (The present study sites are located between the Miami and Fort Pierce sites.) Thevenot and Johnson (1994) monitored dredged material plumes offshore of Miami to assess the validity of a short-term fate numerical model for predicting the fate of dredged material. They found the model properly simulates the behavior of dredged material disposed in open water and accurately predicts suspended sediment concentrations and the dilution of those concentrations. This model was used in the present study.

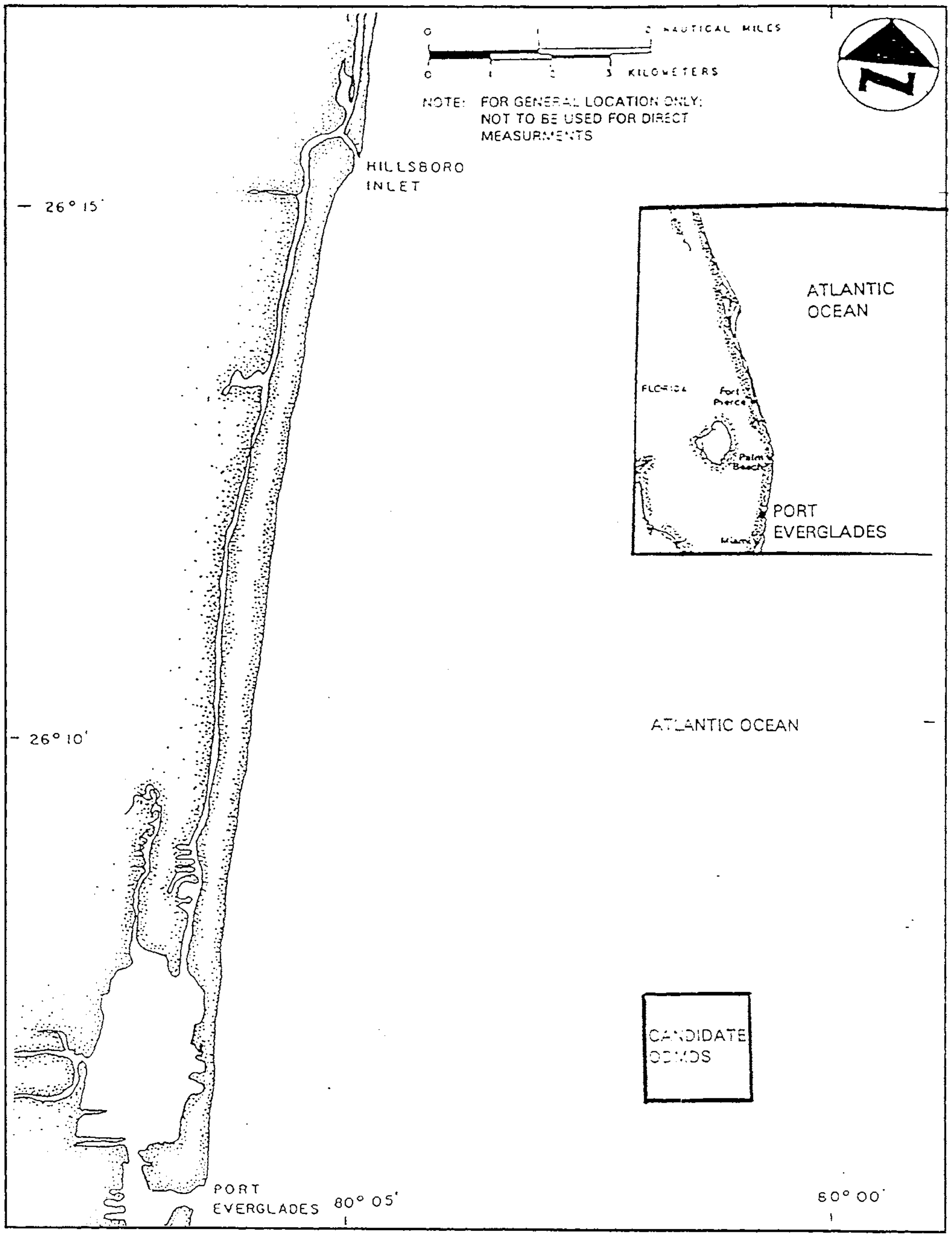


Figure 1. Location map of the Proposed ODMDS, Port Everglades, FL (from Continental Shelf Associates, Inc. 1989)

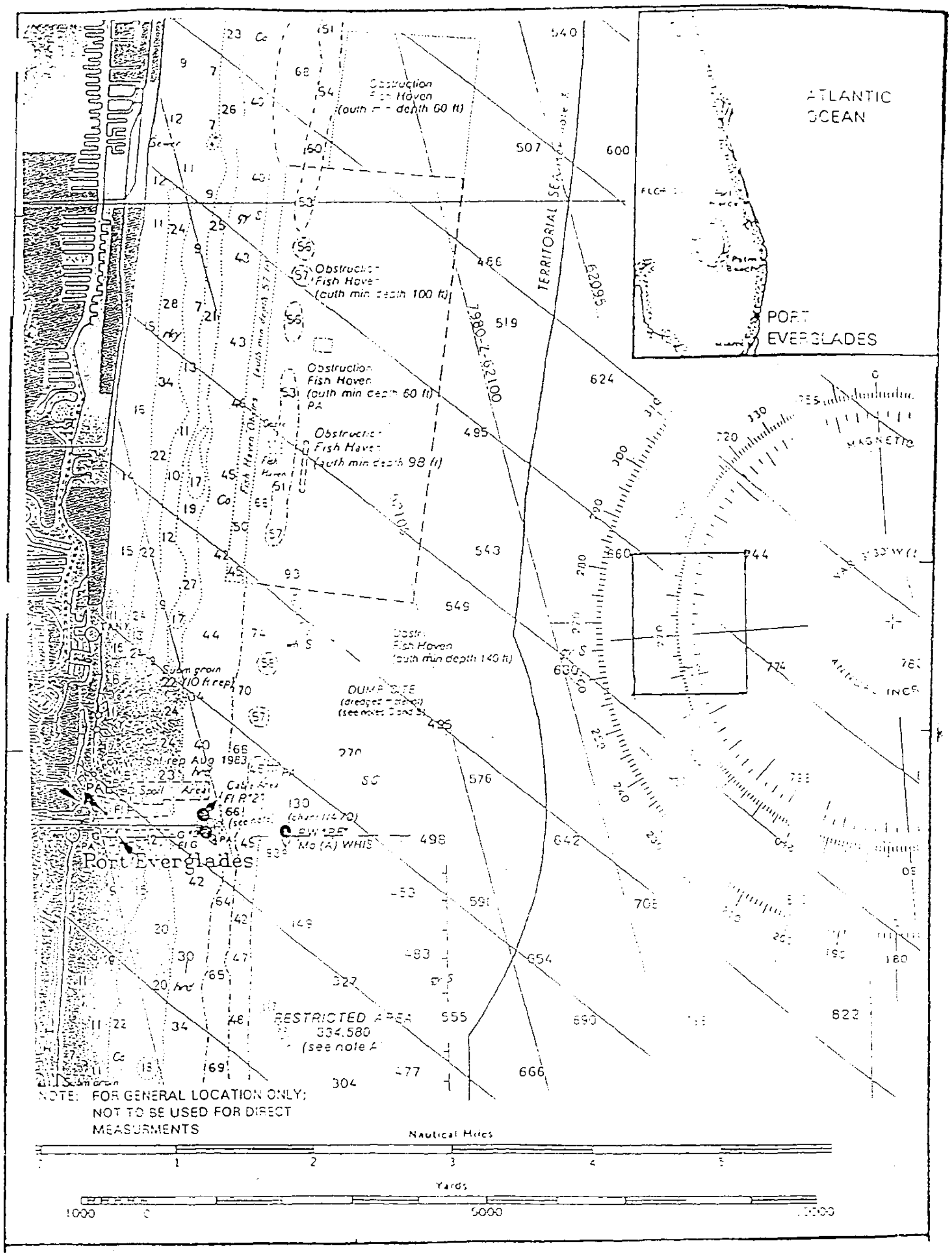


Figure 2. Bathymetry in the vicinity of the proposed Port Everglades Harbor ODMDS (from NOAA, 1989)

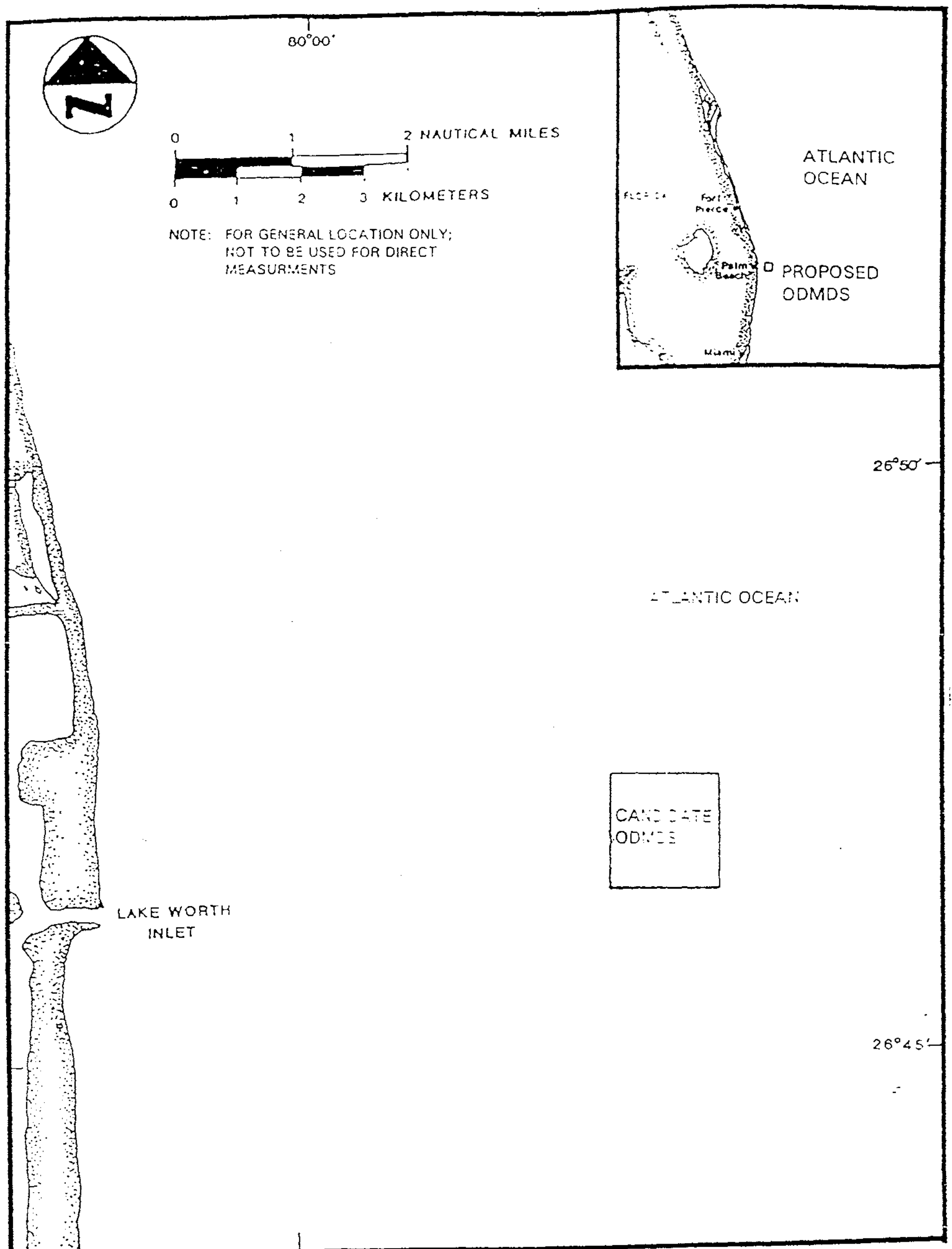


Figure 3. Location map of the proposed ODMDS, Palm Beach Harbor, FL (from Continental Shelf Associates, Inc., 1989)

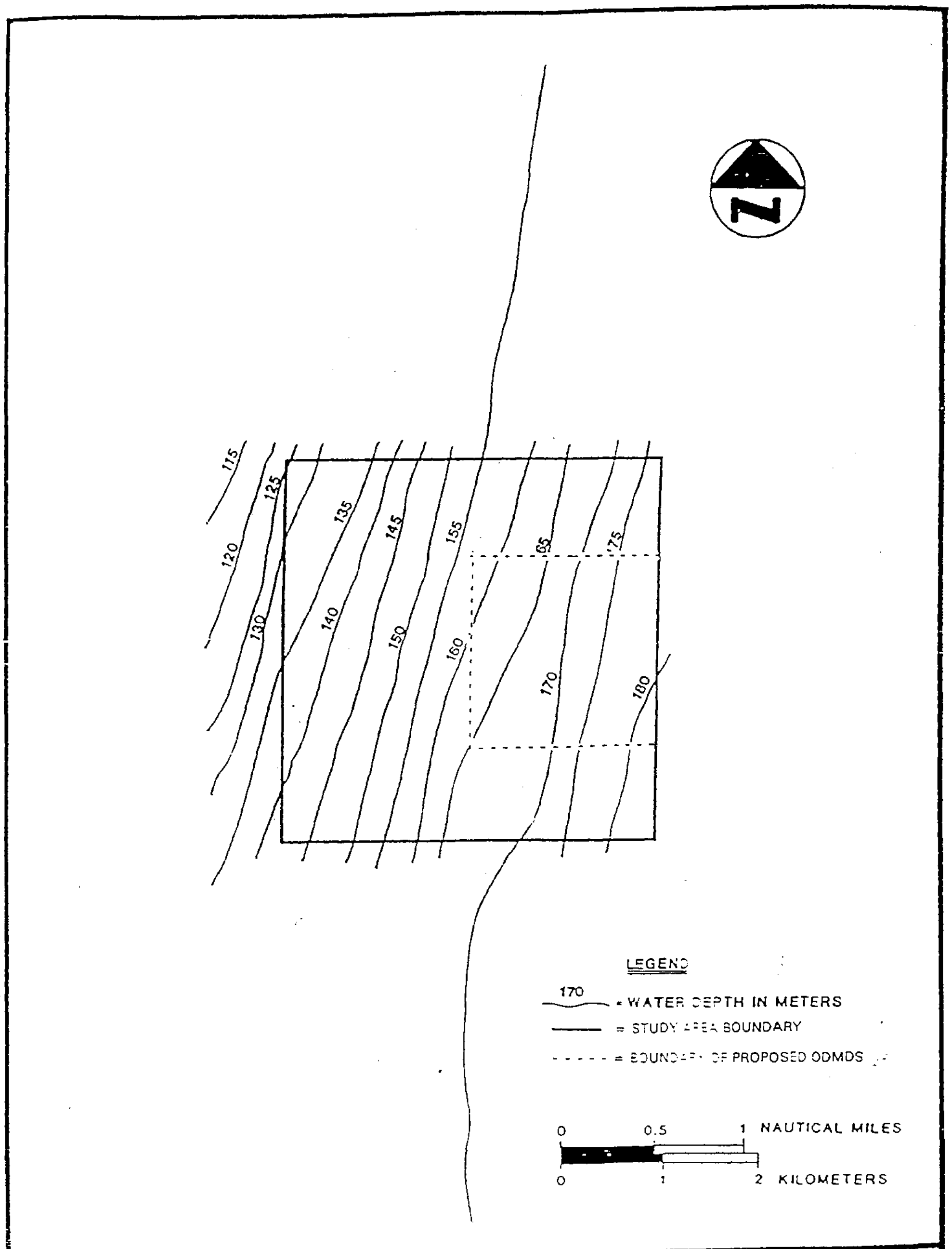


Figure 4. Bathymetry in the vicinity of the proposed Palm Beach Harbor ODMDS (from Continental Shelf Associates, Inc., 1989)

2 Short-term Fate Modeling

The short-term fate modeling phase of the project involved simulation of the descent and collapse of the dredged material plume as it falls through the water column from the barge to the ocean floor. This task required use of the Short-Term Fate (STFATE) model to estimate the dynamics of the sediment cloud following its release from the dredge (Johnson et al., 1993). 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. Model simulation data requirements include local water depths, currents, density gradients, disposal description, and sediment characteristics. The following sections describe the theoretical basis of model STFATE, required model input parameters, input data analyses, model simulations, and a summary of results.

Theoretical Basis

The behavior of dredged material during disposal is assumed to be separated into three phases: convective descent, dynamic collapse, and passive transport-dispersion (Figure 5). During the ***convective descent*** phase, the disposal cloud falls under the influence of gravity and its initial momentum is imparted by gravity, continuing until the cloud either impacts the bottom or arrives at a level of neutral buoyancy. In deep water, such as both ODMDSs, this phase can take greater than 3 minutes due to the great depth and the loss of momentum of the disposed material as it travels through the water column. The ***dynamic collapse*** phase begins when descent stops and horizontal spreading of material dominates. If the material is primarily composed of non-cohesive material, this phase represents the settling and consolidation of the sediment into a mound. However, if the sediment contains cohesive material, a combination of buoyancy and suspension may transport the cloud a considerable distance from the point of disposal. The ***passive transport-dispersion*** phase is characterized by material transport and spreading due to ambient currents and turbulent diffusion more than the dynamics of the disposal operation itself. Short-term simulations end with this the end of this phase of transport.

Data from 1995 to 1997 were analyzed initially by north/south and east/west components. Average and maximum velocities for each component, by year, for all data collected in that year, as a function of depth were determined as shown in Figures 6 through 11. Positive velocity values represent velocities directed to the north and east. Negative velocity values represent velocities directed to the south and west. The average east/west velocity and average north/south velocity indicated in each figure is the residual velocity component for that year. Both the north/south and east/west components show current speeds diminish with depth.

To further examine the directional distribution of velocity as a function of depth, four locations (bins) in the water column were selected from the velocity profile and twelve compass angle bands (see Figure 12) were defined. Zero deg represents currents headed north and 270 deg represents currents headed west. Direction bands 1 through 4 contain currents directed offshore and therefore have coarse (45 deg) resolution. Direction bands 5 through 12 contain shoreward-directed currents and therefore were defined with a finer (22.5 deg) resolution. Average velocities and number of occurrences in each angle band were determined for each selected bin, with Bin 5 corresponding to the 90-m depth, Bin 12 corresponding to 60-m depth, Bin 20 corresponding to the 30-m depth, and Bin 25 corresponding to the 10-m depth measured from the water surface. Directional distributions of velocity for 1995, 1996, and 1997 are shown in Figures 13-16, 17-20, and 21-24, respectively. Examining these data, currents in Angle Band 1 (0-45 deg) are clearly the most prevalent and also have the greatest average velocity. With the shoreline orientation nearly north/south, (approximately 5 deg east of north), only the first 5 deg from this angle band could possibly direct sediment shoreward toward the reef system. Percentagewise, the shoreward-directed (5 deg) band occurs only 3-10% of the total data collection period. Angle Bands 5 (180-202.5 deg) through 12 (337.5-360 deg) also have shoreward-directed currents with the extreme angle bands (5 and 12) having the greatest average current speeds. Percentagewise, shoreward-directed currents from these angle bands occur only 7.5-15.5% of the total data collection time period. Overall, shoreward-directed currents occur only 17.5-19.4% of the total data collection period, including the 5-deg portion of Angle Band 1.

which band is the 5° portion of Band 1?

Cumulative probability distribution curves were determined for the bin closest to the surface (Bin 25) for Angle Bands 1, 5, 9, and 12 and the first 5 deg of Angle Band 1 (Figures 25-29). Cumulative probability distribution curves for years 1995, 1996, and 1997 were each represented with a unique symbol. From the three curves, velocities with exceedances of 50% (V_{50}), 10% (V_{90}), 5% (V_{95}), and 1% (V_{99}) were identified for each angle band. In each case, the most conservative value (curve with the greatest current speed, usually 1997) was selected. Based on analysis of these results, Angle Bands 12 (greatest shoreward-directed current speeds) and 9 (shore-normal but lower current speeds) were examined further. The 3-year database of currents was examined for surface currents that matched the 50, 90, 95, and 99th percentile velocities from the selected cumulative probability distribution curves. Fifteen velocity profiles with surface velocities that were equal to each of the four percentile surface velocities were selected, and average 50, 90, 95, and 99th percentile velocity profiles were determined for use in model simulations. The velocity profiles to be simulated at an orientation of 270 deg (the most conservative angle for Angle Band 9) are shown in Figure 30. Angle Band 12 velocity profiles to be simulated with an orientation of 337.5 deg are shown in Figure 31 (again, a conservative selection for current direction).

Outline

The purpose of this study is to evaluate the dispersive characteristics of proposed disposal sites offshore of Palm Beach Harbor and Port Everglades Harbor. Both sites are in deep water (approximately 170-200 m deep) and are in close proximity to the Gulf Stream and its spin-off eddies. There is concern that the proposed eddies could potentially carry material from the ODMDS to environmentally-sensitive coral reefs. Numerical model simulations were selected as the method of evaluating the potential for sediment transport during disposal (short-term fate) and from the disposal mound (long-term fate). This approach requires information documenting the local velocities near the ODMDSs to define a reef-directed component which may be attributable to the Gulf Stream eddies. This report summarizes the data analysis and model simulations performed for the Palm Beach Harbor and Port Everglades Harbor ODMDSs, including an extensive examination of velocities in the vicinity of the ODMDSs. Chapter 2 focuses on the short-term fate of dredged material at each site, including data analysis and model simulations. Chapter 3 focuses on the long-term fate of dredged material at each site, including data analysis and point model simulations. Chapter 4 summarizes findings from the model simulations.

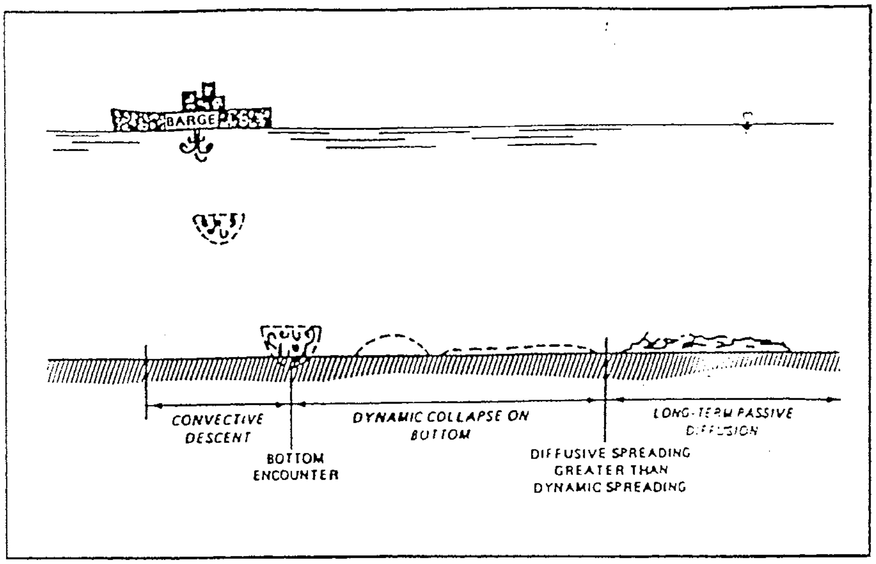


Figure 5. Computational phases of the STFATE model (from Brandsma and Divorky, 1976)

Input Data Requirements

The STFATE model requires site-specific input data to quantitatively predict the short-term fate of a disposal operation. These data include: local environment (depth and velocity fields), dredged material composition, dredge dimensions, and disposal operation, as well as modeling parameters and coefficients. Each of the input requirements will be discussed in the following paragraphs.

Bathymetry. Bathymetry data collected by Continental Shelf Associates in 1986 showed water depths ranged between 175 and 220 m, mean low water (mlw) for the Port Everglades ODMDS and between 155 and 185 m, mlw for the Palm Beach ODMDS. STFATE model simulations covered a broader area than the ODMDS in the event that transport from the ODMDS occurred. The model area was approximately 6700 m by 6700 m with depth values defined every 150 m. Depth values for the modeled regions were taken from NOAA Chart 11469 and 11470 for Port Everglades and from NOAA Chart 11467 for Palm Beach. Figures 3 and 4 show the disposal site bathymetries for Palm Beach and Port Everglades, respectively.

Velocity data. Acoustic Doppler Current Profiler (ADCP) data obtained from the National Oceanographic Data Center (NODC) for location (26° 04.00'N, 80° 03.50'W) in the vicinity of the project sites were analyzed to determine potential velocity profiles that disposed material might be subjected to over the short-term (immediately after disposal). The depth at the ADCP deployment site was 110 m. NODC provided velocity profile data at 4-m depth intervals and 20-minute time intervals for the 1995-1997 time period. The 1995 dataset extended from late August until late December with approximately 7600 velocity profiles. The 1996 dataset was most complete, covering January through early June and late August through December for a total of 19000 velocity profiles. The 1997 dataset extended from January through late May with 8500 velocity profiles.

missing July + August for

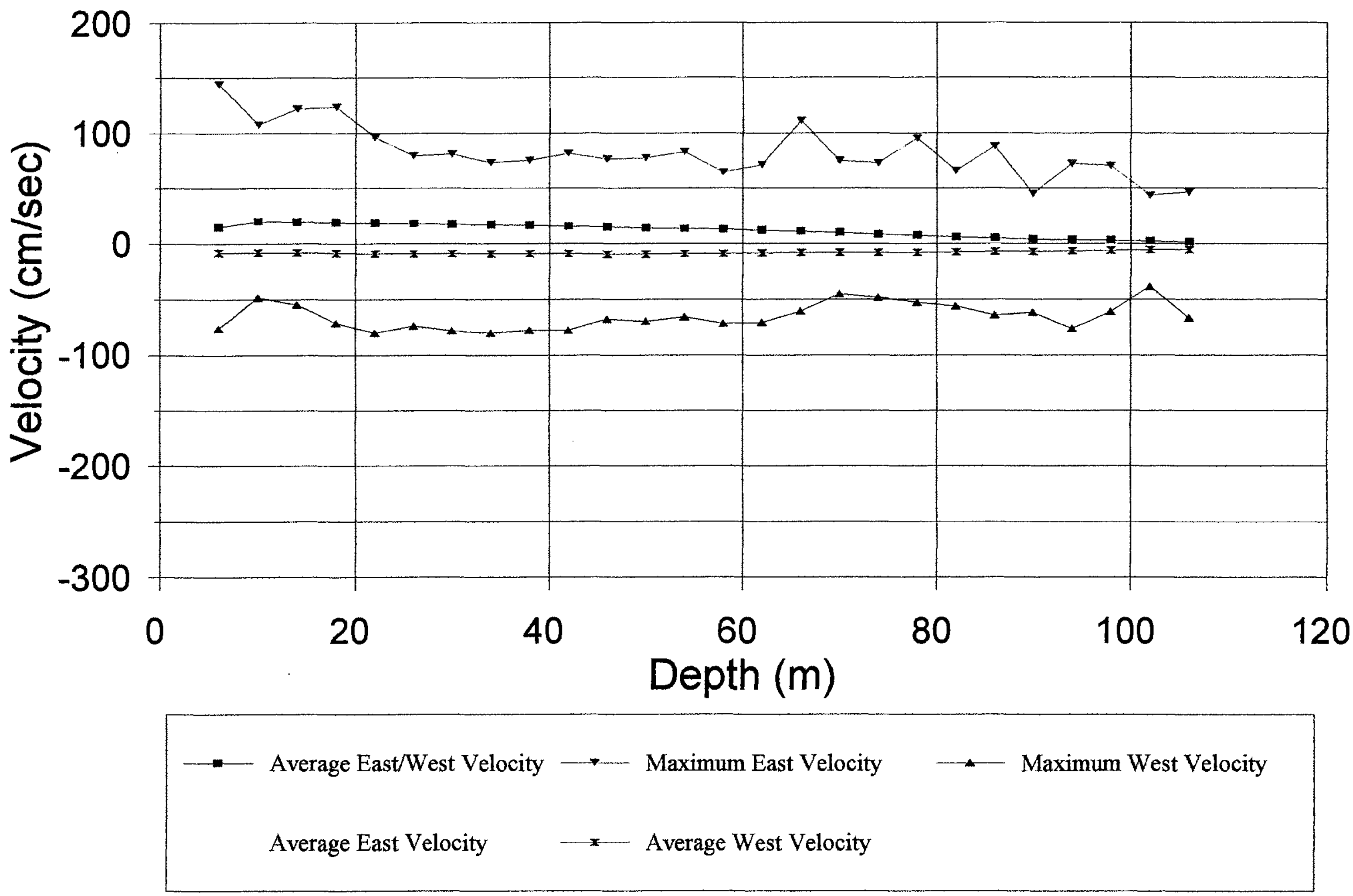


Figure 6. 1995 East/West velocity components

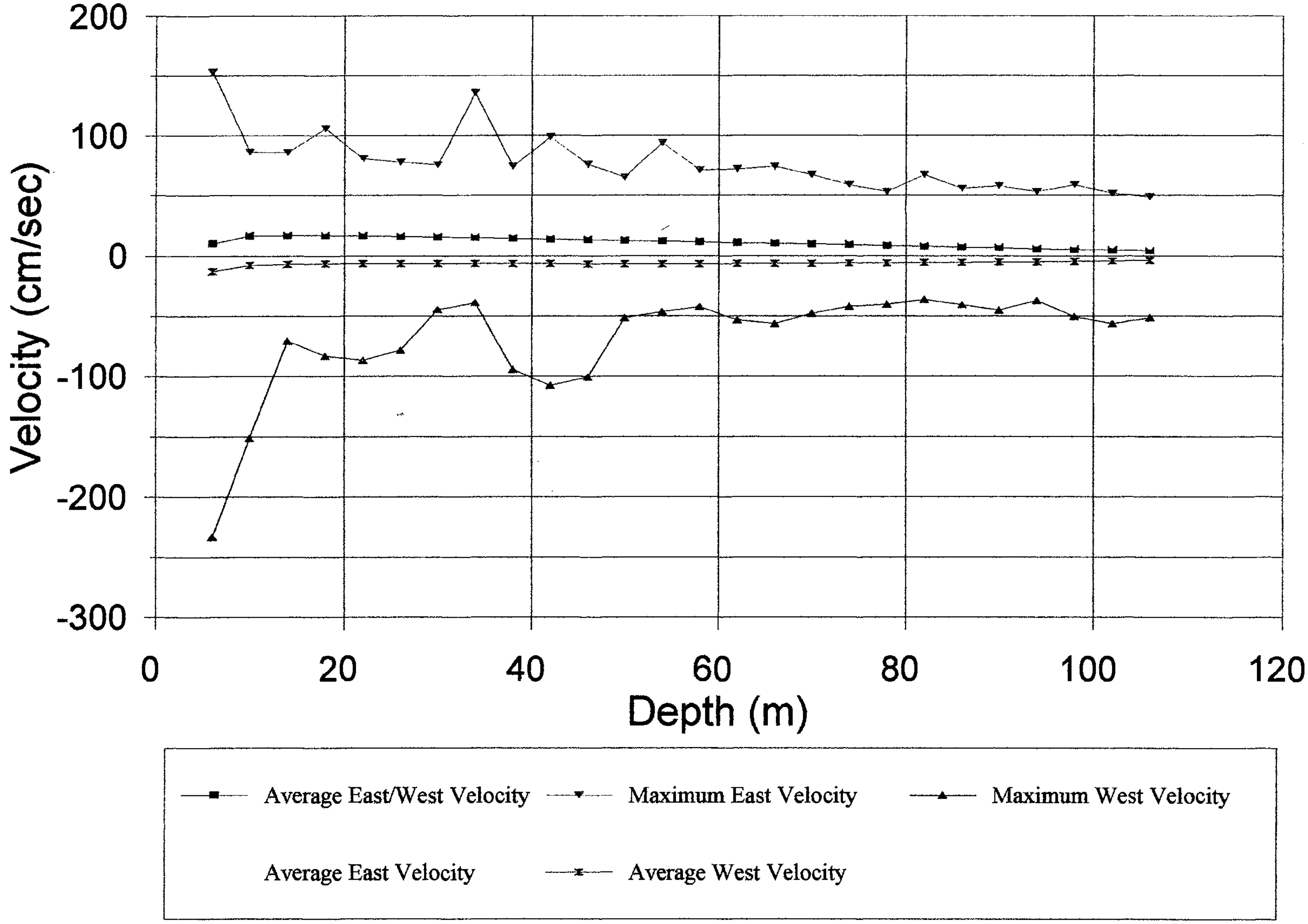


Figure 7. 1996 East/West velocity components

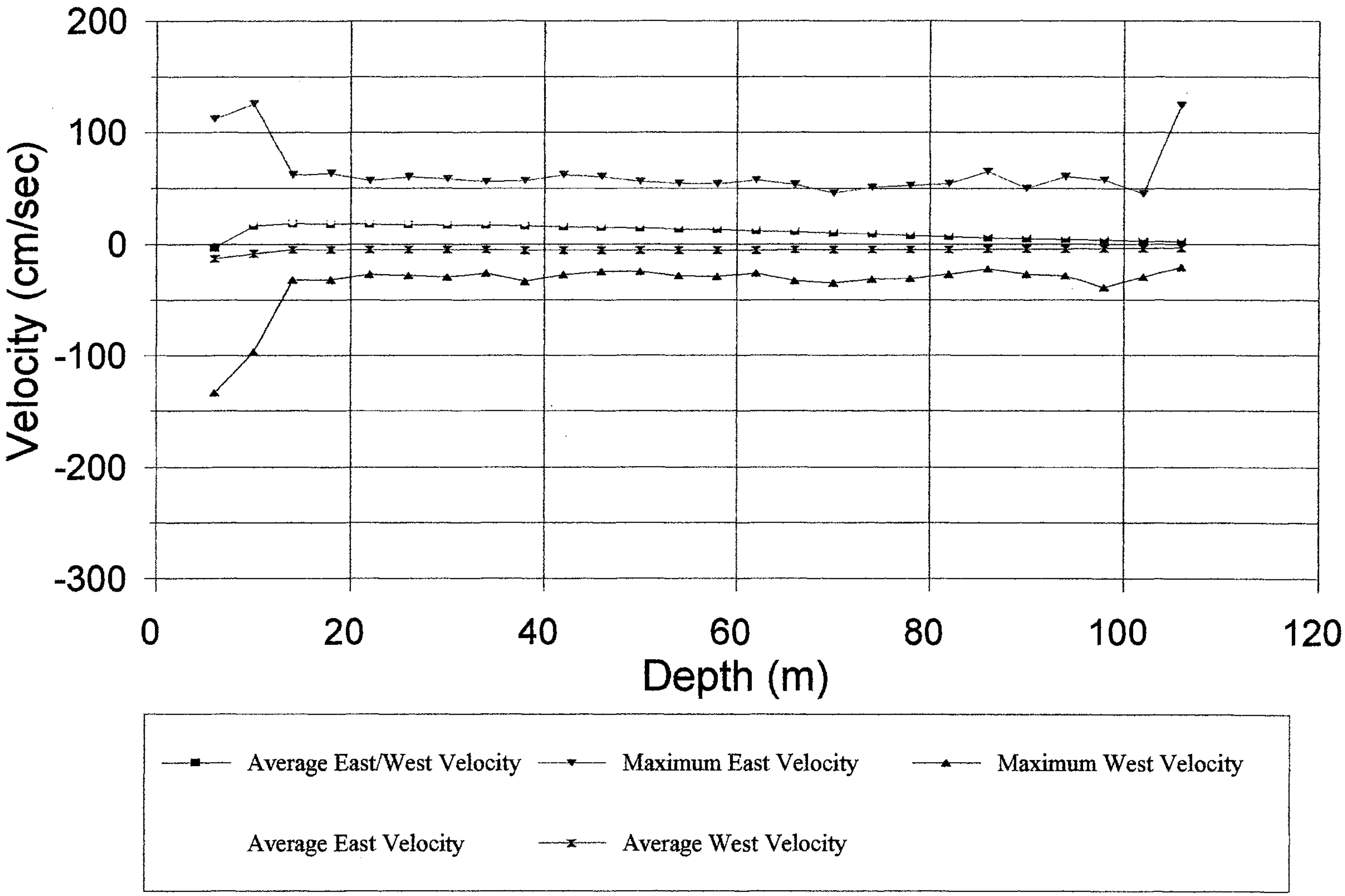


Figure 8. 1997 East/West velocity components

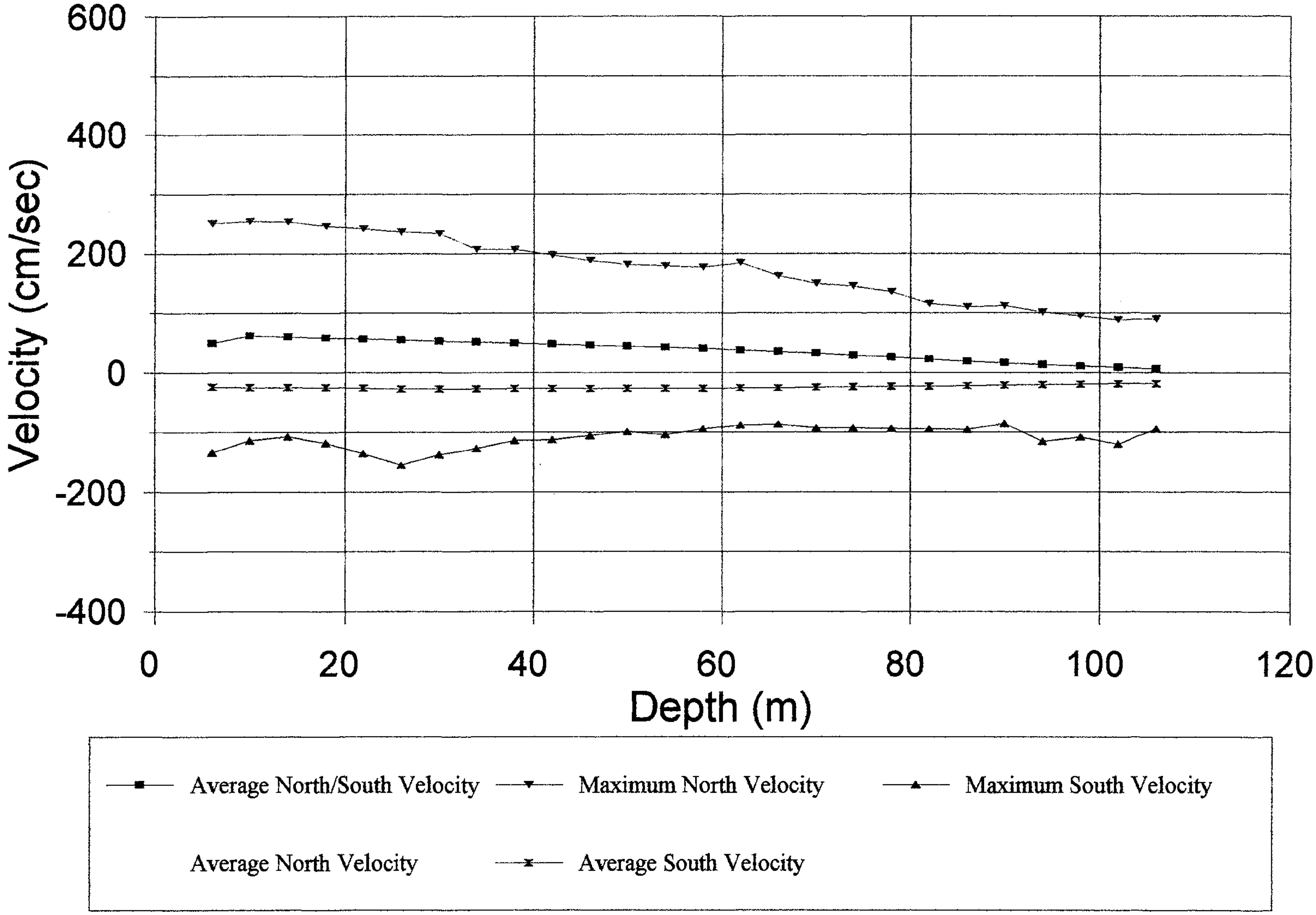


Figure 9. 1995 North/South velocity components

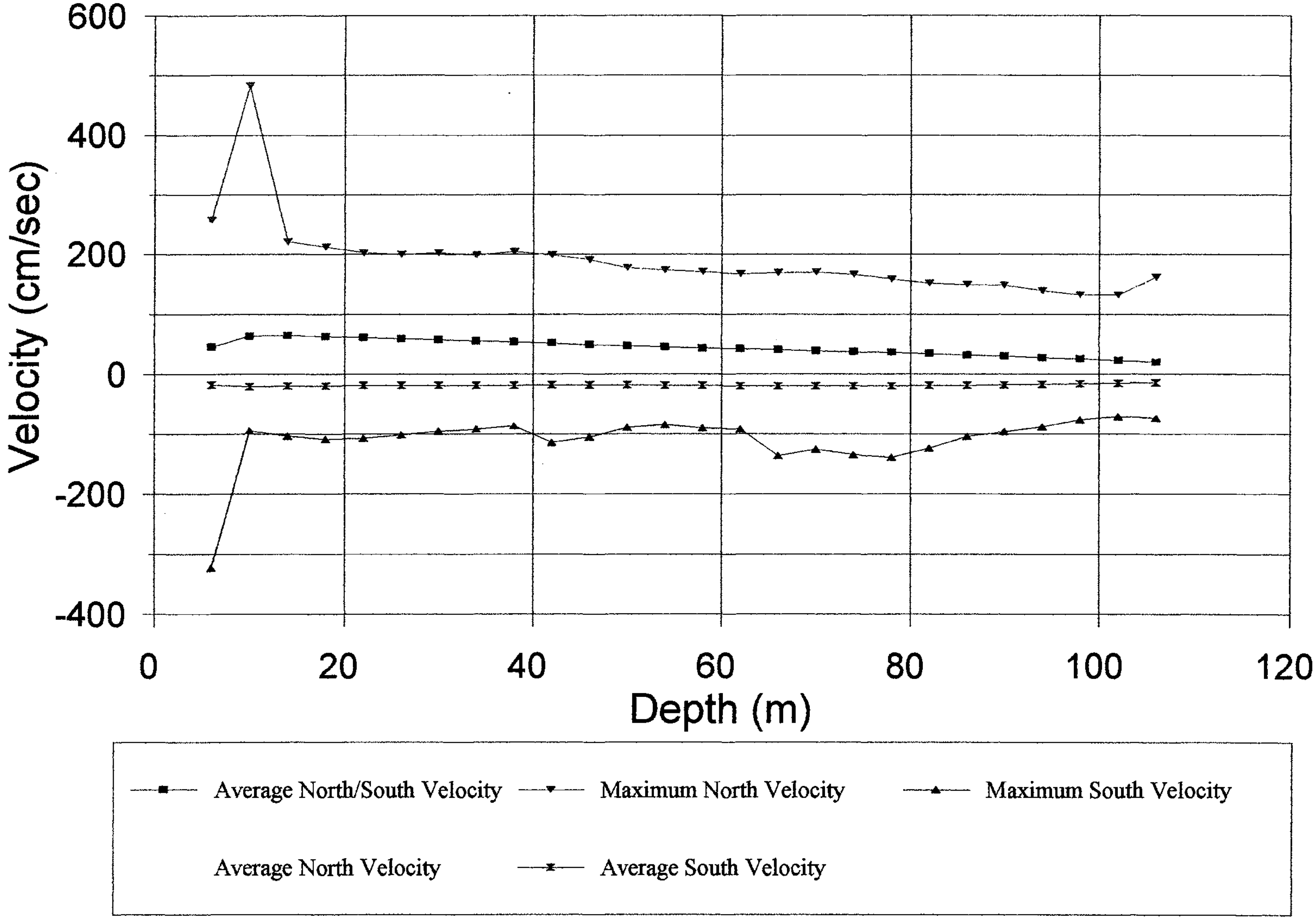


Figure 10. 1996 North/South velocity components

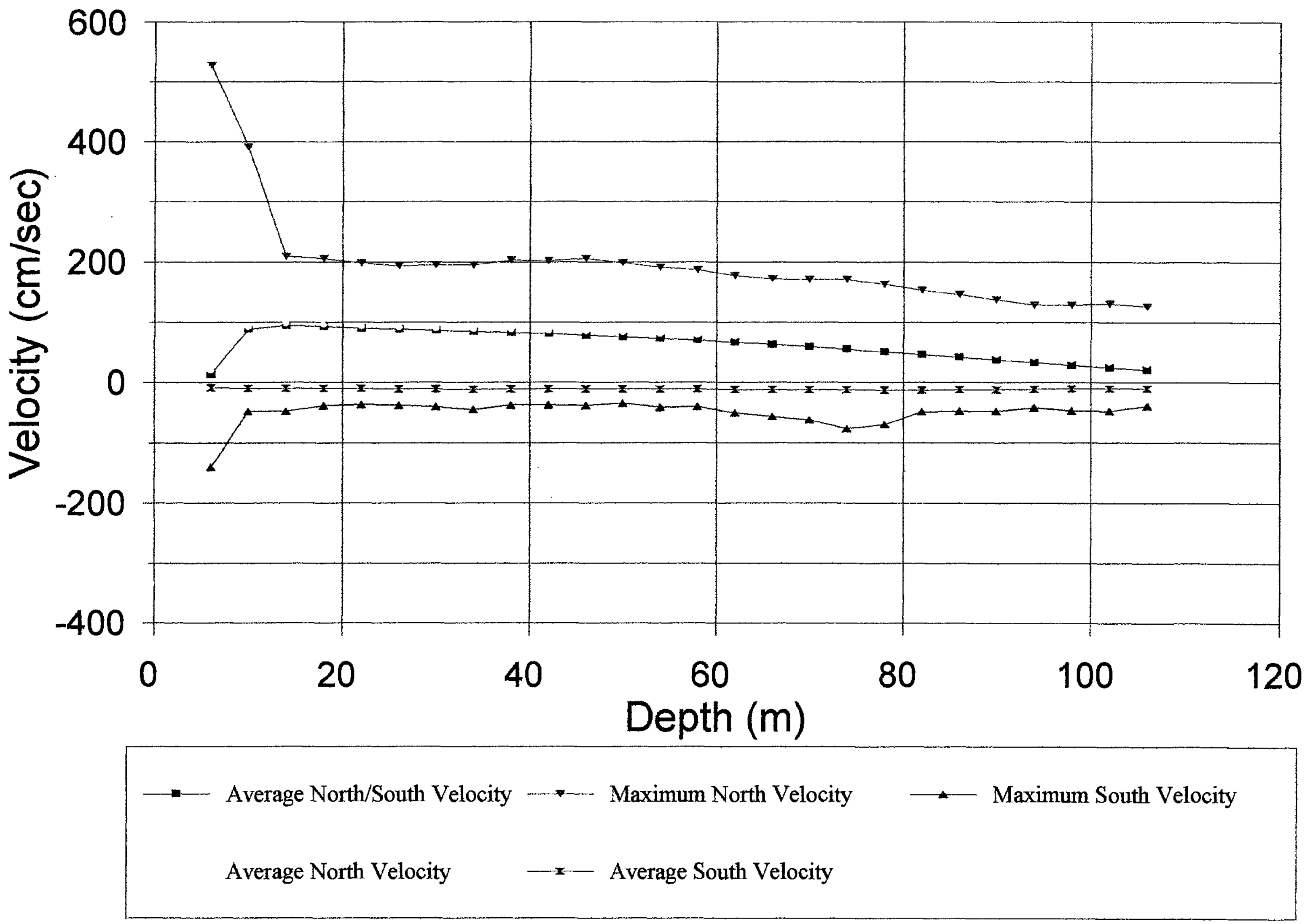


Figure 11. 1997 North/South velocity components

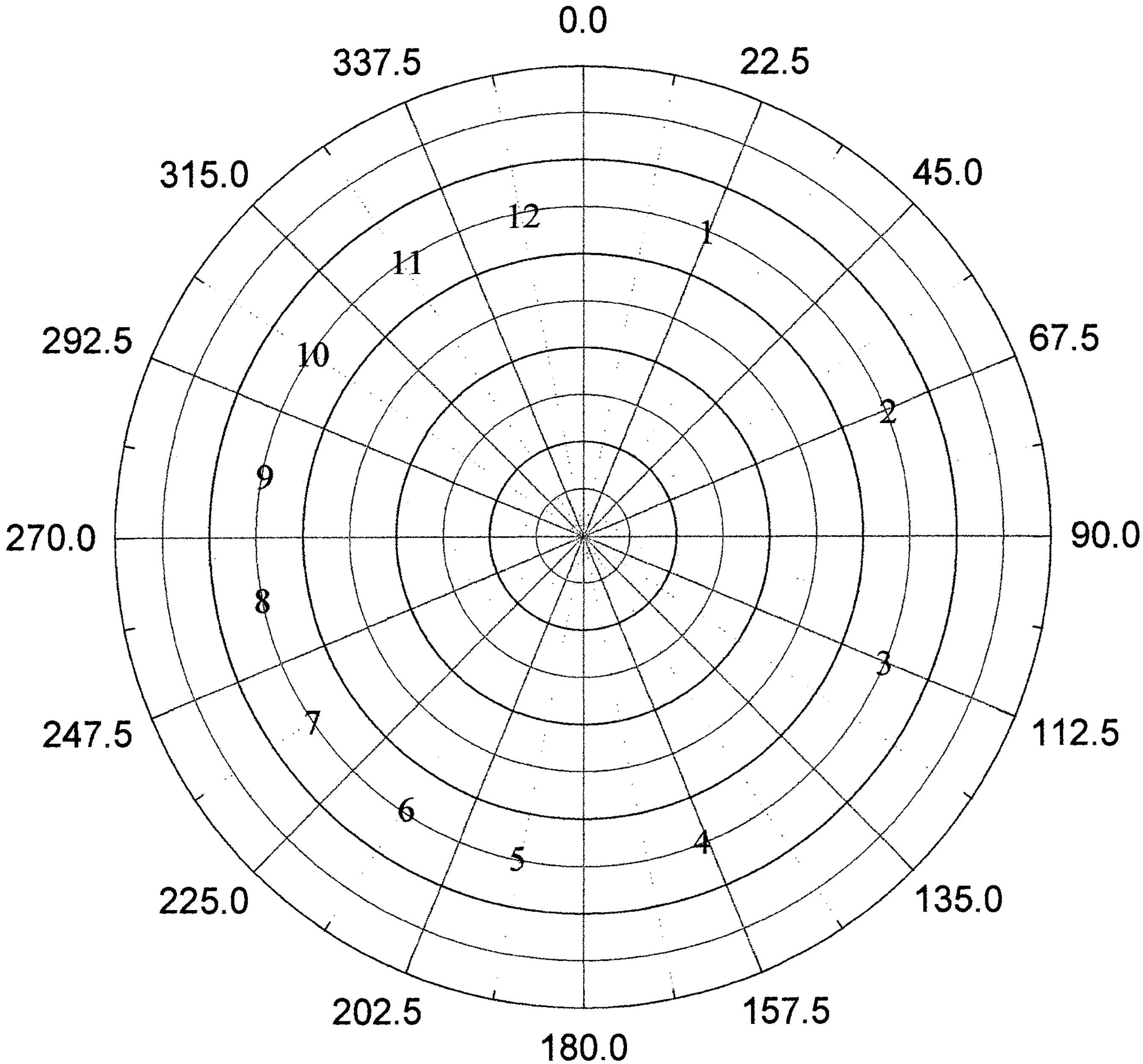


Figure 12. Definition of angle bands

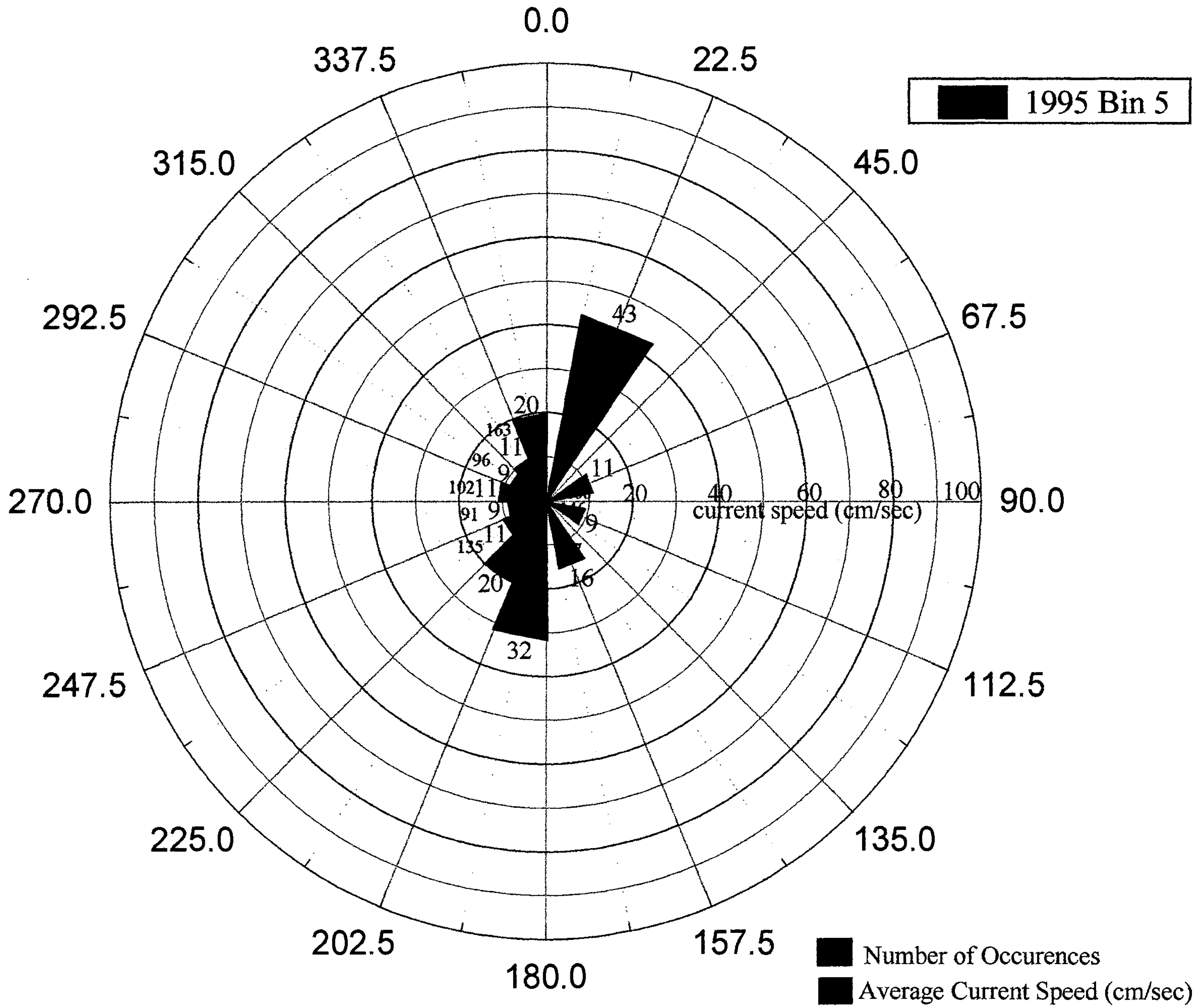


Figure 13. Directional distribution of velocities for 1995-bin 5

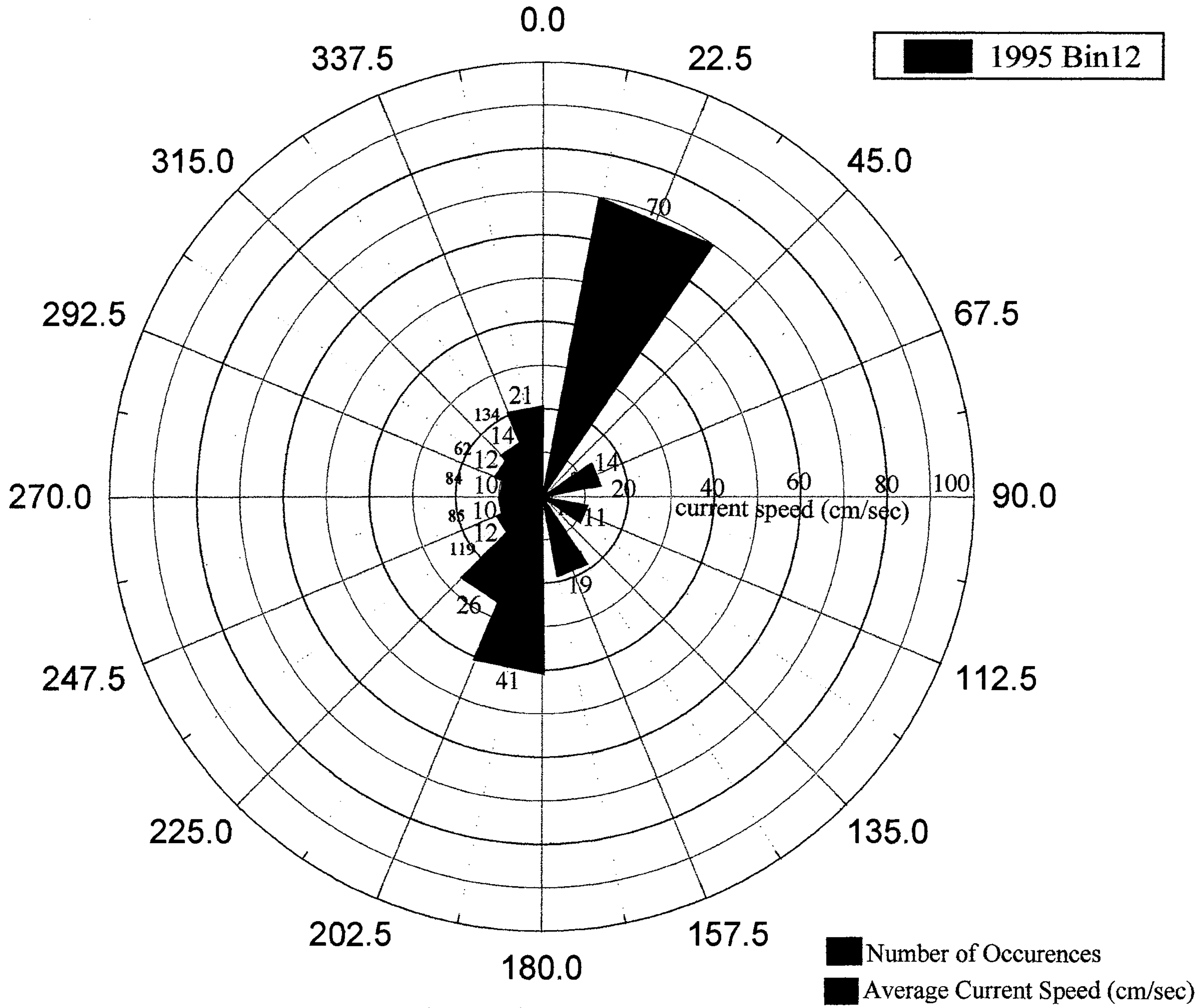


Figure 14. Directional distribution of velocities for 1995-bin 12

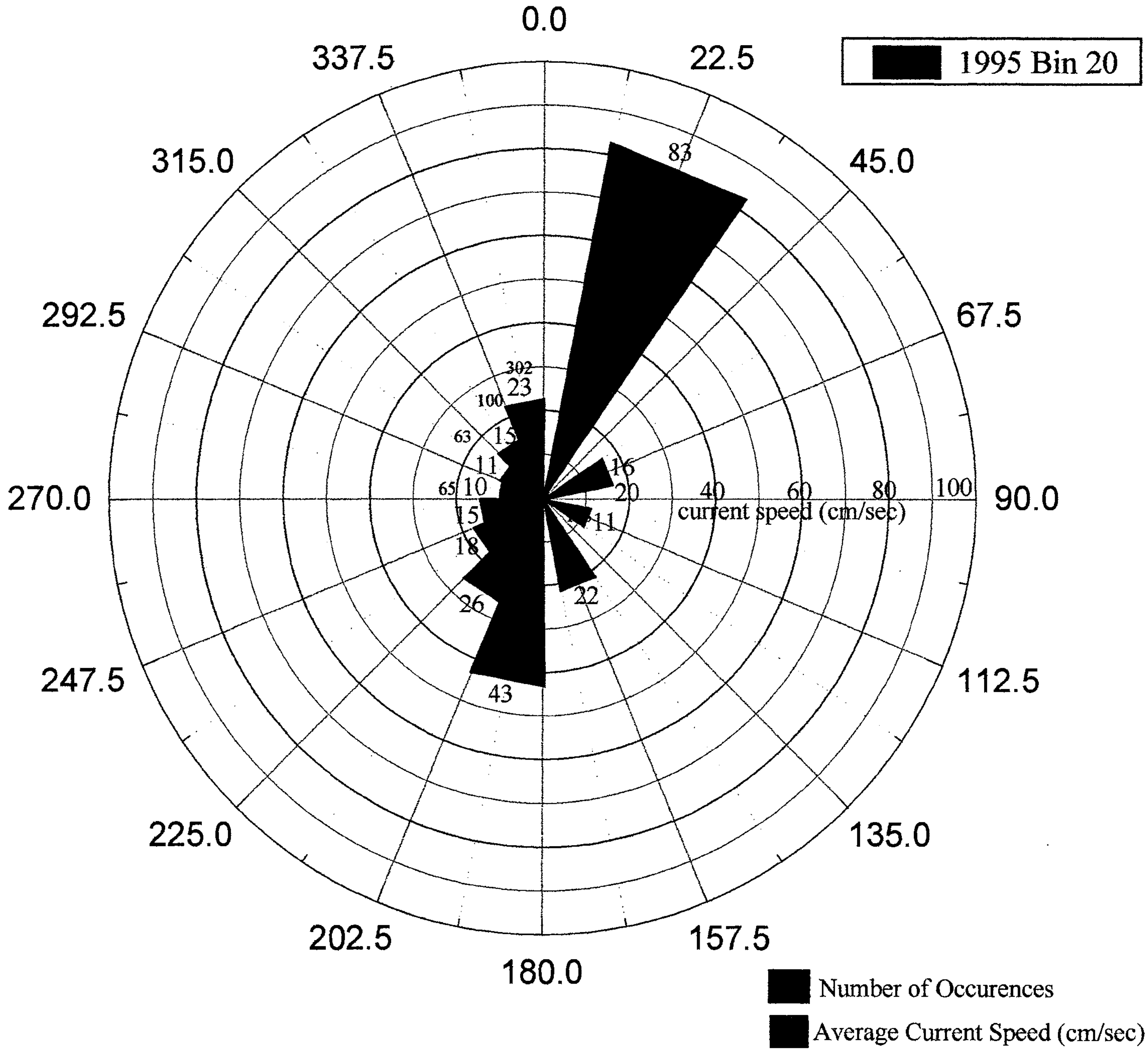


Figure 15 Directional distribution of velocity for 1995-bin 20

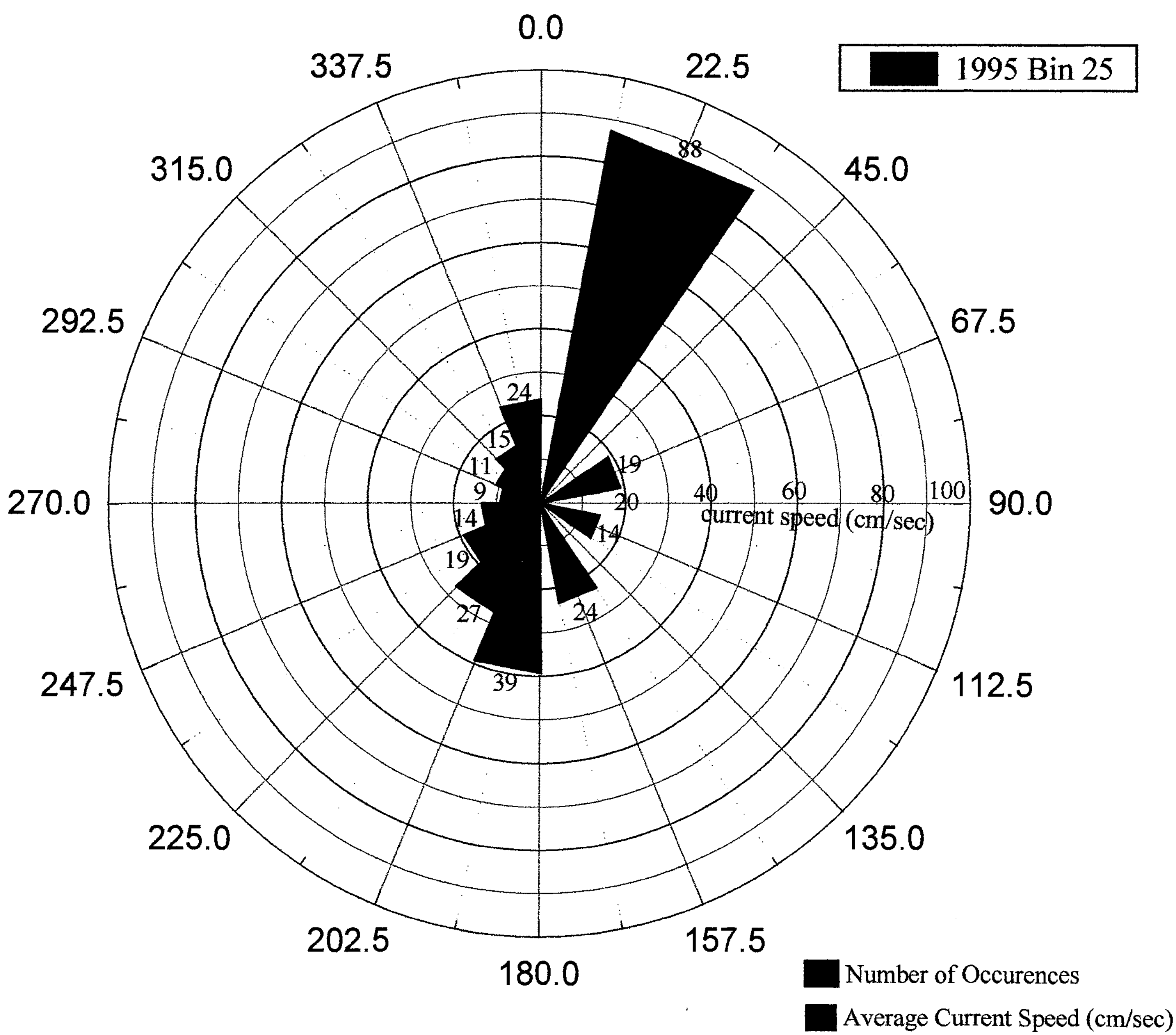


Figure 16. Directional distribution of velocities for 1995-bin 25

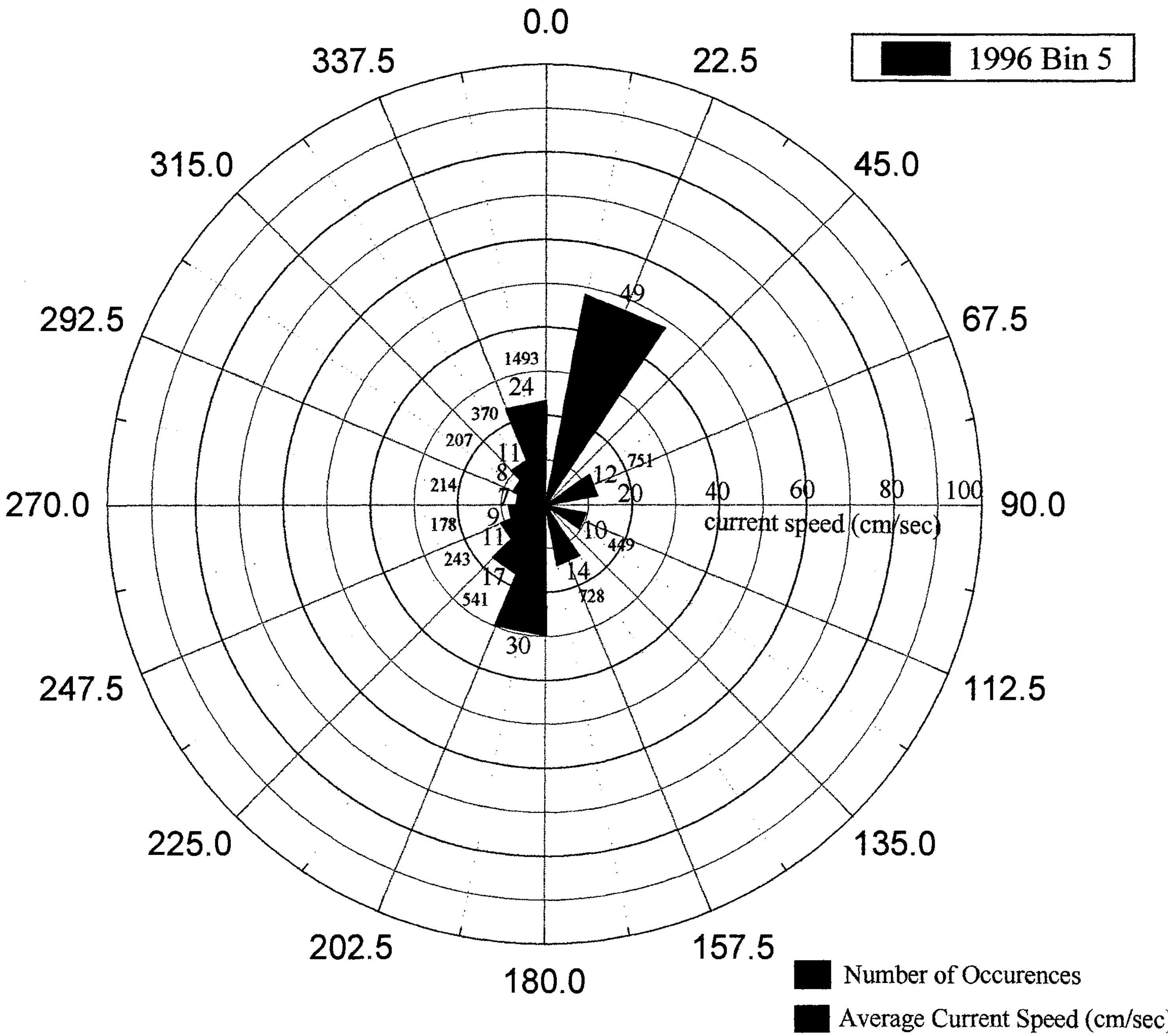


Figure 17. Directional distribution of velocities for 1996-bin5

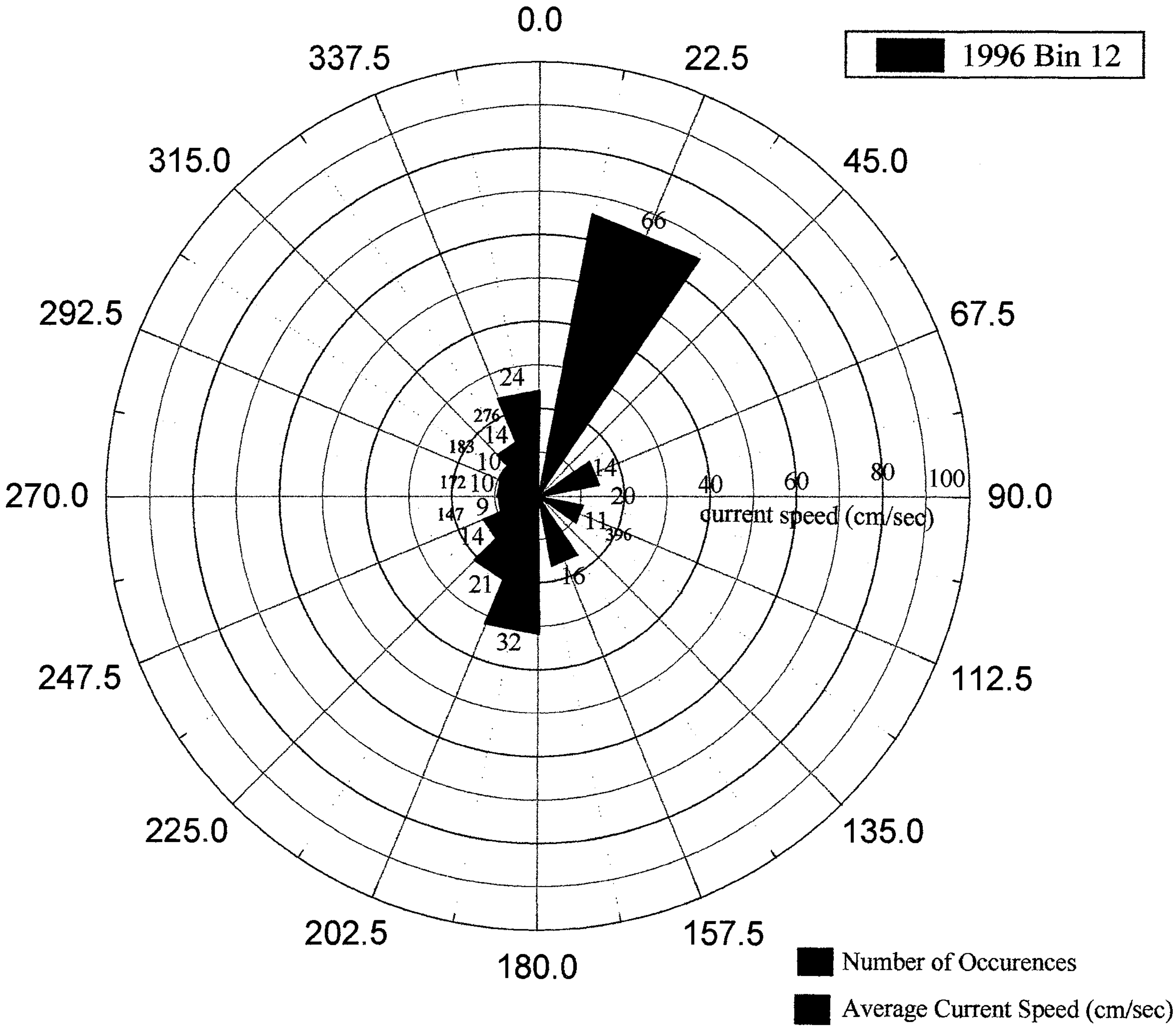


Figure 18. Directional distribution of velocities for 1996-bin 12

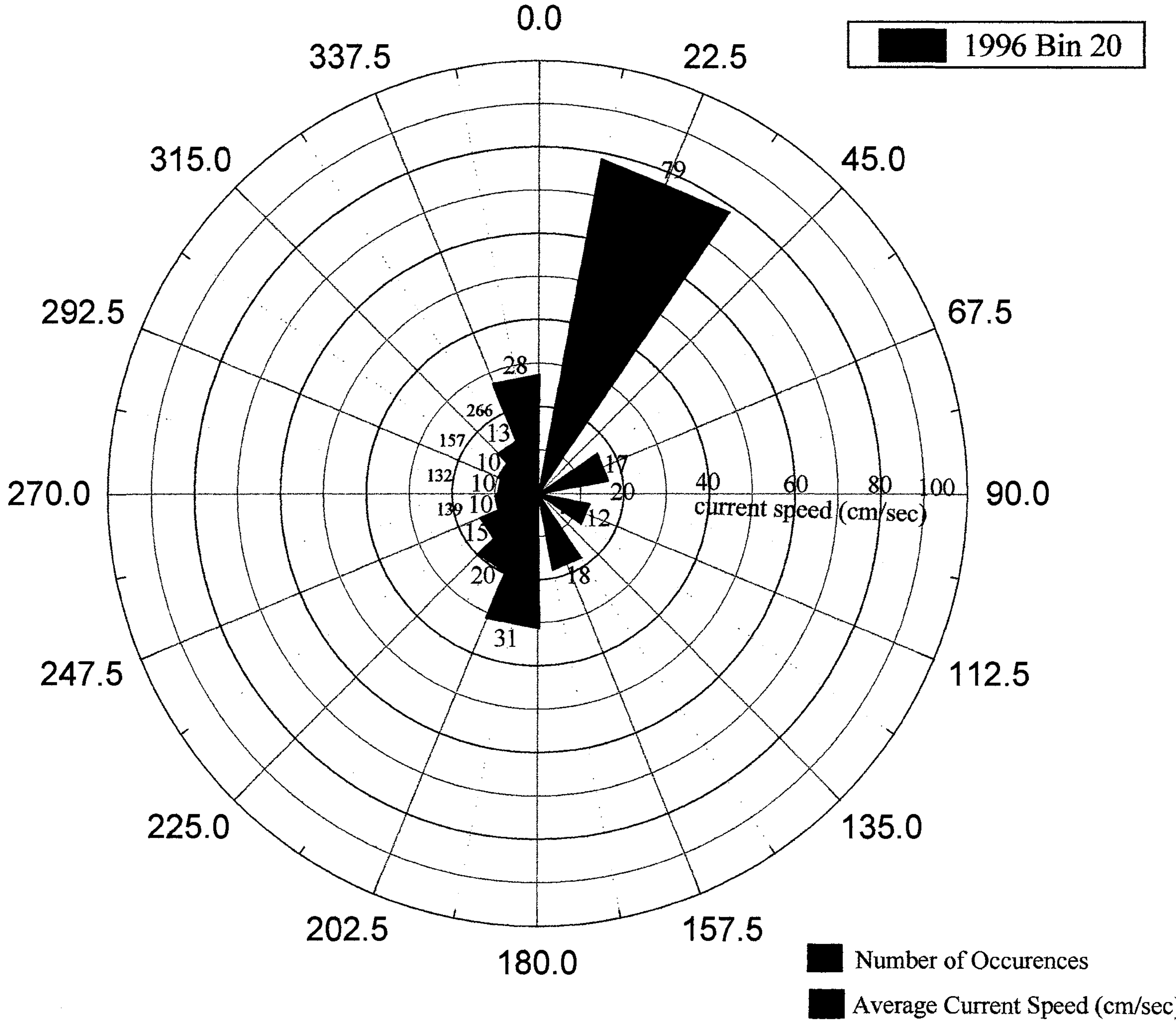


Figure 19. Directional distribution of velocities for 1996-bin 20

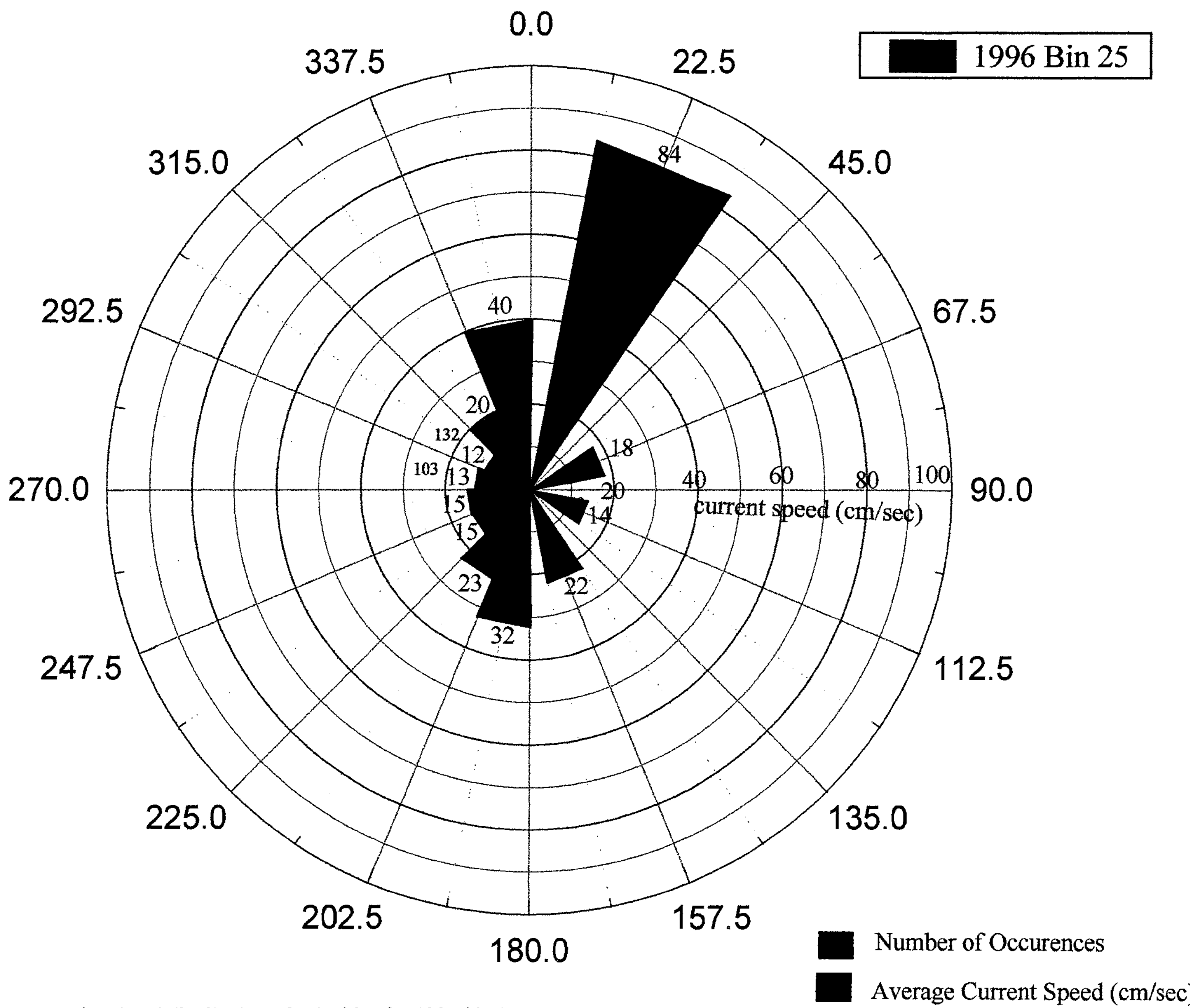


Figure 20. Directional distribution of velocities for 1996-bin 25

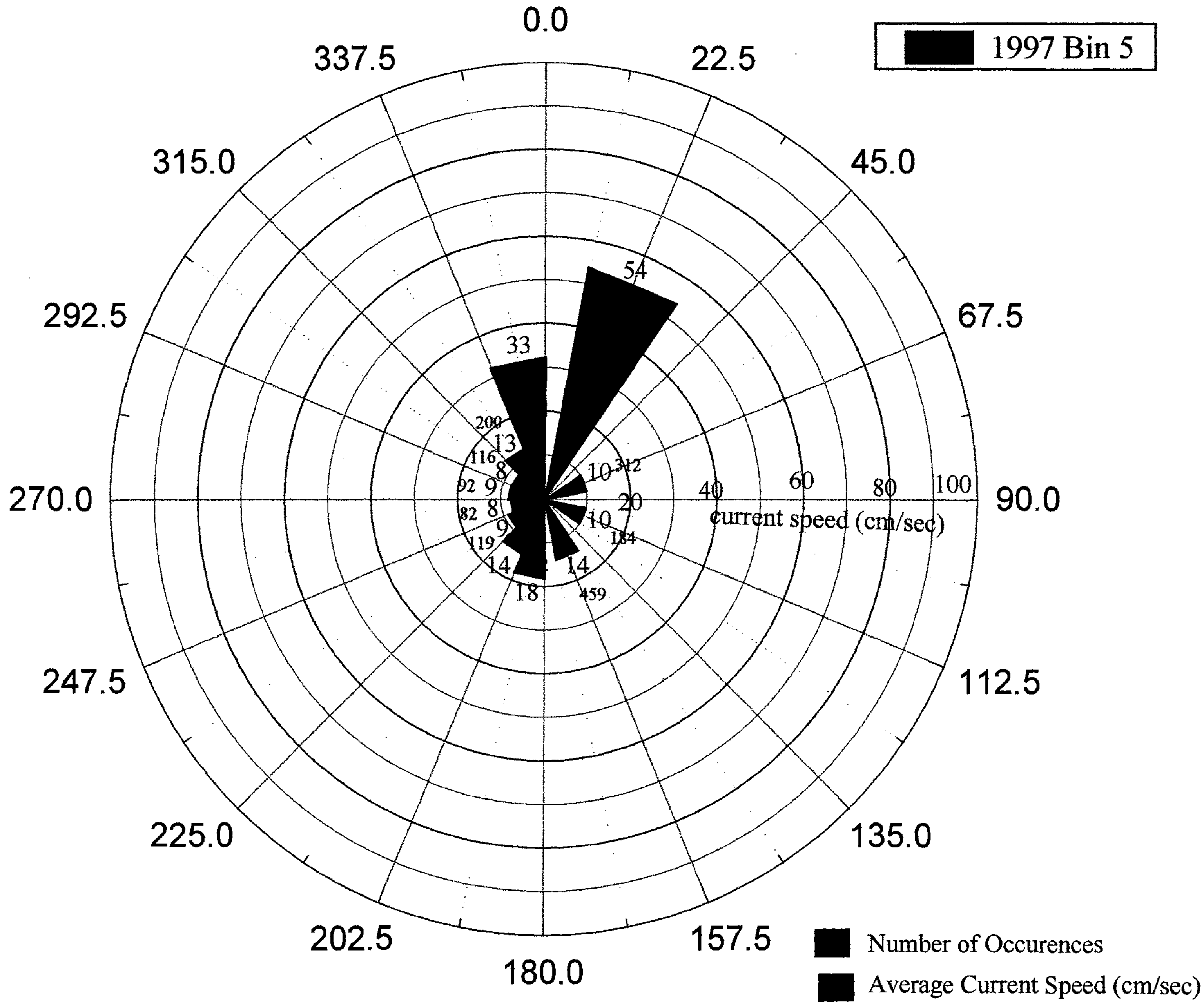


Figure 21. Directional distribution of velocities for 1997-bin 5

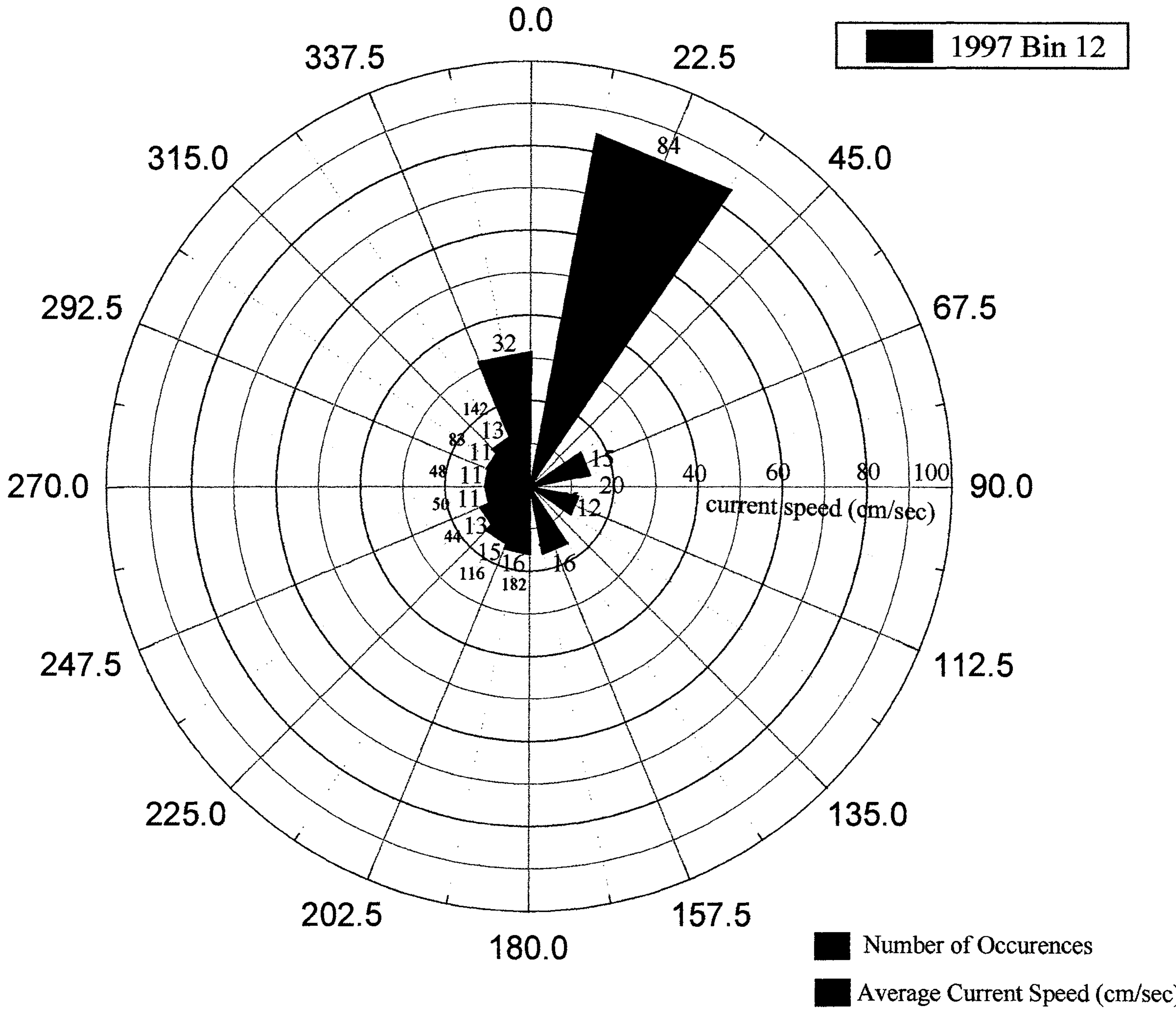


Figure 22. Directional distribution of velocities for 1997-bin 12

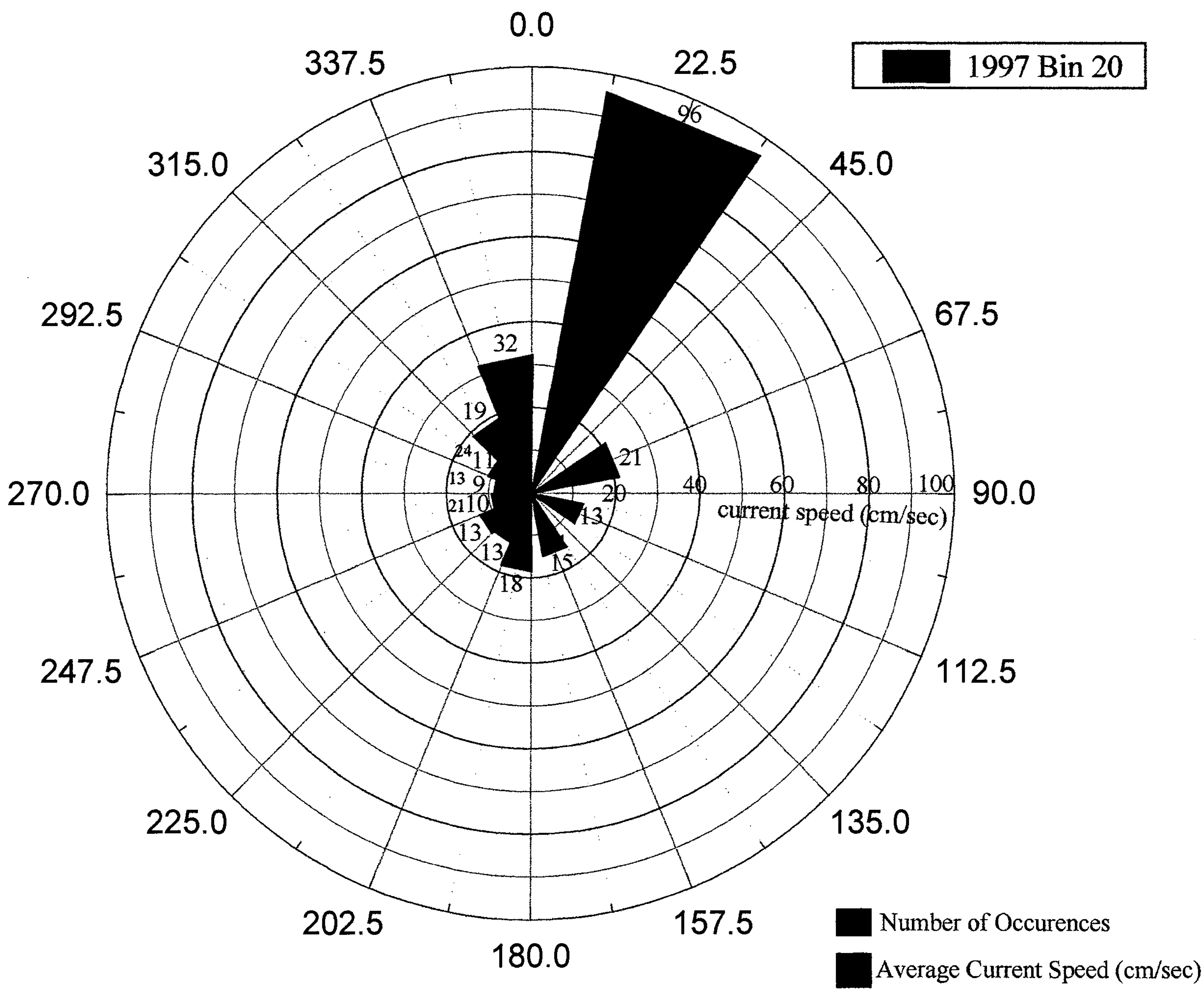


Figure 23. Directional distribution of velocities for 1997-bin 20

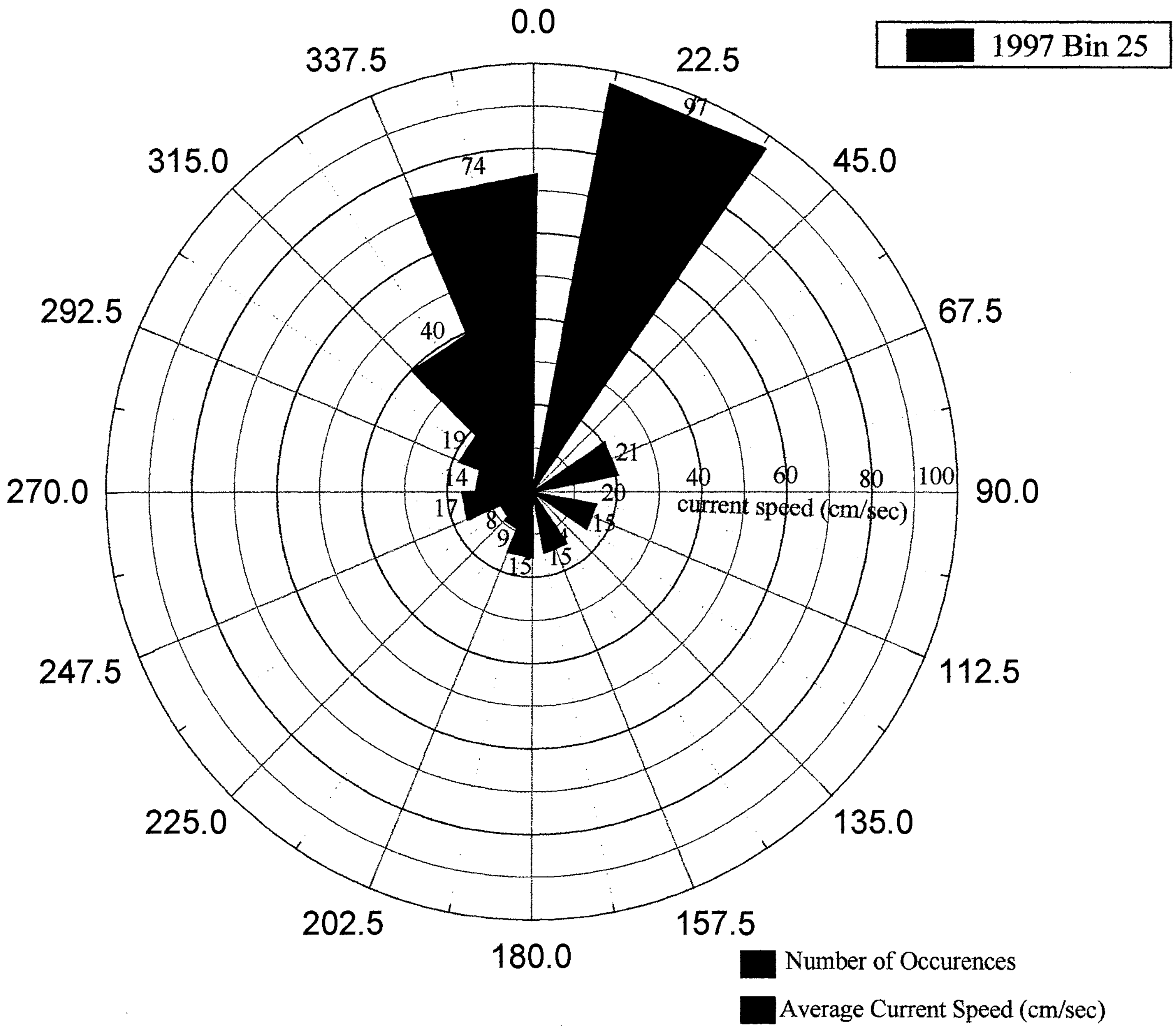


Figure 24. Directional distribution of velocities for 1997-bin 25

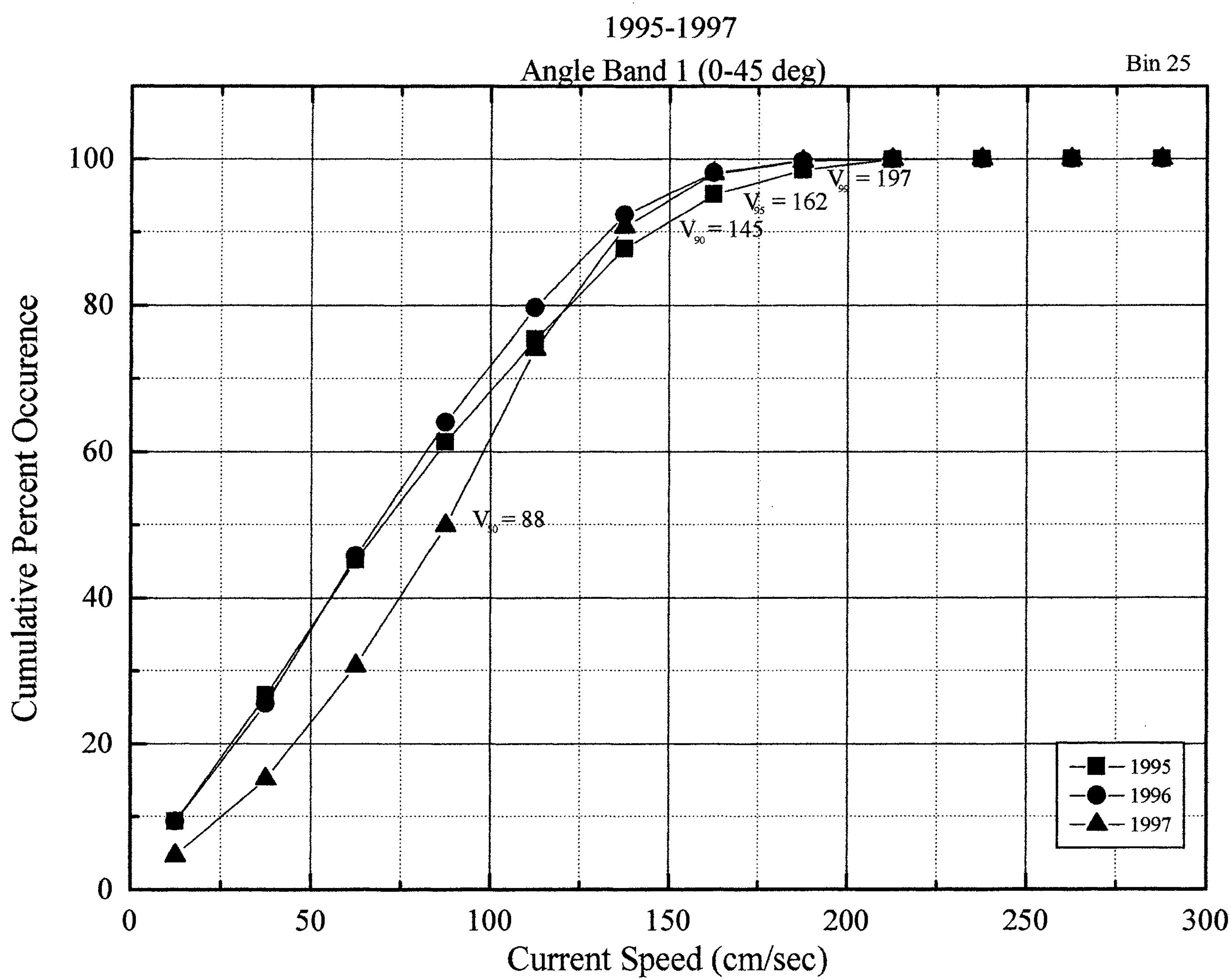


Figure 25. Cumulative probability distribution for Angle Band 1

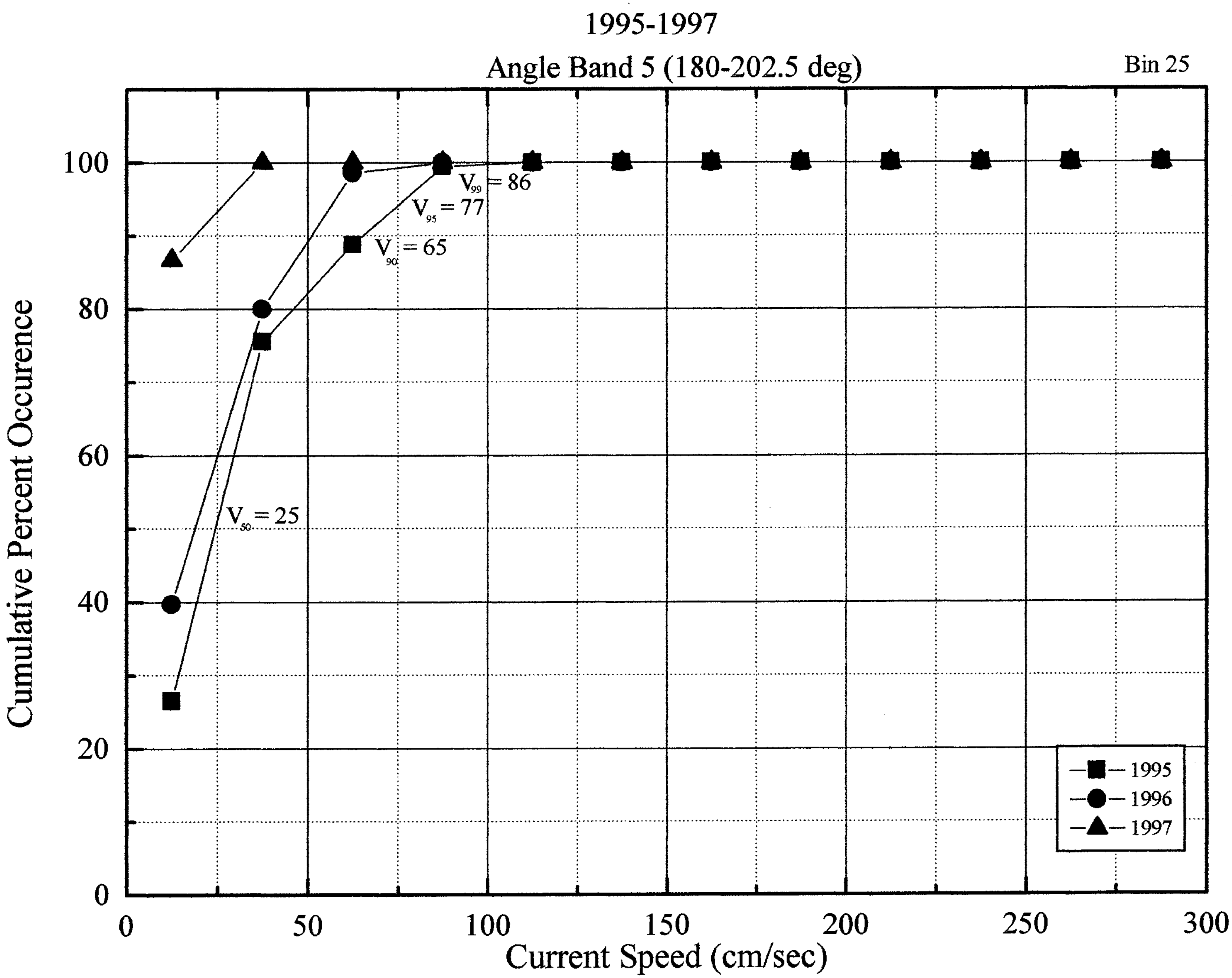
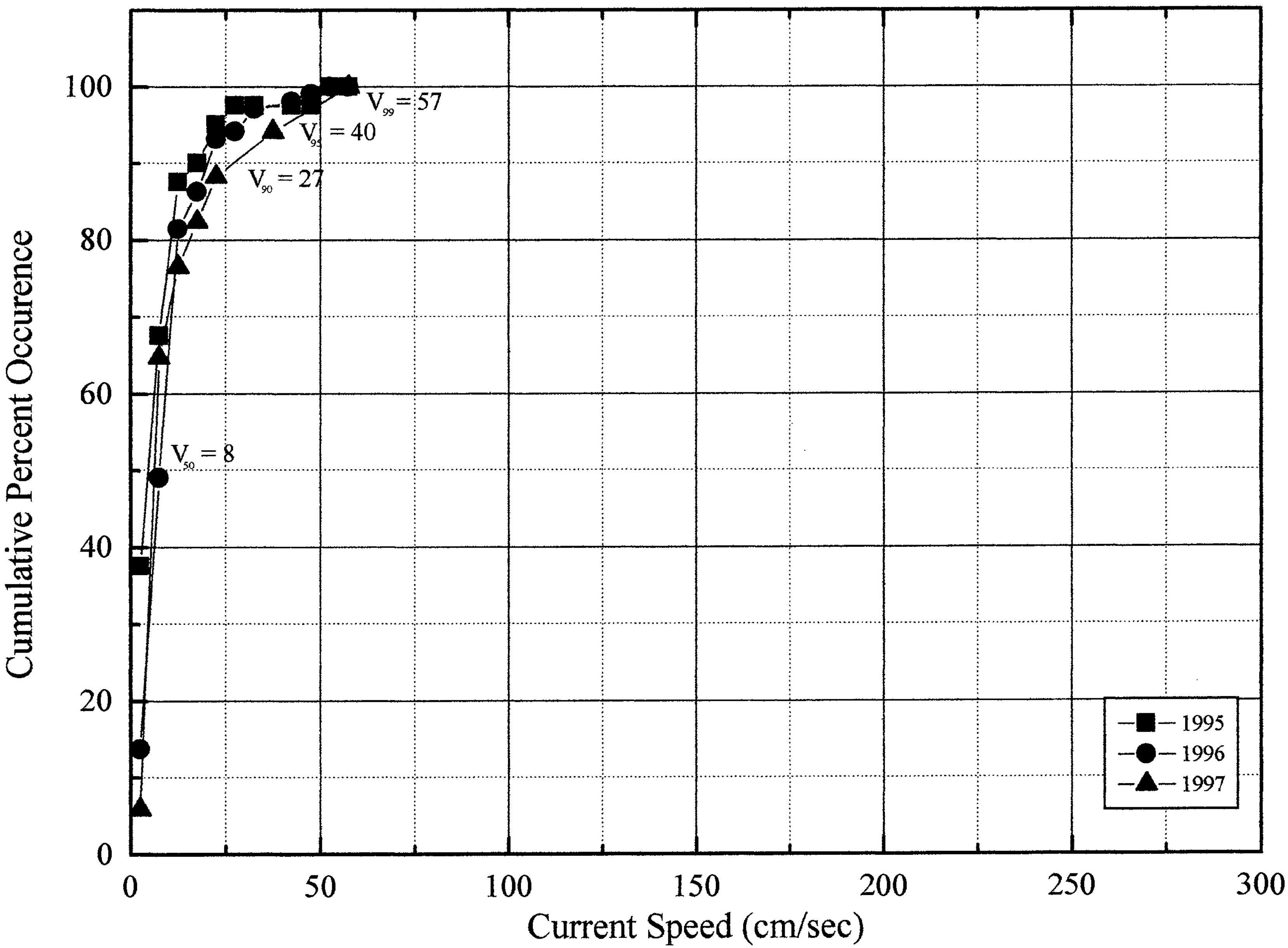


Figure 26. Cumulative probability distribution for Angle Band 5

1995-1997

Angle Band 9 (270-292.5 deg)

Bin 25



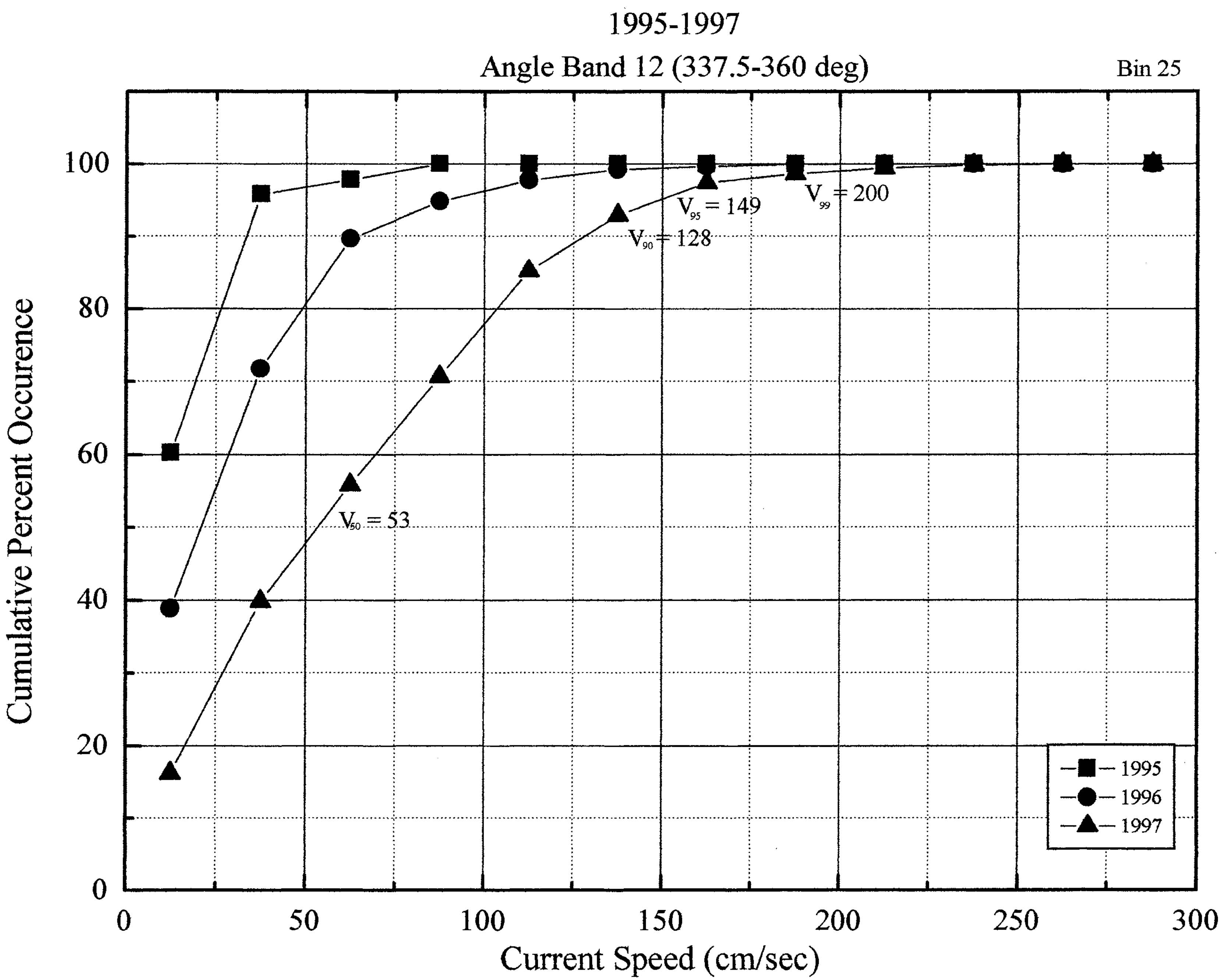


Figure 28. Cumulative probability distribution for Angle Band 12

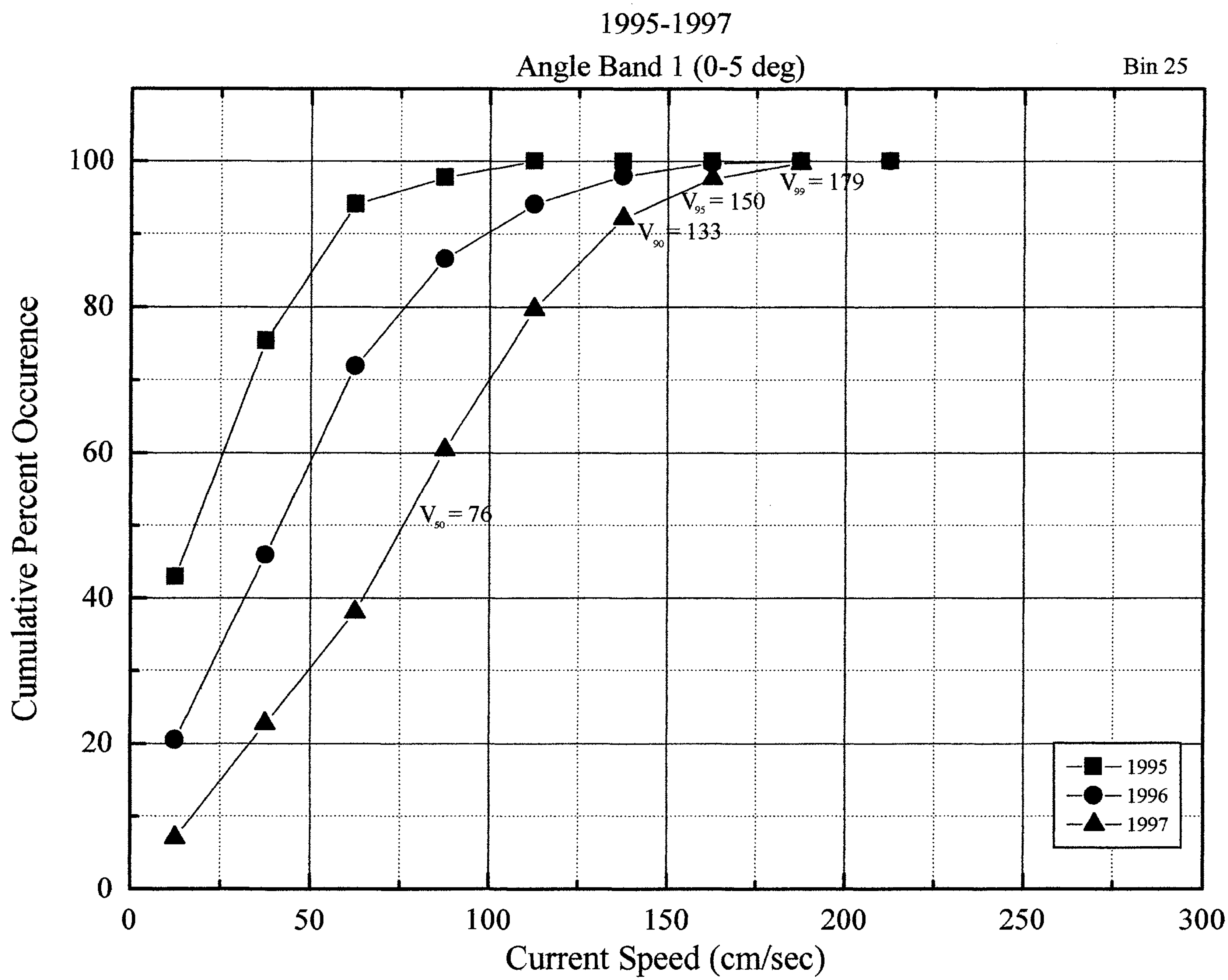


Figure 29. Cumulative probability distribution for Angle Band 1 (0-5 deg)

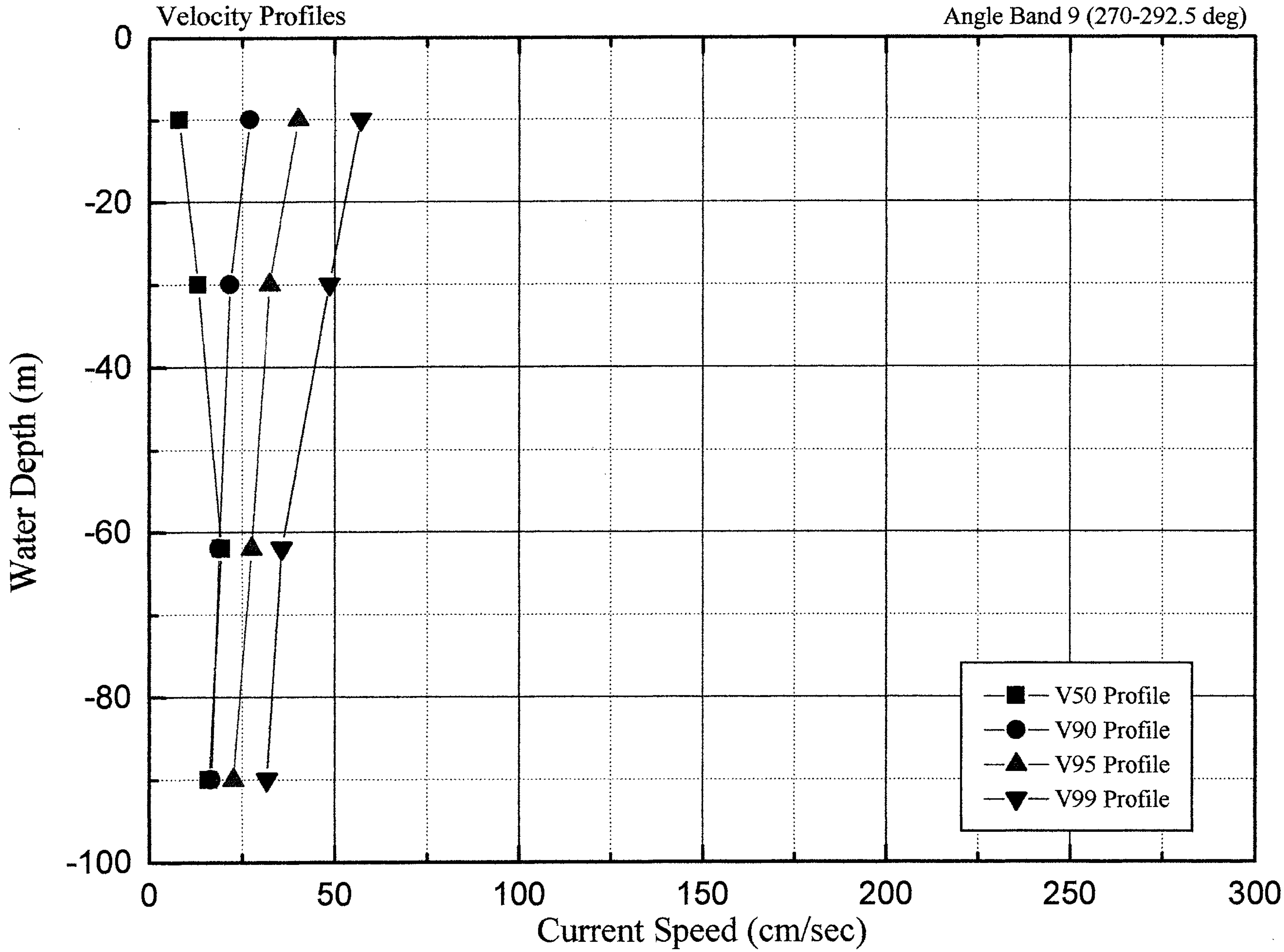


Figure 30. Velocity profiles for Angle Band 9

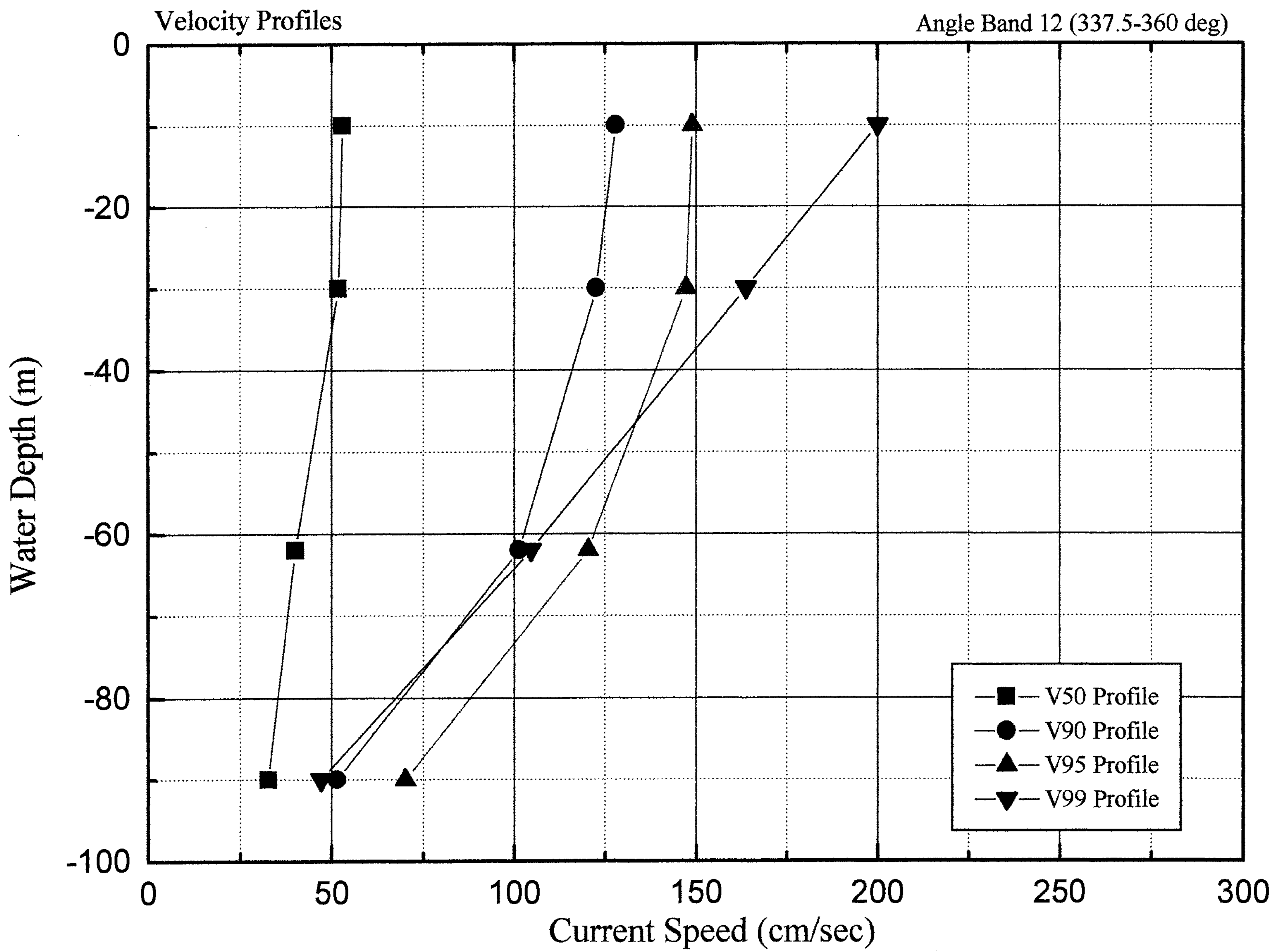


Figure 31. Velocity profiles for Angle Band 12

Note that the selected velocity profiles also reflect conservative estimates of current profiles occurring at the study site. First, the highest value from the cumulative distribution curves (usually 1997) was selected to represent V_{50}, V_{90}, V_{95}, and V_{99}. The 1995 and 1996 cumulative distribution velocity curves show values on the order of 50% lower than the extreme year. Again, one should keep in mind that velocities in these angle bands occur infrequently. For example, velocities in Angle Band 12 occurred only 5-6% of the data collection time period. Only half of that time (3% or approximately 260 hrs per year), would it be likely for velocities in Bin 25 (near the surface) to exceed 53 cm/sec. A velocity with 1% exceedance (200 cm/sec) would most likely occur only 0.06% of a given year, or approximately 4-5 hours per year near the water surface.

Simulated Velocity Values. The STFATE model can accommodate the velocity profiles described above for a single water-depth, but uses a single (depth-integrated) velocity for varying bathymetry. In order to simulate the potential movement of material into the shallower regions of the reefs, an extreme value for the depth-integrated velocity was selected (Table 1). That is, the maximum value for a given velocity profile was used in each simulation (usually the Bin 25 (surface) value).

Table 1. Velocities simulated

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

Sediment Characteristics. The dredged material composition consists of a solid fraction (rock, sand, silt-clay, etc.) and a fluid component. Each component must be defined according to its density, concentration by volume (percentage of total load volume), fall velocity, and void ratio (volume of water to volume of solids ratio).

Ten sediment samples were collected on 17-18 September 1997 at Port Everglades. Upon examination of the data, samples 1-8 located in the bay had 38% fines whereas the 2 samples taken from the inlet had only 5% fines. Bay samples had approximately 60% solids by weight whereas the inlet samples were approximately 70% solids by weight. The great difference in sediment characteristics from the two locations suggested that both conditions should be simulated. Volume fractions of sand and silt were determined and are given in Table 2.

Table 2. Port Everglades sediment characteristics			
% solids by weight	% fines	Volume fraction fines	Volume fraction sand
60	38	.1401	.2247
70	5	.0239	.4460

In June 1997, fifteen core borings were taken in the Palm Beach turning basin. From these borings the Jacksonville District provided eleven gradation curves. Analysis showed that the samples contained approximately 6% fines by weight and the percent solids ranged from 77 to 85% with an average percent solids of 80%. Two conditions selected for simulation were as shown in Table 3.

Table 3. Palm Beach sediment characteristics			
% solids by weight	% fines	Volume fraction fines	Volume fraction sand
80	6	.0368	.5664
85	6	.0417	.6426

Other sediment properties used in model simulations are as shown in Table 4.

Table 4. Sediment properties used in STFATE simulations						
Sediment	Specific Gravity	Fall Velocity (fps)	Void Ratio	Critical Shear Stress (lbs/ft^2)	Cohesive /Non-cohesive behavior	Stripped During Descent?
Sand	2.70	0.04660	0.700	0.030	N	Y
Silt-Clay	2.65	0.00256	4.000	0.007	Y	Y

Temperature and Salinity. A field survey off of Palm Beach Harbor, Florida conducted by Continental Shelf Associates included measurements of temperature and salinity in and around the Palm Beach ODMDS in February and April, 1988. Stations 4-7 were within the limits of the ODMDS and were used in this analysis (Figures 32-35). Temperature and salinity profiles for the four stations were averaged to determine conditions to use in model simulations. Conditions shown in Table 5 were used for both project sites.

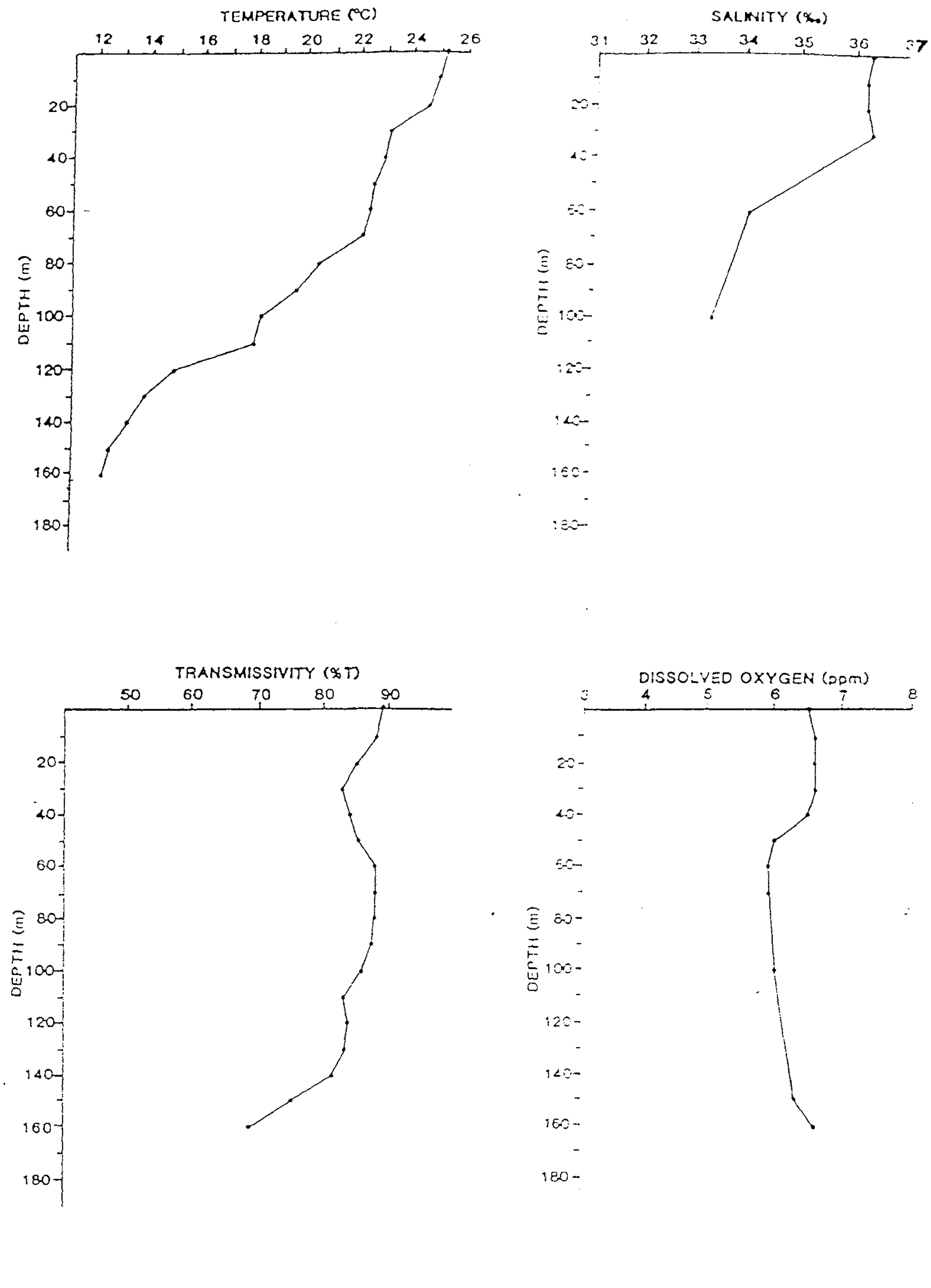


Figure 32. Hydrographic measurements of salinity and temperature at Station 4 (from Continental Shelf Associates, Inc.)

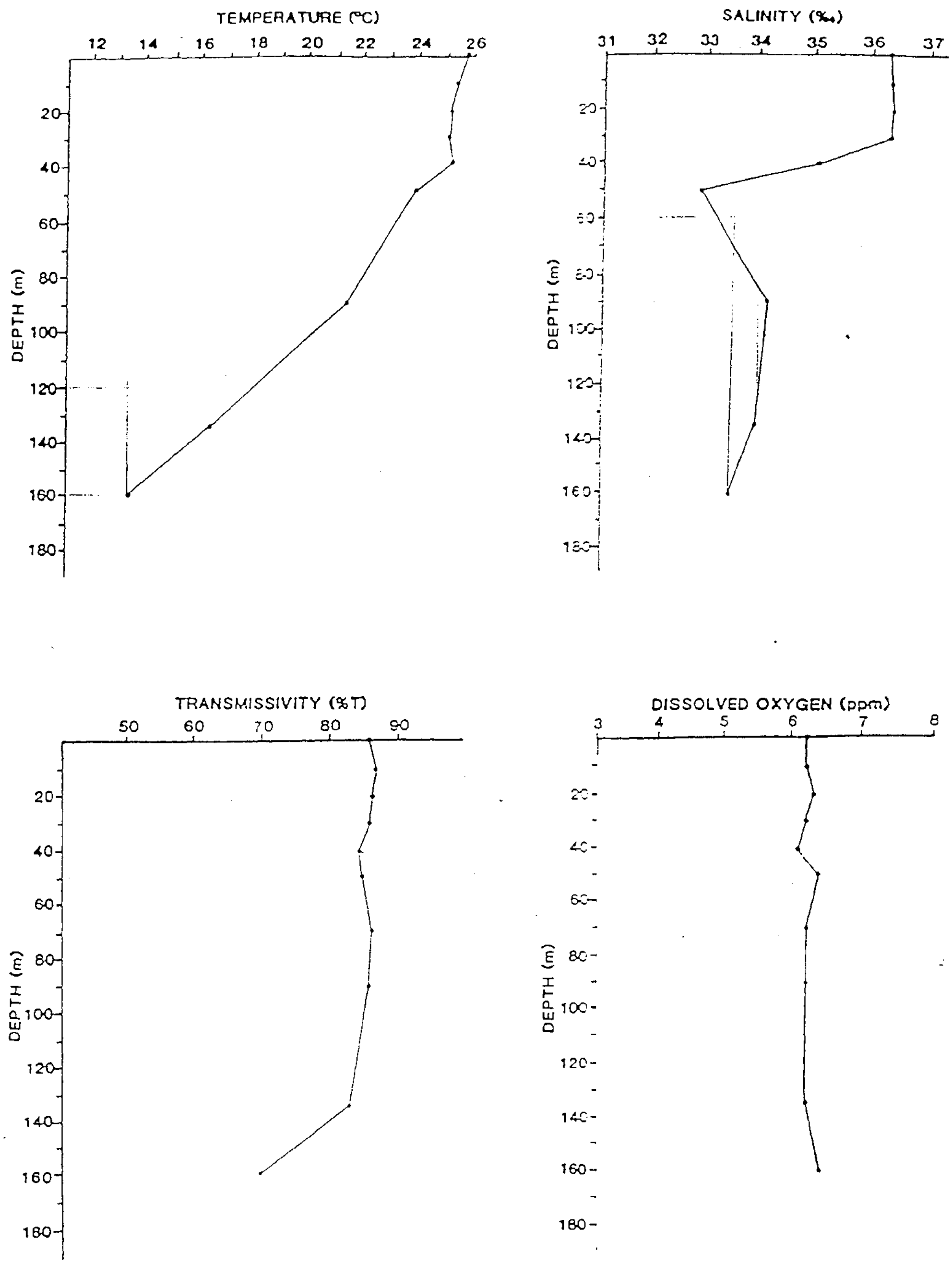


Figure 33. Hydrographic measurements of salinity and temperature at Station 5 (from Continental Shelf Associates, Inc.)

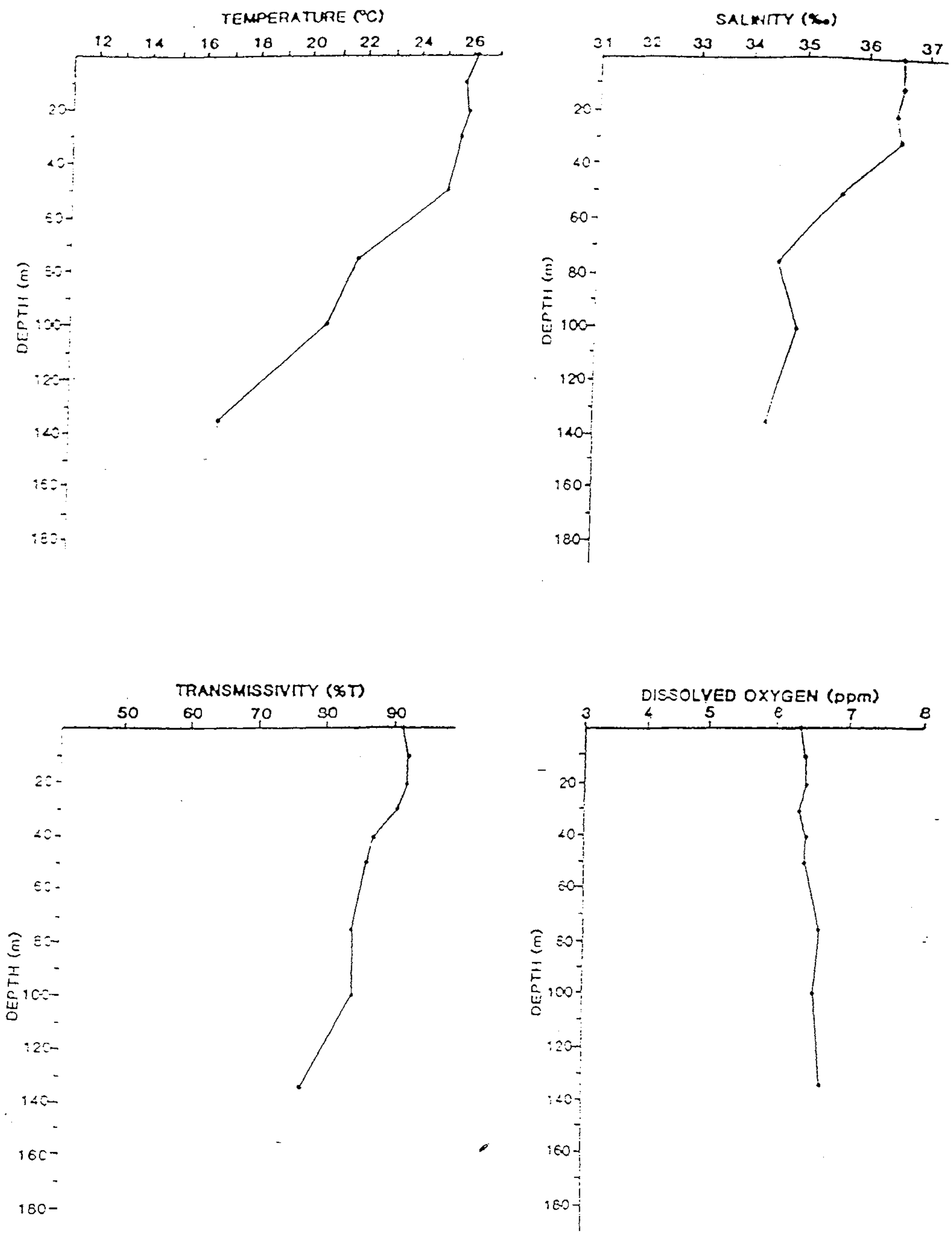


Figure 34. Hydrographic measurements of salinity and temperature at Station 6 (from Continental Shelf Associates, Inc.)

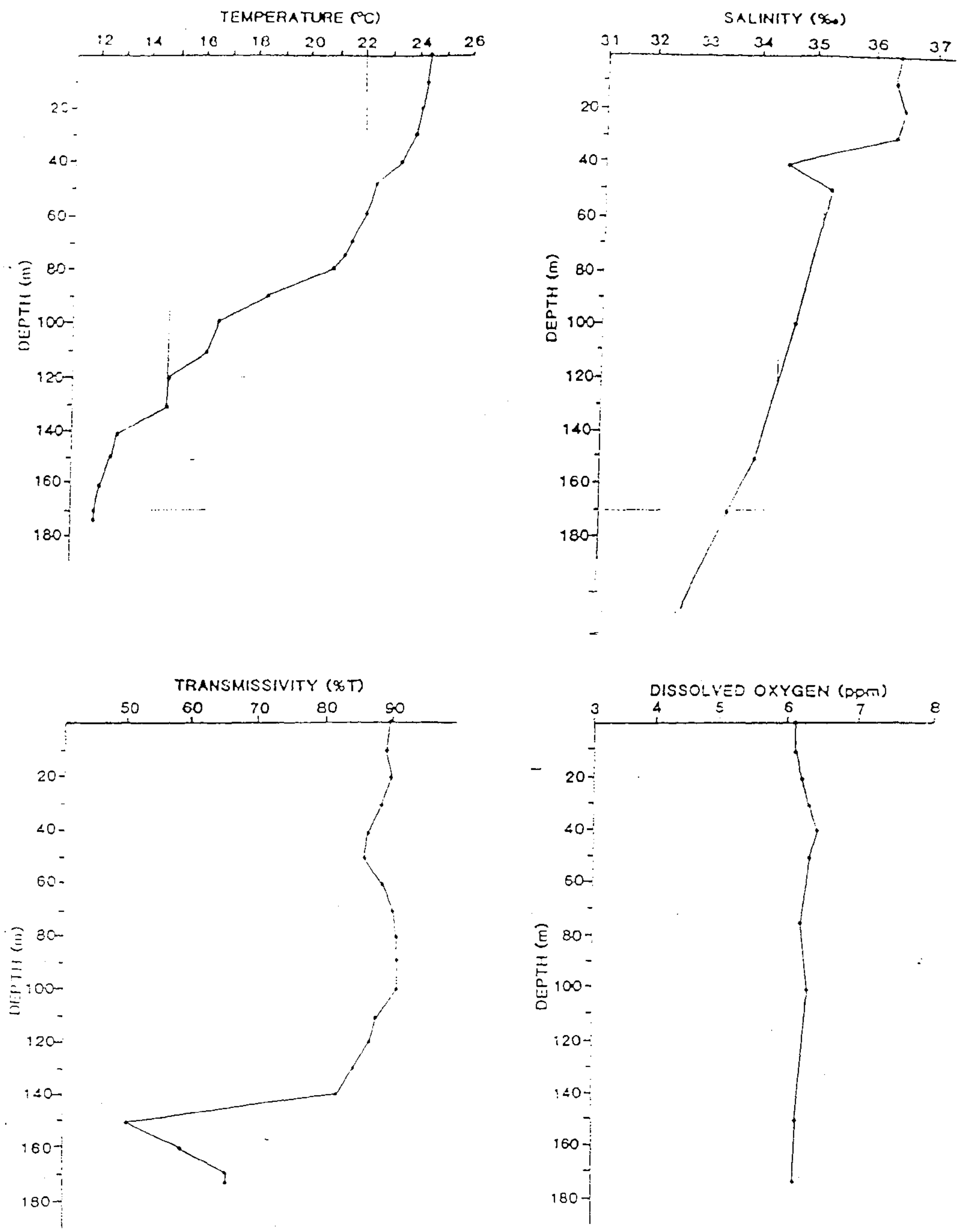


Figure 35. Hydrographic measurements of salinity and temperature at Station 7 (from Continental Shelf Associates, Inc.)

Table 5. Temperature and salinity values used in STFATE simulations		
Depth (m)	**Temperature (deg C)**	**Salinity (ppt)**
0	25.4	36.4
60	22.8	34.5
120	16.5	34.3
Max	12.0	33.5

Density Profile. Temperature and salinity profiles given above resulted in the following density profiles computed by the STFATE model:

Table 6. Density profile	
Depth (m)	Density (g/cm^3)
0	1.0243
60	1.0243
120	1.0258
Max	1.0265

Dredge Dimensions and Disposal Operations. The objective of the short-term modeling effort was to determine the fate of disposed material at the two ODMDSs and the likelihood of material transport in the direction of the shore-parallel reefs. A large capacity, split-hull dredge was specified in STFATE model simulations because it was anticipated that a large volume of disposed material would be placed in the water column at one time. The disposal vessel bin length and width were 100 and 16 m (300 and 50 ft), respectively. STFATE model simulations were for 2750 m^3 of material in a single disposal. The pre-disposal draft was 18 ft and the post-disposal draft was 4 ft. The time to empty was 5 sec.

~ 3,560 yd^3

Model Parameters and Coefficients. Model parameters (time step, grid spacing, etc.) used for STFATE simulations were selected based on required overall grid dimensions, ambient velocities, and required model duration (Table 7). Model coefficients were selected based on recommended default values and values more appropriate for the study area (Norman Scheffner and Paul Schroeder, personal communications).

~ which are [illegible] [illegible] personal communication [illegible]

Table 7. Model coefficients

Variable	Palm Beach	Port Everglades
Grid size (m)	150	150
Number cells: cross-shore alongshore	45 45	45 45
Time step (sec)	375-750	300-600
Simulation Duration (hrs)	1-5	3-6
Maximum Velocity (cm/sec)	200	200
Density (g/cm^3)	1.0247	1.0247
CSTRIP	0.003	0.003
ALPHA0	0.235	0.235
BETA	0.000	0.000
CM	1.000	1.000
CD	0.500	0.500
GAMA	0.250	0.250
CDRAG	1.000	1.000
CFRIC	0.010	0.010
CD3	0.100	0.100
CD4	1.000	1.000
ALPHAC	0.100	0.100
FRICTN	0.010	0.010
ALAMDA ($m^{(2/3)}$/sec)	0.005	0.005
AKY0 (m^2/sec	0.025	0.025

Model Simulations

All variables and model parameters discussed above were used to simulate the short-term fate of dredged material disposed of at the Palm Beach or Port Everglades ODMDSs. Final results for westerly and northwesterly directed sets of velocities for the four selected velocity magnitudes and two sediment compositions resulted in 16 simulations for each ODMDS. The length of each simulation was a function of the ambient velocity, with slower current speeds requiring longer simulation times.

Port Everglades. STFATE modeling results for Port Everglades are presented in Figures 36-43. In all Port Everglades applications sediment was disposed 6100 m (20,000 ft) from the grid origin (reef location). Note that westerly-directed and northwesterly-directed velocities are denoted in the figures with a W and N, respectively. Velocities with exceedances of 50% (V_{50}), 10% (V_{90}), 5% (V_{95}), and 1% (V_{99}) were identified in the figures with 50, 90, 95, and 99, respectively.

Results indicate silt-clay concentrations diminish to approximately 1 mg/l or less within 1500 m (5000 ft) of the disposal location (4500 m (15,000 ft) from the reef location). Higher current speeds carry sediment from the disposal location more rapidly, but silt-clay concentrations still drop below about 1 mg/l within 1500 m (5000 ft) of the disposal location. A major portion of the dredged matèrial is sand. Sand concentrations diminish to 1 mg/l or less within 2440 m (8000 ft) of the disposal location (3660 m (12,000 ft) from reef location)even under the most severe velocity conditions. The majority of the sand in the dredged material settles rapidly, but some of the sand that is stripped during descent remains in the water column for longer time/distances as indicated by these results.

Palm Beach. STFATE modeling results for Palm Beach are presented in Figures 44-51. In all Palm Beach applications sediment was disposed 5300 m (17,500 ft) from the grid origin (reef location). Two sediment compositions were simulated, 80% and 85% solids by weight, with 6% fines.

Silt-clay concentrations diminish rapidly to 1 mg/l or less within 1500 m (5000 ft) of the disposal location (12500 ft from the reef location) under all flow conditions. Higher current speeds carry sediment from the disposal location more rapidly, but the concentration of fines remains low (less than 1 mg/l within 1500 m (5000 ft) of the disposal location). A major portion of the dredged material is sand. Sand concentrations diminish to 1 mg/l or less within 2400 m (8000 ft) of the disposal location (2900 m (9500 ft) from reef location). The majority of the sand in the dredged material settles rapidly, but some remains in the water column for longer time/distances as indicated by these results.

In summary, conservative estimates of flow conditions were identified and used to model the short-term fate of dredged material. Even under the most severe flow conditions, the impact on the reefs is negligible. As a most conservative estimate one might limit disposal operations to periods when velocities are less than V_{90}.

Would be nice to see plots with [illegible]

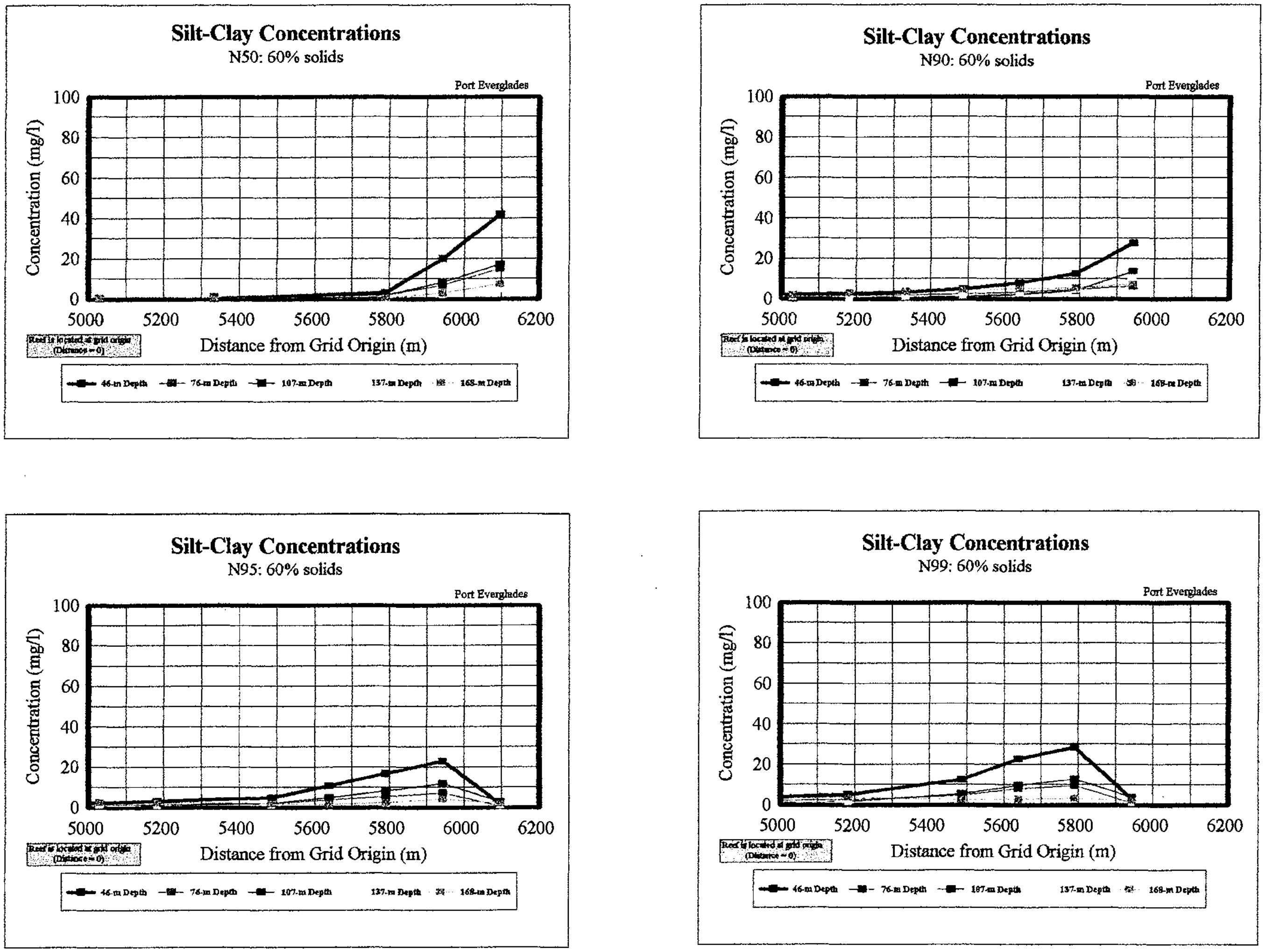


Figure 36. Port Everglades silt-clay concentrations for northwesterly-directed velocities and 60% solids

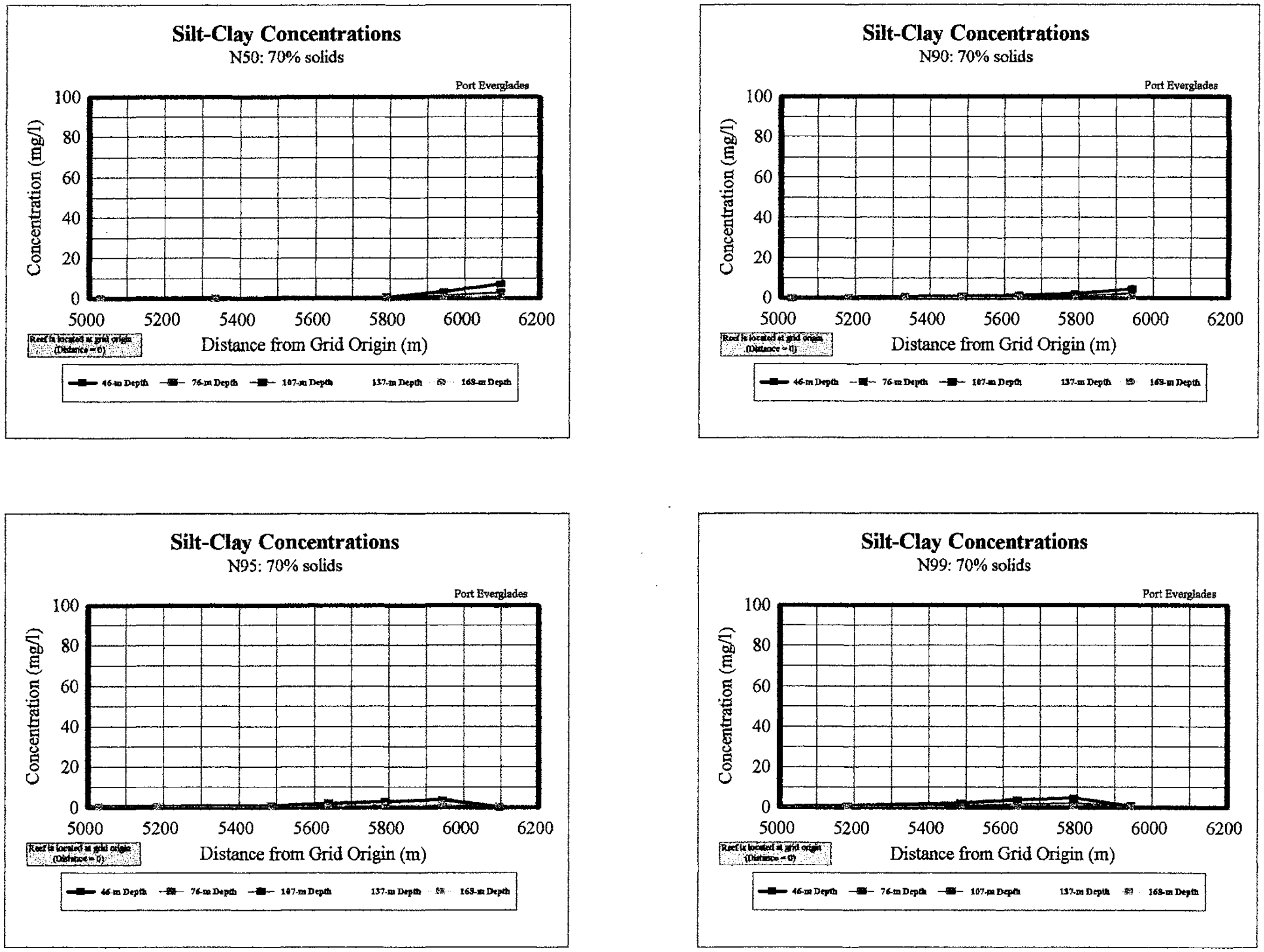


Figure 37. Port Everglades silt-clay concentrations for northwesterly-directed velocities and 70% solids

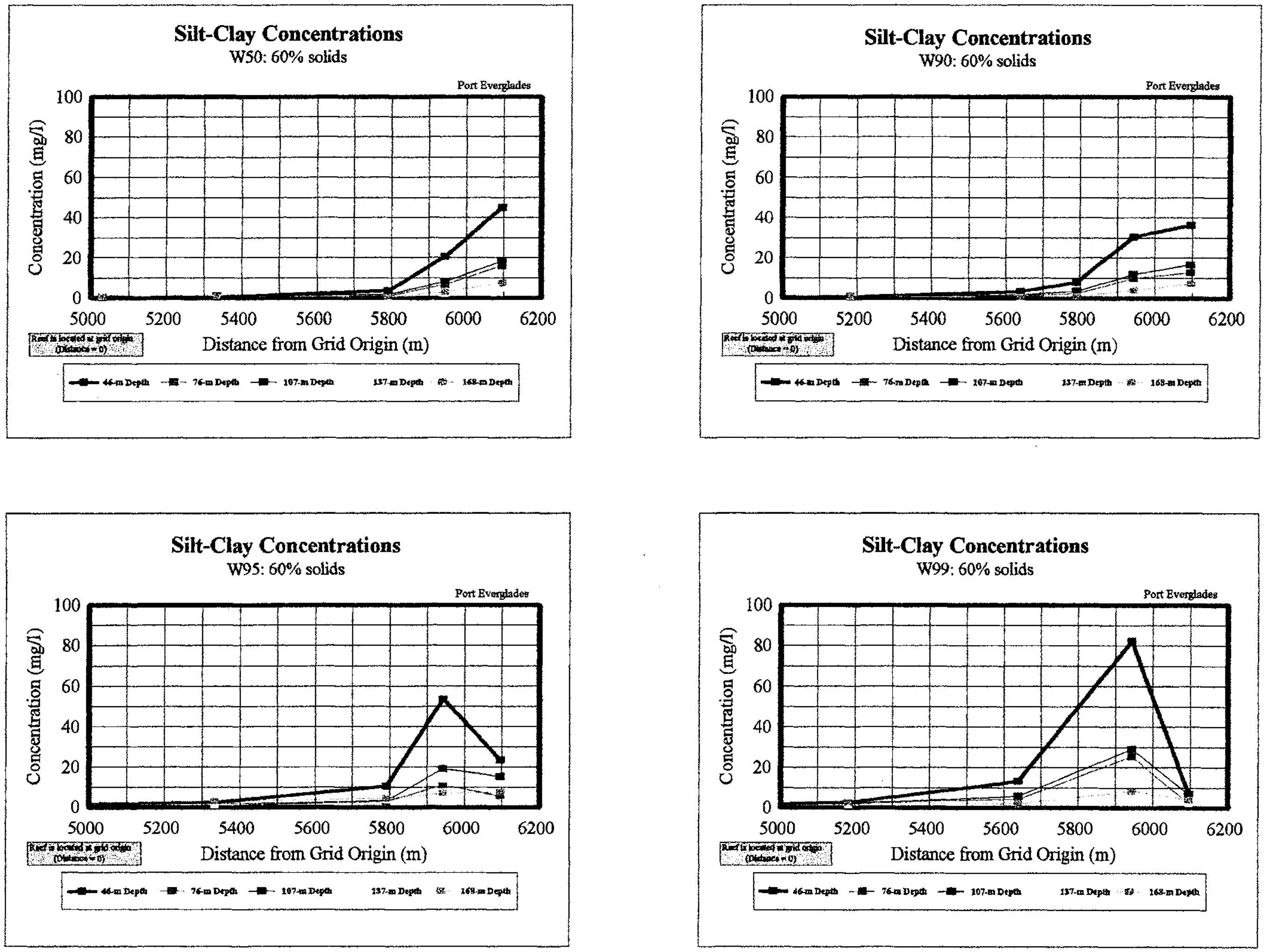


Figure 38. Port Everglades silt-clay concentrations for westerly-directed velocities and 60% solids

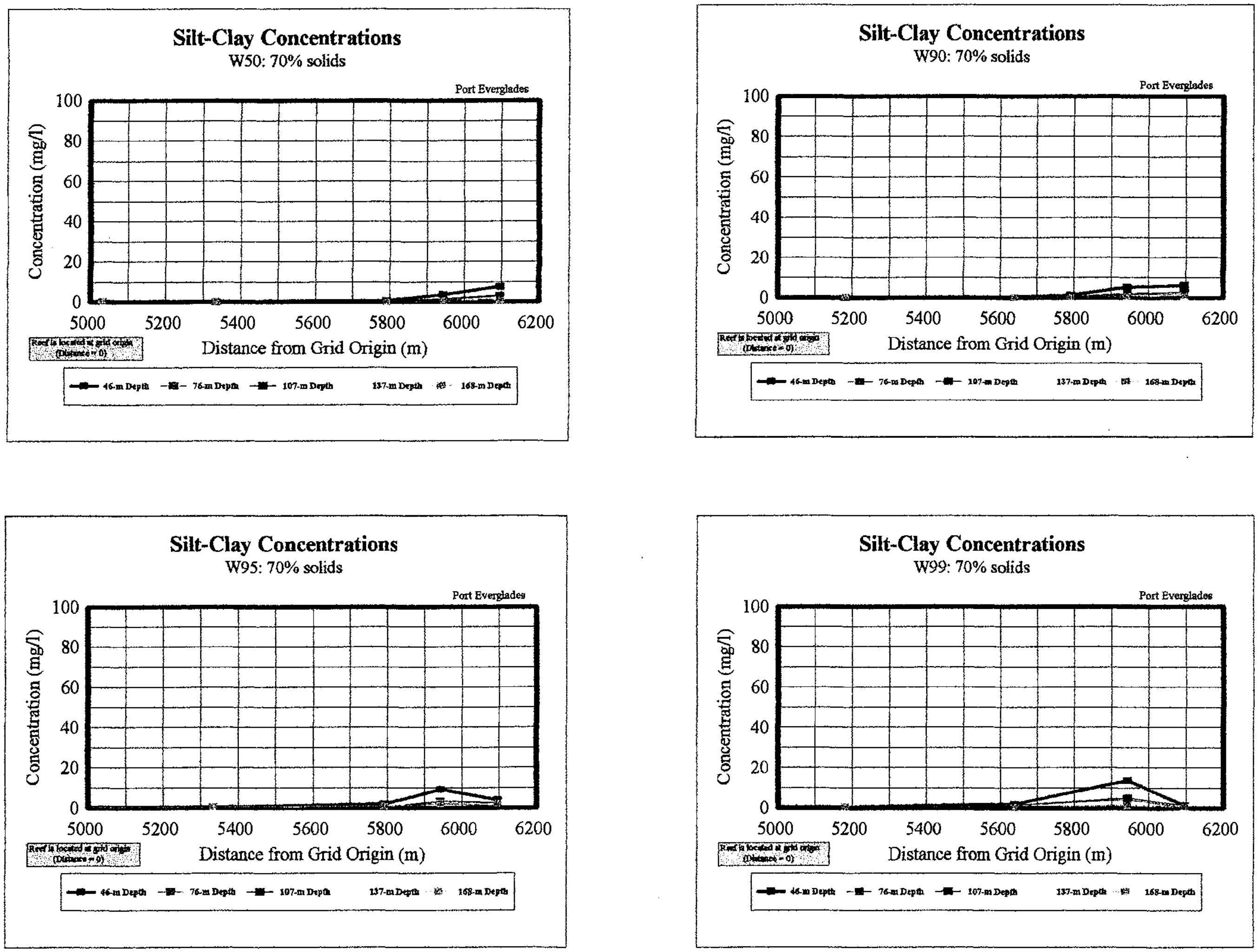


Figure 39. Port Everglades silt-clay concentrations for westerly-directed velocities and 70% solids

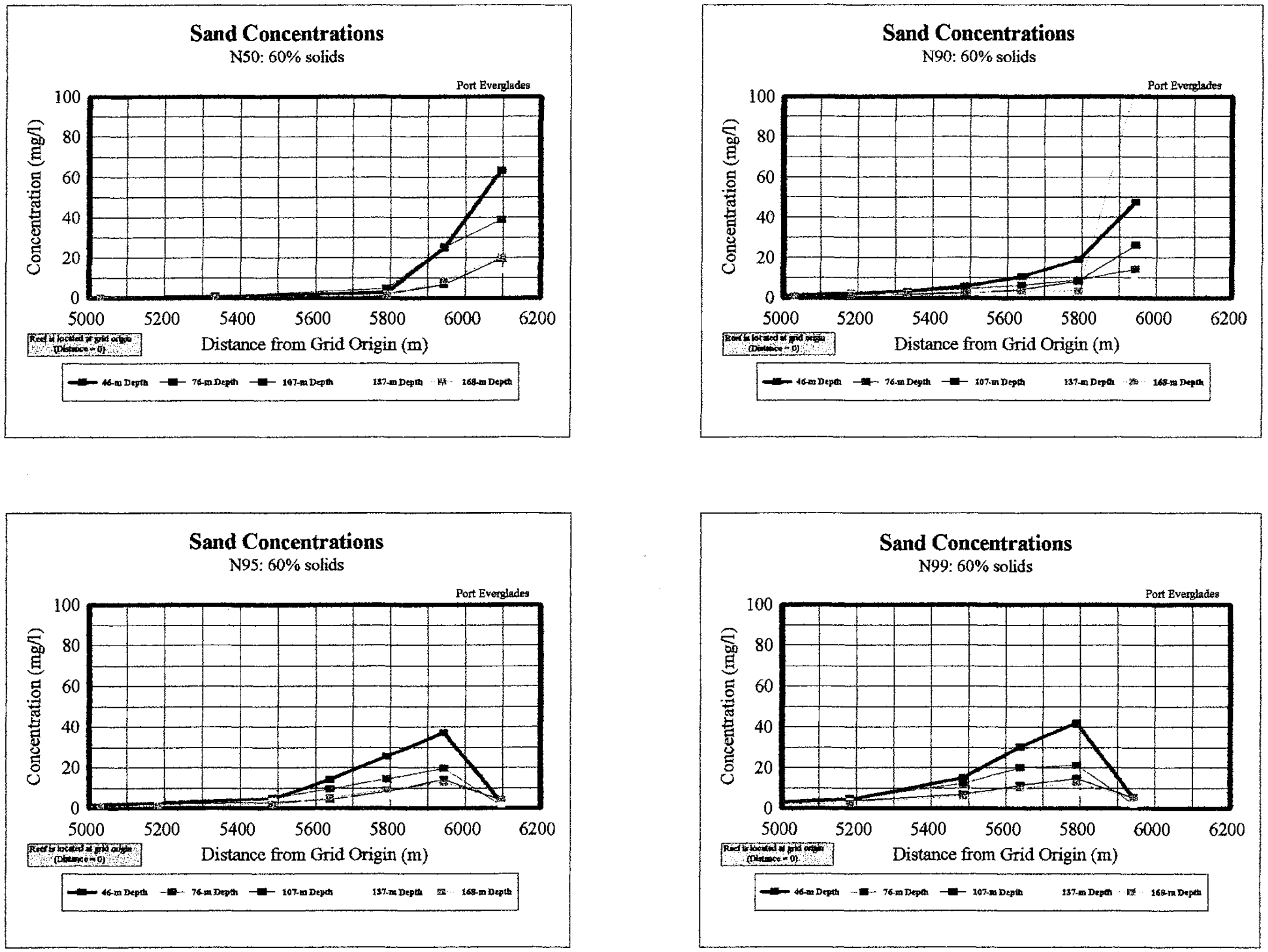


Figure 40. Port Everglades sand concentrations for northwesterly-directed velocities and 60% solids

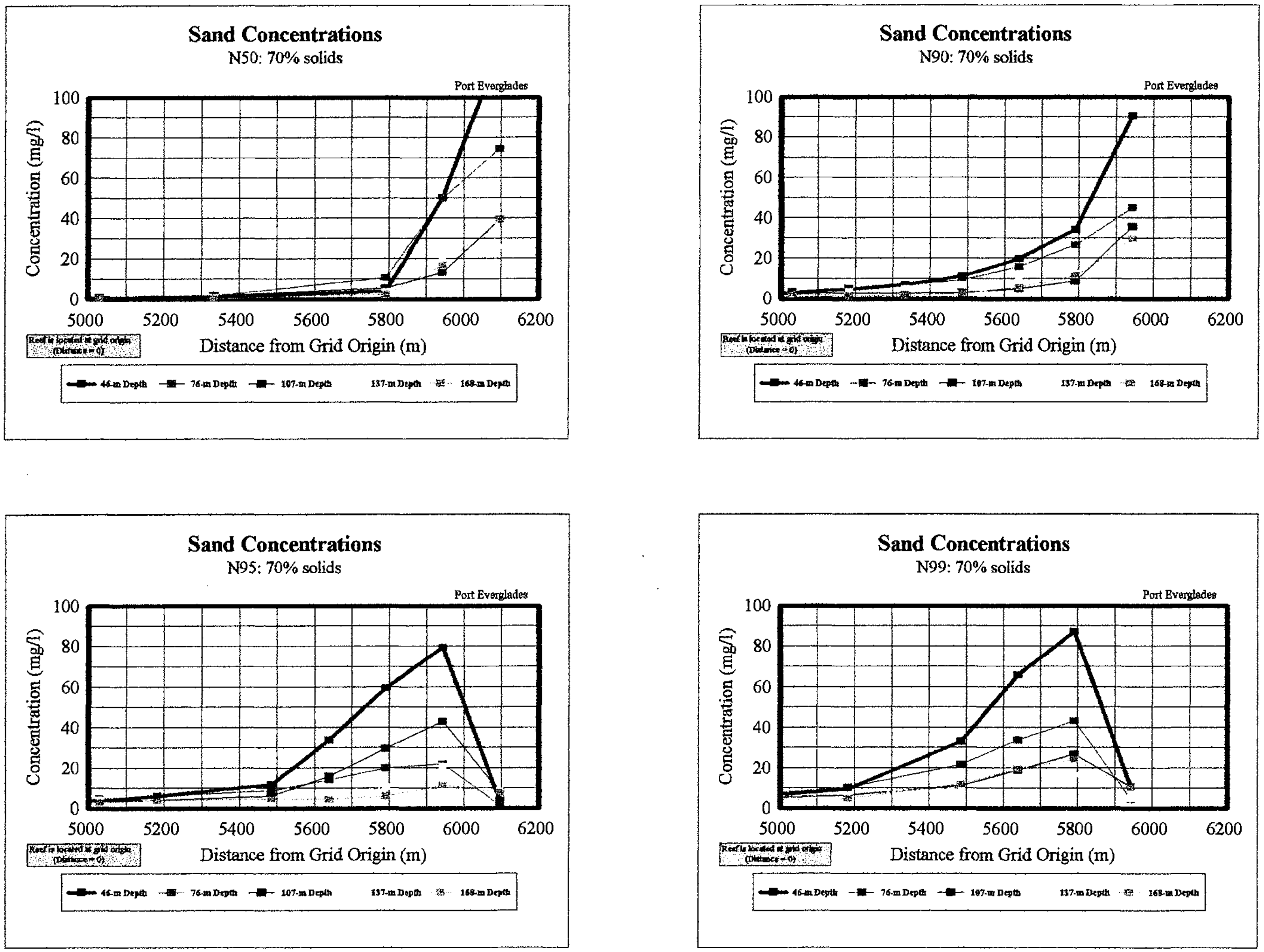


Figure 41. Port Everglades sand concentrations for northwesterly-directed velocities and 70% solids

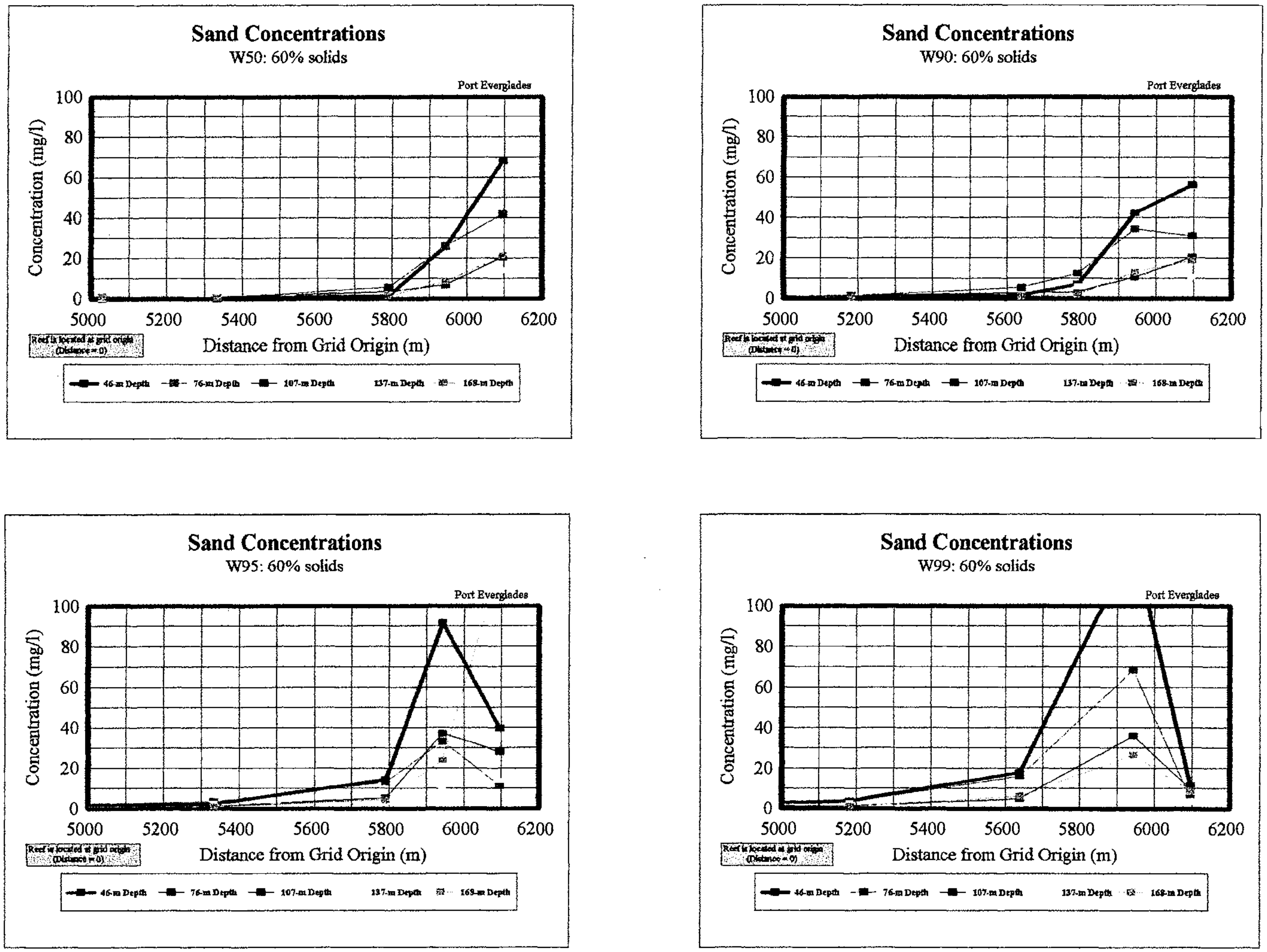


Figure 42. Port Everglades sand concentrations for westerly-directed velocities and 60% solids

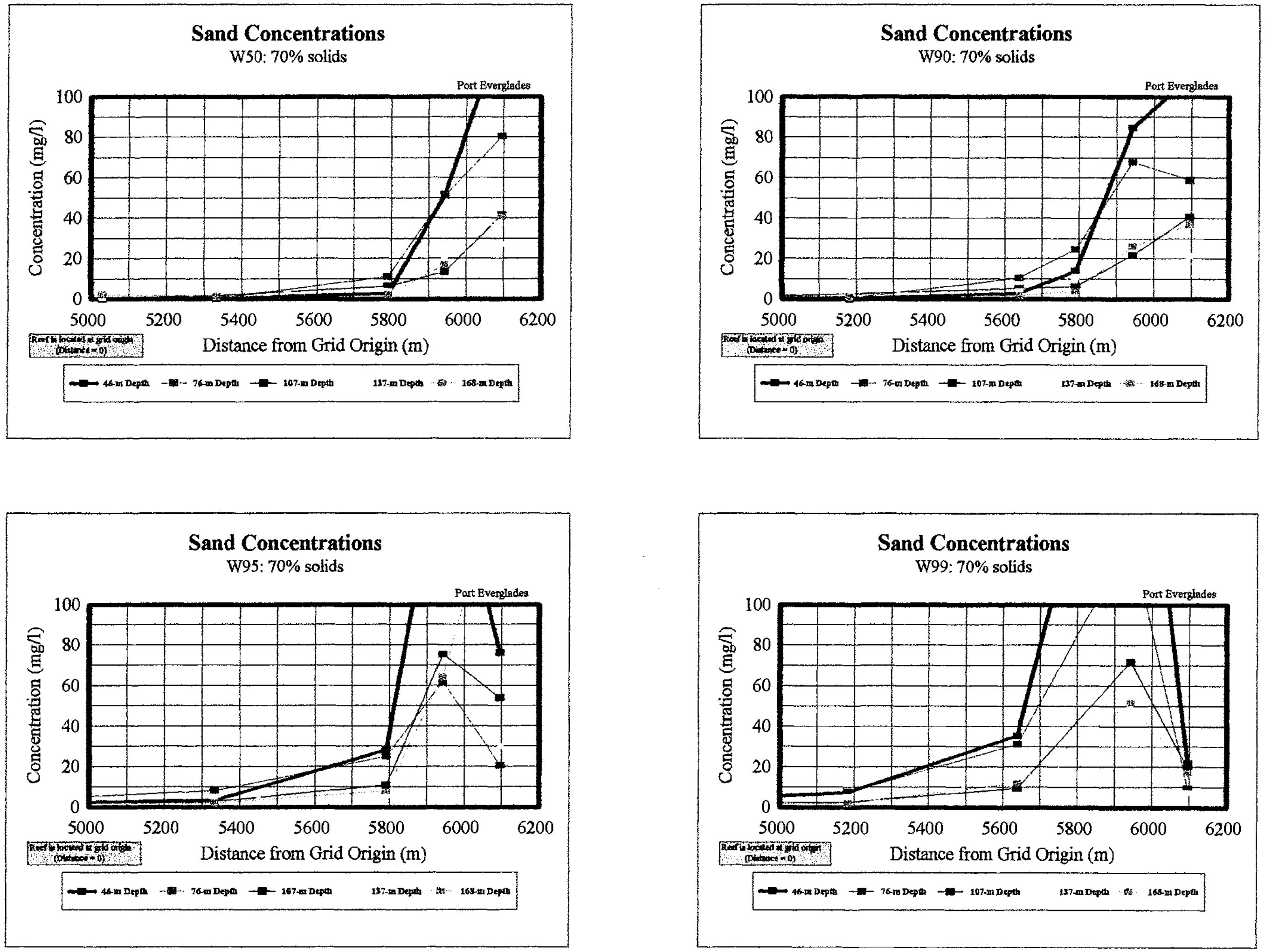


Figure 43. Port Everglades sand concentrations for westerly-directed velocities and 70% solids

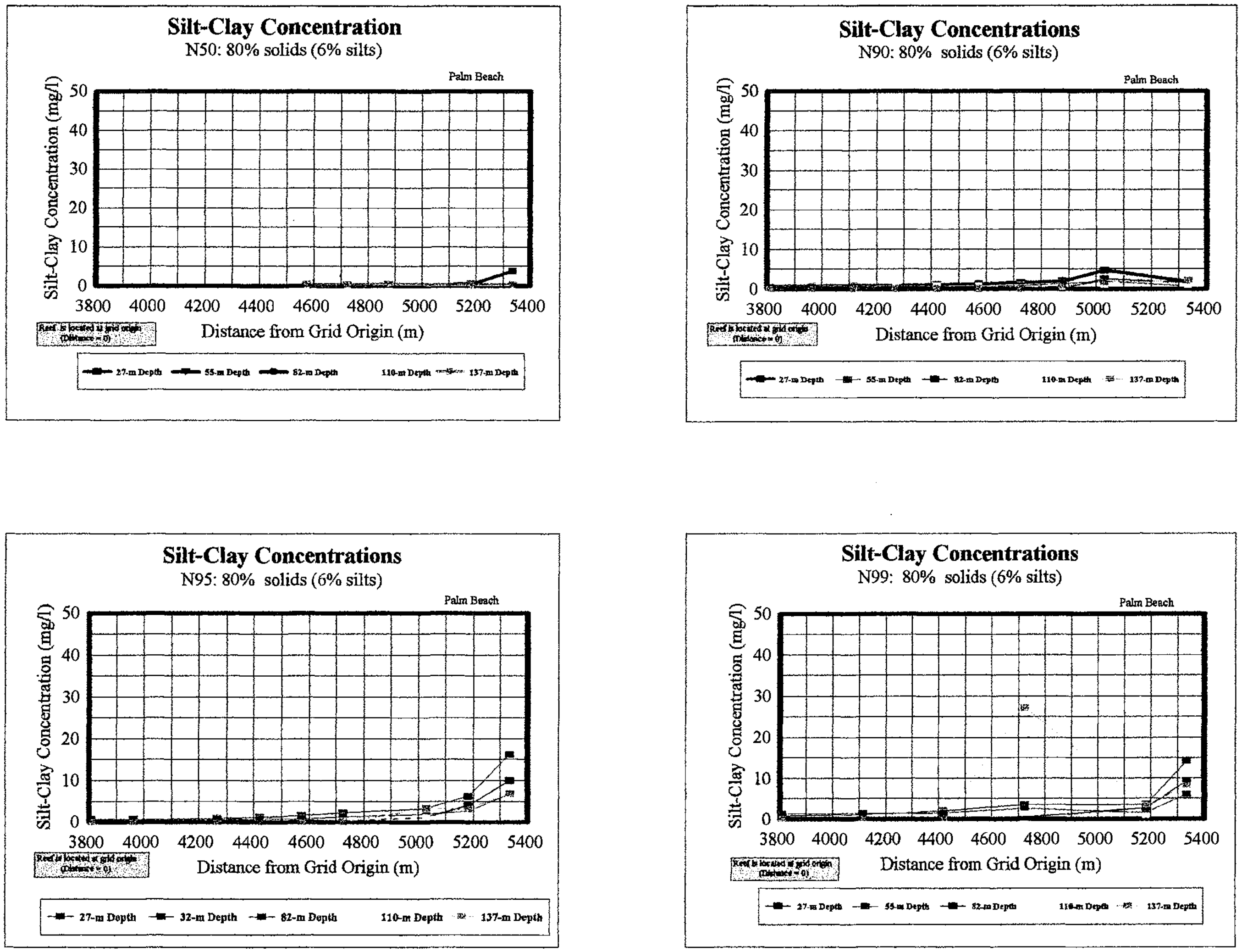


Figure 44. Palm Beach silt-clay concentrations for northwesterly-directed velocities and 80% solids

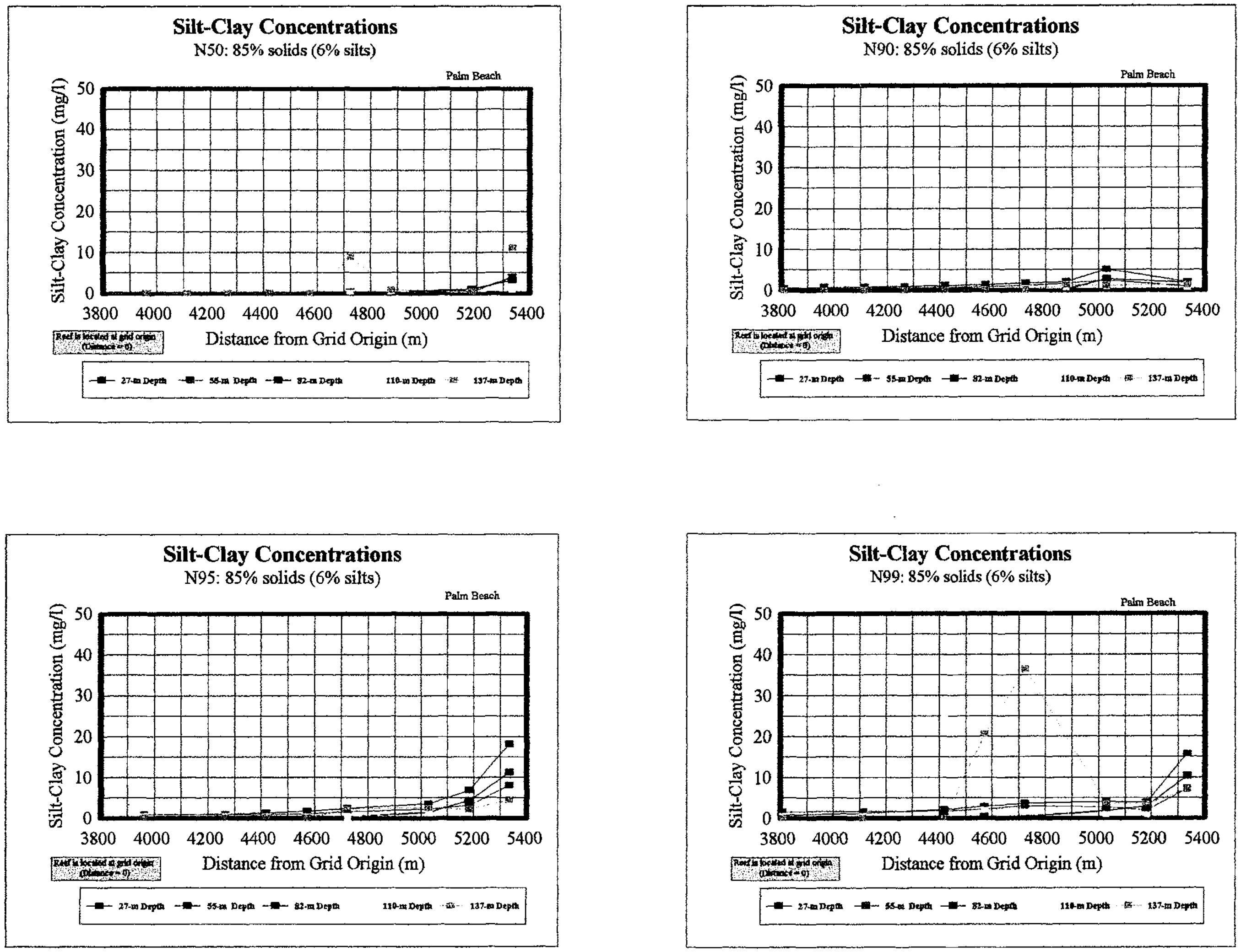


Figure 45. Palm Beach silt-clay concentrations for northwesterly-directed velocities and 85% solids

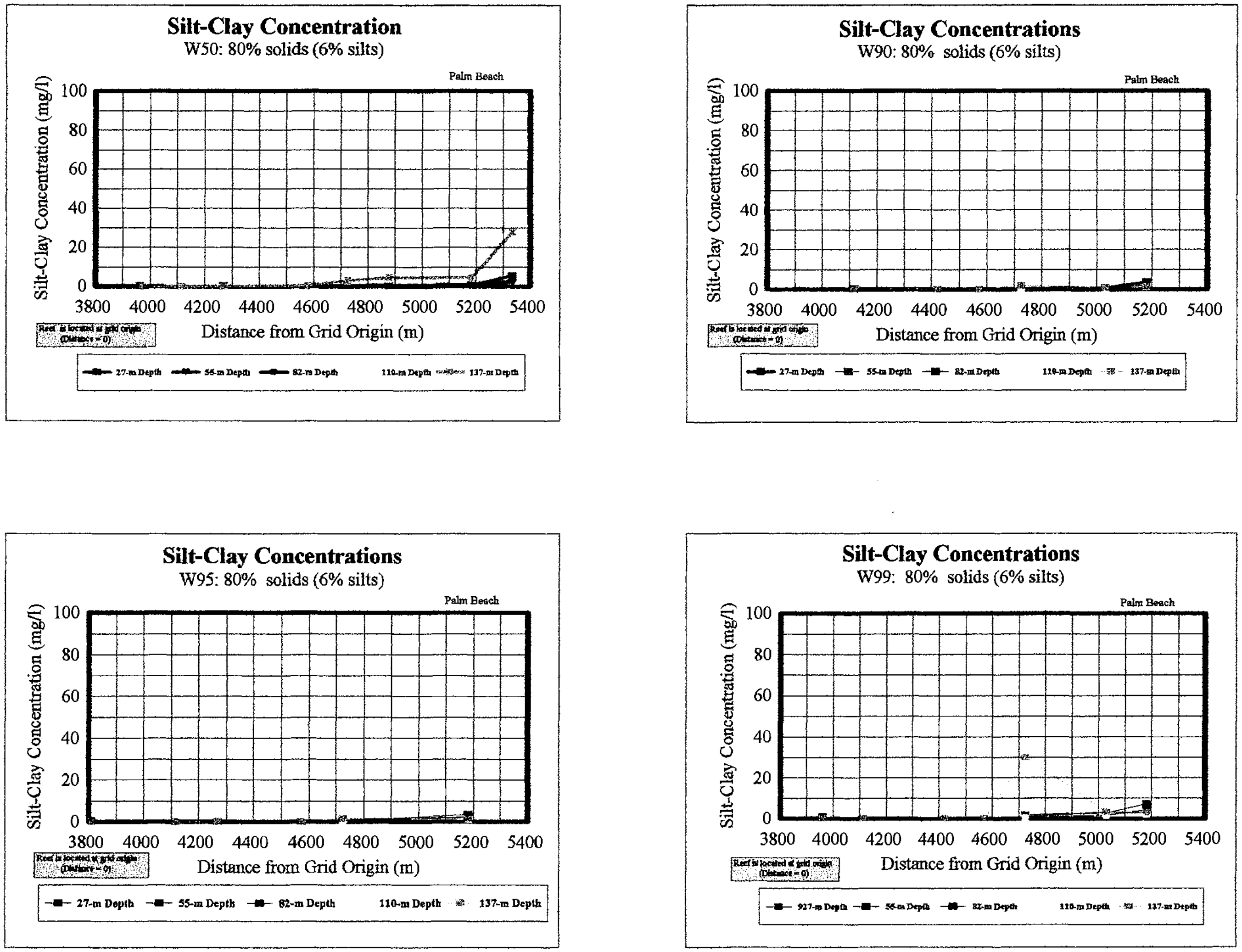


Figure 46. Palm Beach silt-clay concentrations for westerly-directed velocities and 80% solids

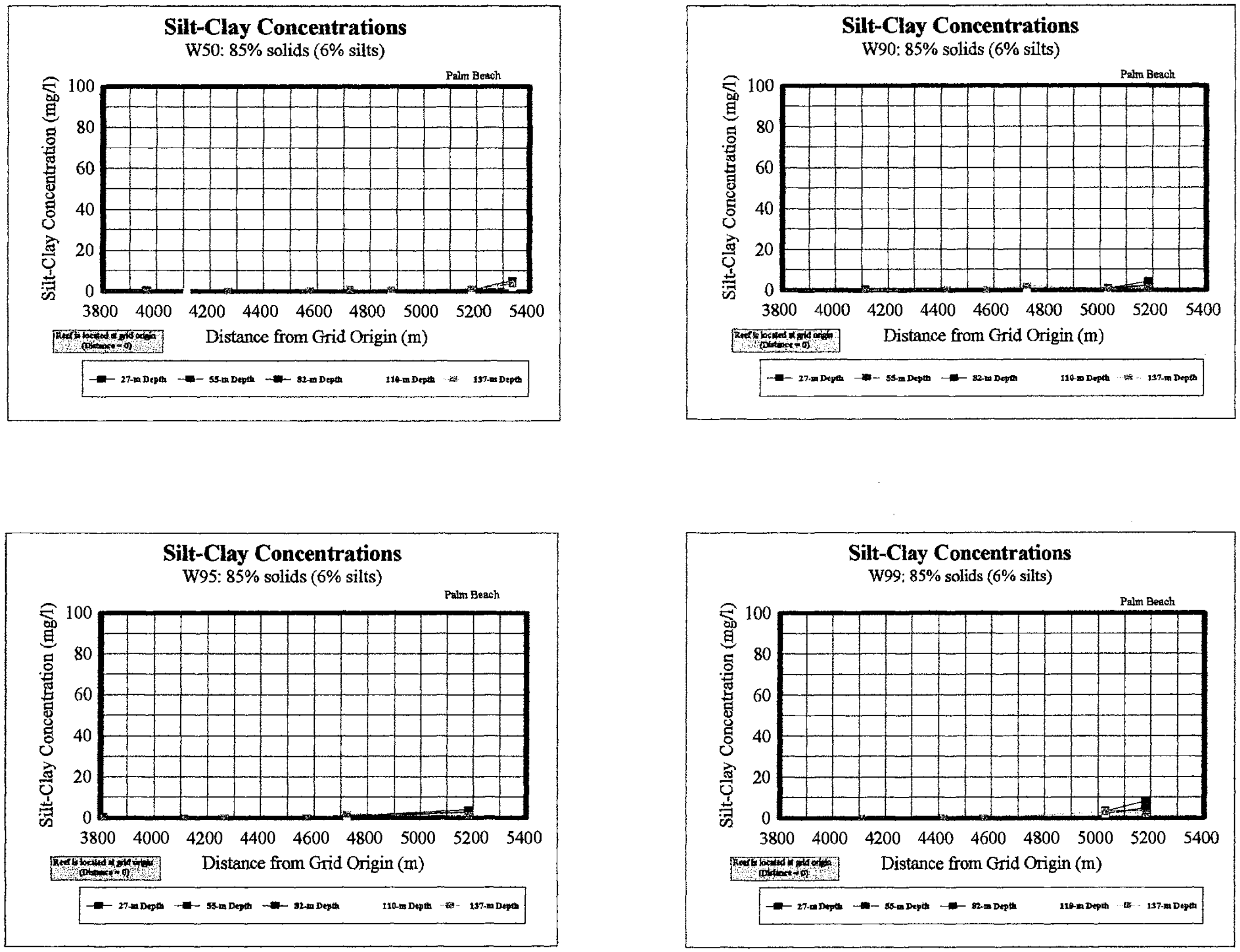


Figure 47. Palm Beach silt-clay concentrations for westerly-directed velocities and 85% solids

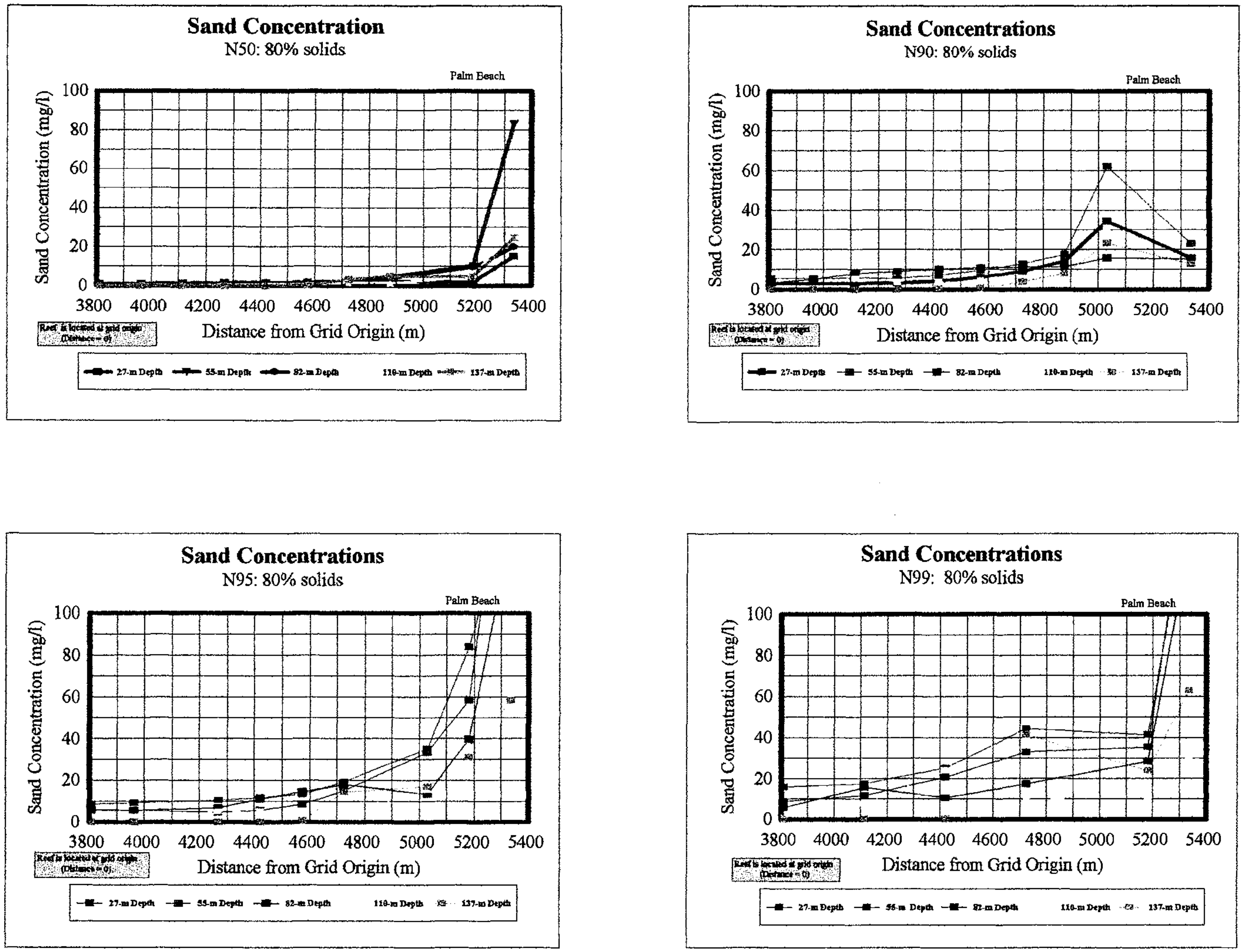


Figure 48. Palm Beach sand concentrations for northwesterly-directed velocities and 80% solids

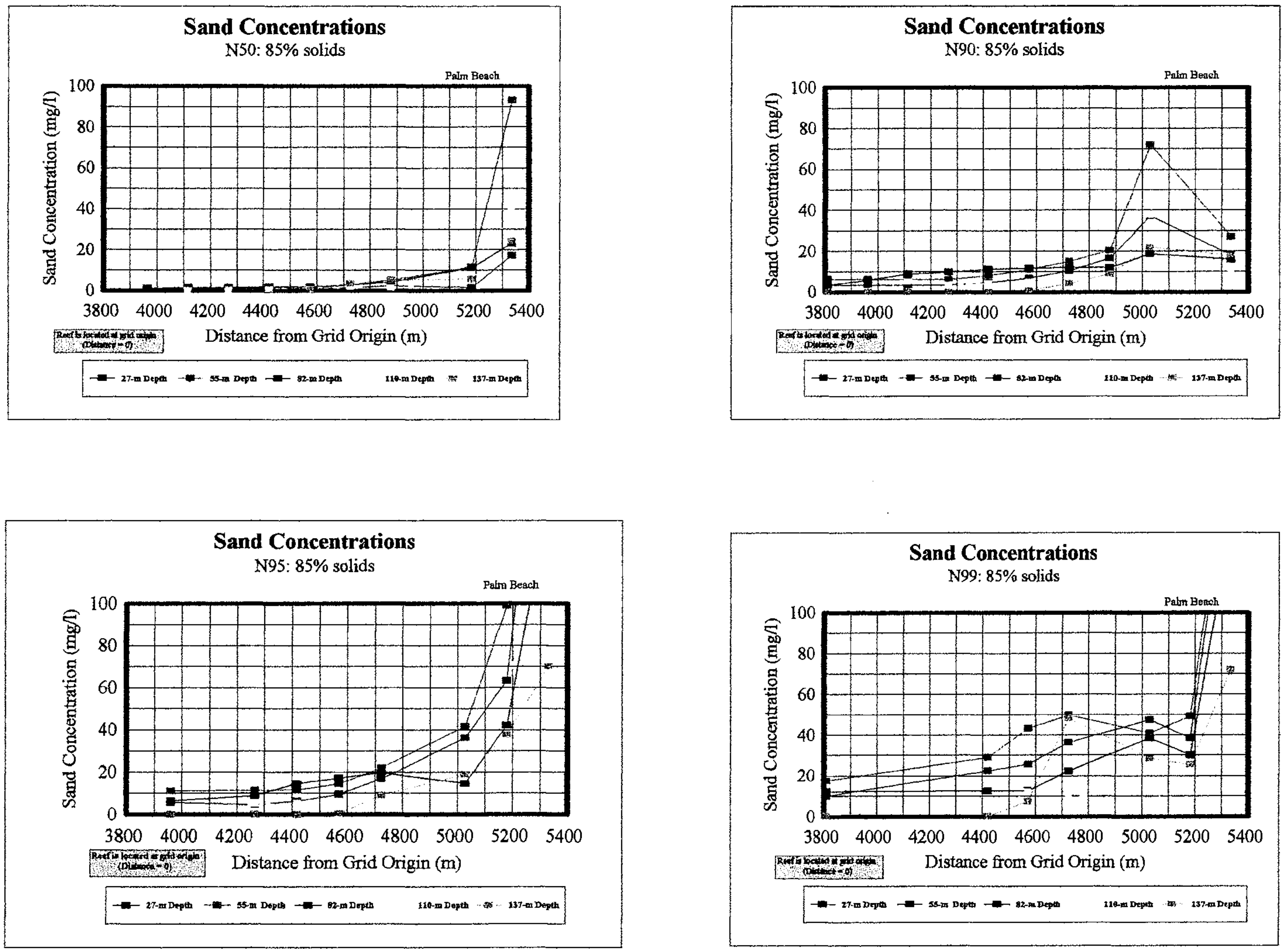


Figure 49. Palm Beach sand concentrations for northwesterly-directed velocities and 85% solids

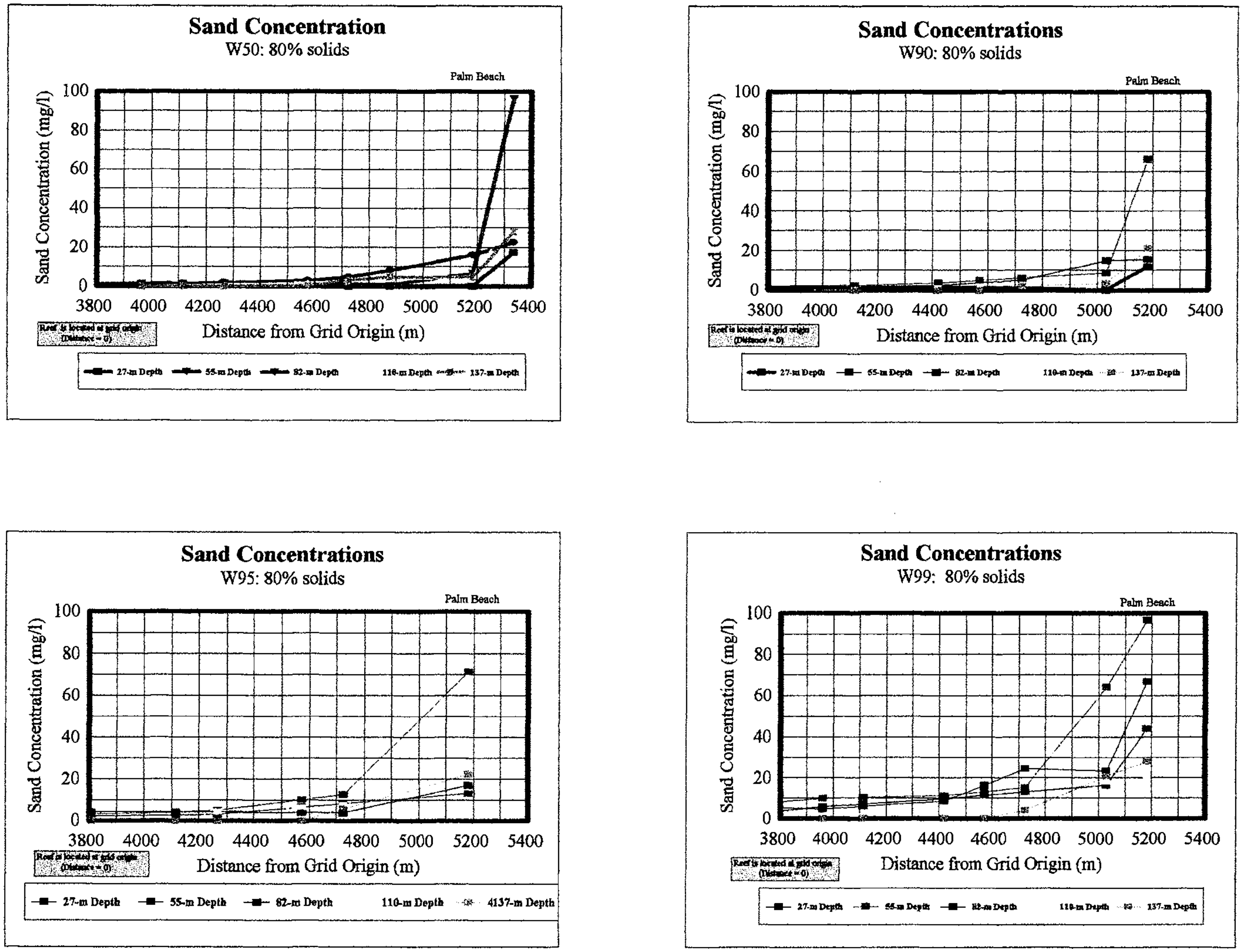


Figure 50. Palm Beach sand concentrations for westerly-directed velocities and 80% solids

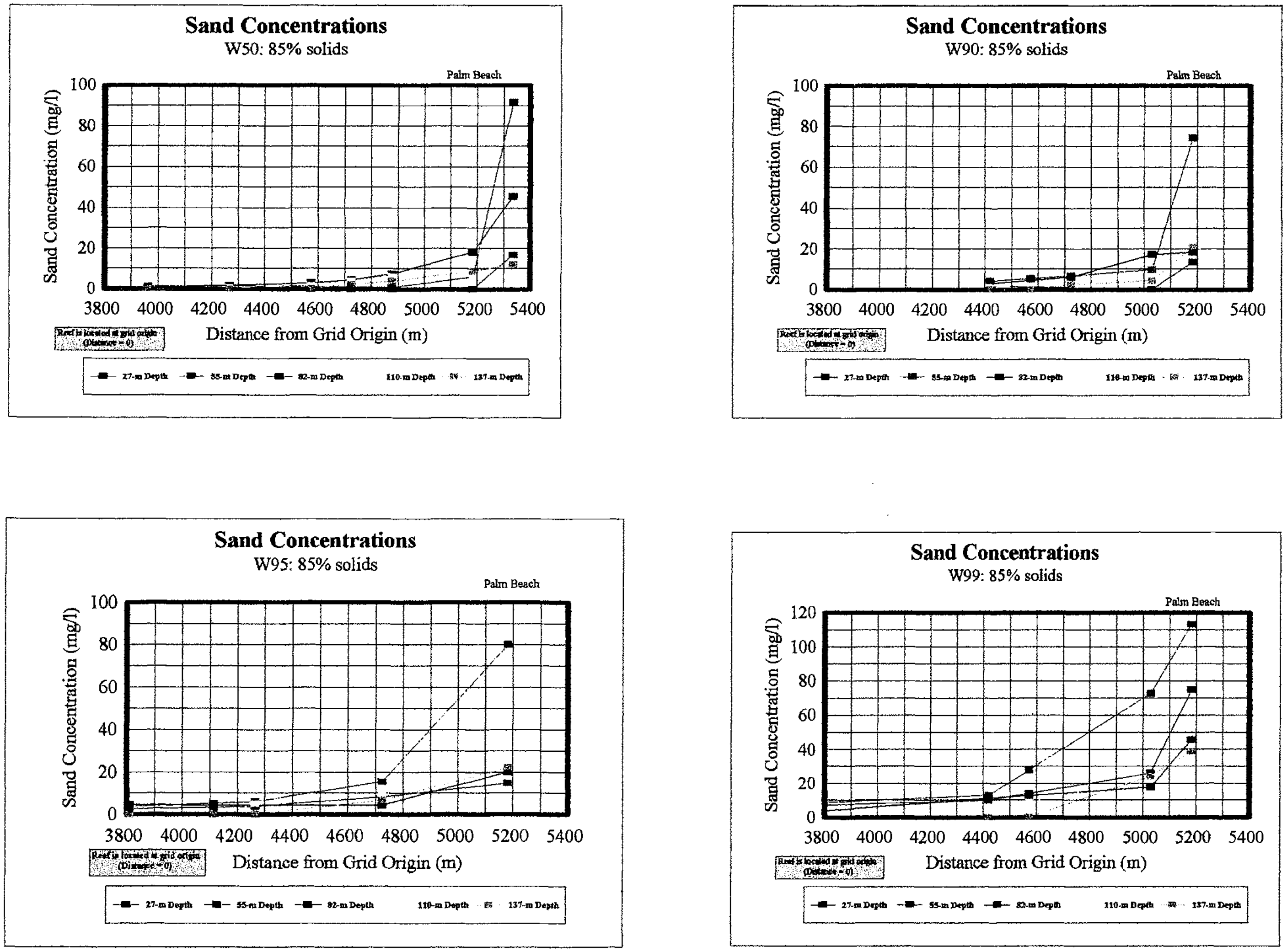


Figure 51. Palm Beach sand concentrations for westerly-directed velocities and 85% solids

3 Long-term Fate Modeling

LTFATE is a site-analysis program that uses coupled hydrodynamic, sediment transport, and bathymetry change sub-models to compute site stability over time as a function of local waves, currents, bathymetry, and sediment characteristics (Scheffner et al., 1995). LTFATE was developed to simulate the long-term fate and stability of dredged material placed in open water with an initial intended use for classifying existing or proposed disposal sites as dispersive or nondispersive. The model estimates the stability of a site for time periods ranging from days (for storm events) to years (for ambient conditions). If the site is demonstrated to be dispersive, model output will provide an estimate of the temporal and spatial fate of the eroded cohesionless material. Sediment movement is estimated as a function of not only the local bathymetry and sediment characteristics, but also the time varying wave and current conditions. LTFATE uses an information database to provide design wave and current time series boundary conditions that realistically represent conditions at the candidate disposal site. The user can also specify conditions for specific storms , if desired.

The wave simulation methodology and the water surface elevation and current databases referenced in this report were developed through the Dredging Research Program (DRP) (Hales, 1995) at WES. The database of tidal elevations and currents for the study area was from DRP tidal constituent database. Wave data necessary for these applications is derived from the Wave Information Study (WIS) hindcast for the Atlantic Coast (Brooks and Brandon, 1995). These sources are used to generate wave, water surface elevation and current condition data for use as input to LTFATE for evaluating mound stability.

cohesive too?

LTFATE has the capability of simulating both non-cohesive and cohesive sediment transport. In addition, consolidation of cohesive sediments are accounted for to more accurately predict physical processes which occur at the site. Many sediment transport equations require near bottom velocities, but the methods incorporated in LTFATE were developed and work well using mean velocity of flow reflective of conditions outside the wave and current boundary layers. Unlike near-bottom velocities, these velocities are not significantly effected by bottom roughness. This is an advantage in regions where bottom roughness is unknown or continually changing. A screening level erosion model was used initially to determine if LTFATE level modeling was necessary. The screening level erosion uses the same basic equations as LTFATE, but the solution is at a point rather than over a grid mesh. If the sediment fluxes determined from the point model prove to be sufficiently large, than the LTFATE model would be used. Following are sections describing the effects of waves on the sediment/water interface and non-cohesive sediment transport. What about cohesive sediments?

Effect of Waves at Sediment/Water Interface. Most non-cohesive sediment transport equations are developed for a current only environment. Areas of interest where LTFATE or the screening level erosion model is applied normally include bottom stresses due to both currents and waves. Therefore the effects of waves must be included in estimating sediment transport. A modification of the transport equations proposed by Bijker (1967) is incorporated into LTFATE and the screening level erosion model to reflect an increase in the transport rate if the ambient currents are accompanied by surface waves. The modification, in the form of an effective increase in the near-bottom velocity outside the wave and current boundary layers used to compute sediment transport, is based on equations reported by Swart (1976). This increased velocity can be thought of as the current velocity that would produce a bottom stress equivalent to the stress due to the combined effects of ambient currents and waves. The effective increase in velocity for currents accompanied by waves V_{wc}, is written as a function of the current velocity V_c in the absence of waves as follows:

$$V_{wc} = V_c \left[1.0 + \frac{1}{2} \left(\xi \frac{\hat{u}_0}{V} \right)^2 \right]^{1/2} \tag{1}$$

where:

$$\xi = \hat{C} \left(\frac{f_w}{2g} \right)^{1/2} \tag{2}$$

$$\hat{C} = 18 \log\left(\frac{12d}{r} \right) \tag{3}$$

$$f_w = \exp\left[-5.977 + 5.213 \left(\frac{r}{a_0} \right)^{0.194} \right] \tag{4}$$

(if $f_w > 0.3$, $f_w = 0.3$)

$$\hat{u}_0 = \frac{Hgk}{2\sigma} \frac{1}{\cosh(kd)} = \frac{HgkT}{4\pi} \frac{1}{\cosh(kd)} \tag{5}$$

$$a_0 = \frac{Hgk}{2\sigma^2} \frac{1}{\cosh(kd)} = \frac{H}{2} \frac{1}{\sinh(kd)} \tag{6}$$

where $\hat{u}_0$ is the amplitude of the orbital velocity at the bed (Van De Graff and Van Overeem 1979), computed according to linear wave theory (Ippen 1966, p 28) and a_0 is defined as the orbital excursion (amplitude) at the bed (Swart 1976), computed from linear wave theory (Ippen 1966, p 29). In the above, the parameter f_w is defined as the bottom friction coefficient (Jonsson 1966). The parameter r is the hydraulic bed roughness and taken to be 0.197 ft (0.06 m), (Van De Graff and Van Overeem 1979). The terms H, k, σ, and T represent wave height (ft), wave number (ft^{-1}), angular frequency (sec^{-1}) and period (sec) respectively. The terms d and g represent water depth (ft) and acceleration of gravity (ft sec^{-2}) respectively.

Non-Cohesive Sediment Transport Model Component. The equations reported by Ackers and White (1973) were selected as the basis for the non-cohesive sediment transport modeling component. These relationships predict sediment transport as a primary function of sediment grain size, depth, and depth averaged velocity (here the depth averaged velocity is assumed to be V_{wc}). The equations are applicable to uniformly graded noncohesive sediment with a grain diameter in the range of 0.04 mm to 4.0 mm (White 1972).

The Ackers-White transport equations relate sediment transport to three dimensionless quantities. The first, a nondimensional grain size D_{gr}, is defined as a function of the ratio of the immersed particle weight to the viscous forces acting on the grain. The value is defined as:

$$D_{gr} = D \left[\frac{g(s-1)}{\nu^2}\right]^{1/3} \qquad \textbf{(7)}$$

where:

D = sediment diameter (i.e., D_{50}), ft
g = acceleration of gravity, ft/sec^2
s = sediment specific gravity
ν = fluid kinematic viscosity, ft^2/sec

The value of D_{gr} is used to categorize the sediment as coarse or transitional, with the following coefficients defined for the two sediment classifications:

a. Coarse sediments: $D_{gr} > 60$.
n = 0.0
m = 1.50
A = 0.17
C = 0.025

b. Transition sediments: $1.0 < D_{gr} \leq 60.0$

$$n = 1.00 - 0.56 \log(D_{gr}) \qquad \textbf{(8)}$$

$$m = \frac{9.66}{D_{gr}} + 1.34 \tag{9}$$

$$A = \frac{0.23}{\sqrt{D_{gr}}} + 0.14 \tag{10}$$

$$\log C = 2.86 \log D_{gr} - (\log D_{gr})^2 - 3.53 \tag{11}$$

The second nondimensional parameter, F_{gr}, represents particle mobility defined as the ratio of shear forces to the immersed sediment weight. The general form of the relationship is

$$F_{gr} = \frac{v_*^n}{\sqrt{gD(s-1)}}\left[\frac{V_{wc}}{\sqrt{32}\log(10\frac{d}{D})}\right]^{1-n} \tag{12}$$

where V is the depth averaged velocity determined from the above described modification to the current velocity to account for the effect of waves (ft/sec), d is the mean depth of flow (ft), and v_* is the shear velocity (ft/sec) which can be defined from Chow (1959, p 204) as:

$$v_* = \frac{\sqrt{g}V_{wc}}{C_z} \tag{13}$$

where C_z is the Chezy coefficient.

The third nondimensional parameter, G_{gr}, defines a sediment transport rate as a ratio of shear forces to the immersed weight multiplied by the efficiency of transport. The efficiency term is based on work needed to move the material per unit time and the total fluid power. The transport rate is written as

$$G_{gr} = \frac{Xd}{sD}\left(\frac{v_*}{V_{wc}}\right)^n \tag{14}$$

where X is a nondimensional sediment transport function in the form of mass flux per unit mass flow rate. The sediment transport rate G_{gr} can be related to the mobility function F_{gr} through the following relationship:

$$G_{gr} = C\left(\frac{F_{gr}}{A} - 1.0\right)^m \tag{15}$$

Equations 14 and 15 are used to solve for X as:

$$X = C\left(\frac{F_{gr}}{A} - 1.0\right)^m \frac{sD}{d}\left(\frac{V_{wc}}{v_*}\right)^n \tag{16}$$

A dimensional sediment load transport rate Q_b, defined in cubic feet of sediment (solids) per second per unit width can be written as:

$$Q_b = XVd \tag{17}$$

Therefore, the total sediment mixture transport, i.e., solids plus voids, is written as:

$$Q_b = \frac{Q_b}{(1-n)} \tag{18}$$

where n is the porosity (ratio of void volume to total volume).

A dimensional sediment transport magnitude in volume (ft^3) of sediment mixture per second per unit width (ft) is finally written in the following form:

$$Q = C\left[\frac{F_{gr}}{A} - 1.0\right]^m \frac{sD}{(1-e)}\left(\frac{V_{wc}}{v_*}\right)^n V_c \tag{19}$$

Equation 19 represents sediment transport as a primary function of depth, sediment grain size, and depth-averaged velocity.

LTFATE was applied to a site just south of Mobile Bay (Alabama) and successfully predicted the movement of the Sand Island disposal mound over a 30-month period from March 1987 through August 1989 (Scheffner 1996). Mound movement was tracked using six bathymetric surveys (Hands and Allison 1991). LTFATE predictions compared favorably to these bathymetry data, offering partial verification of the methods incorporated in the model.

Screening Level Erosion Model

As a preliminary to performing LTFATE simulations, a screening level erosion model is run to address the potential for sediment transport from the dredged material mound. If the screening level erosion model indicates little to no potential for sediment movement, then LTFATE model simulations would be purely academic. In the screening level erosion model the total load of sediment is assumed to move as bed load. The method followed for this application is based on Ackers and White (1973). This work is well accepted as one of the best methods for estimating non-cohesive sediment transport and compares favorably to multiple datasets collected under varied hydrodynamic conditions (Brownlie, 1981). The application for this project is similar to the application of the Ackers and White method to the LTFATE model (Scheffner, 1996). The Ackers and White formula for bed load transport were originally developed for streams, as were most commonly used non-cohesive formulas. Therefore, the formulas are generally for current dominated environments. The same method was used to solve for this shortcoming as was used in LTFATE. A coefficient is determined based on current velocity, wave height, wave period, bottom roughness and water depth. This current velocity is then multiplied by this coefficient to determine a new 'perceived bottom velocity', which is a velocity that would produce the same shear as the combined current and wave motions. Derivation of the coefficient and the application to calculation of shear stress can be found in Bijker (1971), Swart (1976) and Scheffner (1996). It should be noted, however, that the strength of orbital velocities in the large water depths at the ODMDSs would be minimal except for the longest period waves experienced at each site.

Approximations used in estimating the sediment erosion from the ODMDSs are as follows: All sediment was assumed to move as bed load. Because bed load is calculated as a flux across a boundary, a cell size estimate was necessary. For these calculations, the cells were set to 305x305 m^2 with the flow moving perpendicular to one of the faces. The mound height was assumed to be small relative to the total water depth. Outside the mound, the sediment type was assumed to be identical to that of the mound, with a median grain size of 0.12 mm. With these assumptions, calculation of sediment flux was determined.

In all likelihood, placement of material in 170-220 m depths will not lead to resuspension of material. If in fact, no mound movement occurs for severe storms, then simulation of long-term average conditions would not be needed.

Input Data Requirements

All data for the long-term fate and stability of dredged material disposal site modeling were assembled for the Palm Beach and Port Everglades ODMDSs. These data include bathymetry and tidal conditions at the disposal site, sediment characteristics, storm surges and velocities at Wave Information Study (WIS) Stations 9 (for Port Everglades) and 10 (for Palm Beach), and wave conditions at WIS Stations 9 and 10.

Bathymetry. A 305x305 m square mound configuration (41 cm high) was assumed as a reasonable first estimate for model simulations. These dimensions achieve a 38,230 m^3 (50,000 c.y.) mound volume, which is the annual amount that each disposal site is expected to accommodate.

Tidal Conditions. Tidal constituent data from the Dredging Research Program (DRP) tidal constituent database were used to generate tidal elevations and tidal velocity time series at the two ODMDSs. Maximum velocities at the Port Everglades ODMDS were approximately 10 cm/sec in the direction of maximum storm velocities. Maximum velocities at the Palm Beach ODMDS were approximately 7 cm/sec in the direction of maximum storm velocities.

Sediment Characteristics. A mean grain size of 0.12 mm was used for initial screening level erosion modeling at both ODMDSs.

Storm Conditions. Severe (storm) conditions were simulated to determine the "worst case" scenario. If movement was minimal for storm conditions, then simulating average conditions would be unnecessary. Thirteen tropical storms were selected from the 104-year period covered in the National Hurricane Center's HURDAT database. HURDAT includes storm parameters for all hurricanes, tropical storms, and severe depressions that impacted the east coast, Gulf of Mexico, and Caribbean from 1896 to 1989. These data were used as input to the ADCIRC model to compute depth-averaged velocities and water surface elevation data (which are saved in the DRP Hurricane Database).

Storm Velocities. Depth-averaged velocities and water surface elevation data (Figure 52) for the largest three storms were selected from the DRP Hurricane Database for the initial screening level modeling at the ODMDS sites. Based on current measurements near the ODMDSs, depth-averaged velocities are probably not representative of bottom velocities in 170-200 m of water. Evaluation of the ADCP velocity profile data was used to determine a more realistic estimate of near-bottom velocities to use in the evaluation of long-term fate of dredged material at the two sites (Figure 53). This figure shows that if the depth-averaged velocity is 1.0 m/sec, one could expect the velocity at the 90-m depth to be approximately 50% of the depth-averaged value, or 0.5 m/sec. Near-bottom velocities in 200-m of water would be somewhat less and 40% of the depth-averaged value was considered a conservative estimate.

Storm Waves. No database of wave conditions exists for the 104-year period from which the tropical storms were selected. Therefore, the Planetary Boundary Layer (PBL) model was used to generate each hurricane wind and pressure field. The PBL model output was then used as input to the WISWAVE ocean hindcast model to generate wave conditions for the entire east coast. Wave conditions at WIS Station 9, corresponding to the Port Everglades ODMDS are shown in Figure 54. (Wave conditions at WIS Station 10 correspond to the Palm Beach ODMDS.)

Model Simulations

Screening level erosion modeling was completed for the three largest storms selected from the National Hurricane Center's HURDAT database. This model was used to estimate the peak sediment flux and total sediment loss caused by the three severe tropical storms. Tables 8 and 9 summarize the input data, the resulting sediment flux, and an estimate of the total sediment loss for each storm, in which the peak flux was assumed to occur for four hours across one side of a 305 X 305 m disposal site for each of the disposal sites. Computed total sediment losses were zero for two of the three most severe tropical storms, and rather small (less than 3%) for even the most severe historical hurricane to occur during the 100+ years of the HURDAT database.

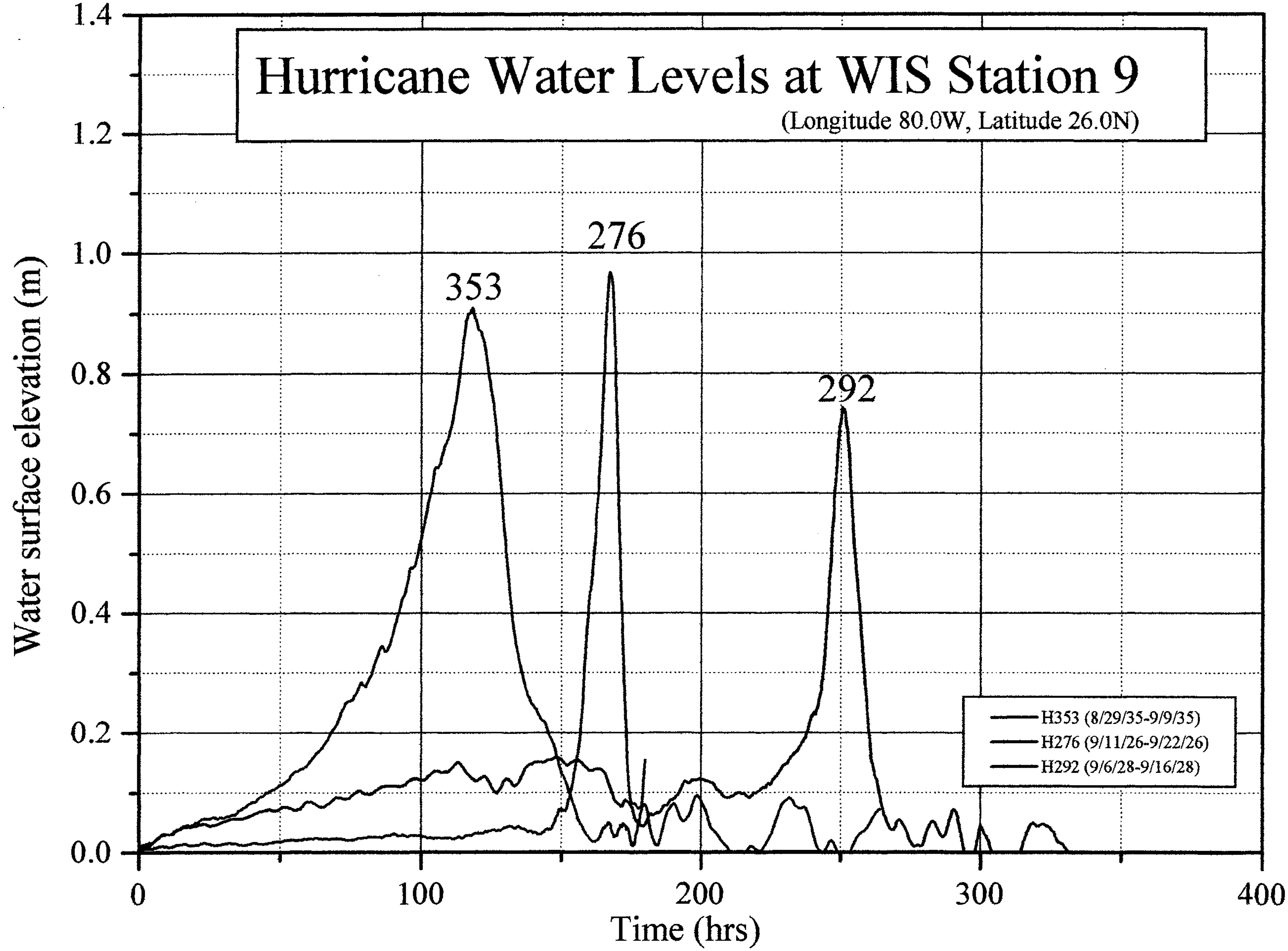


Figure 52. Water surface elevations for three largest storms at WIS Station 9

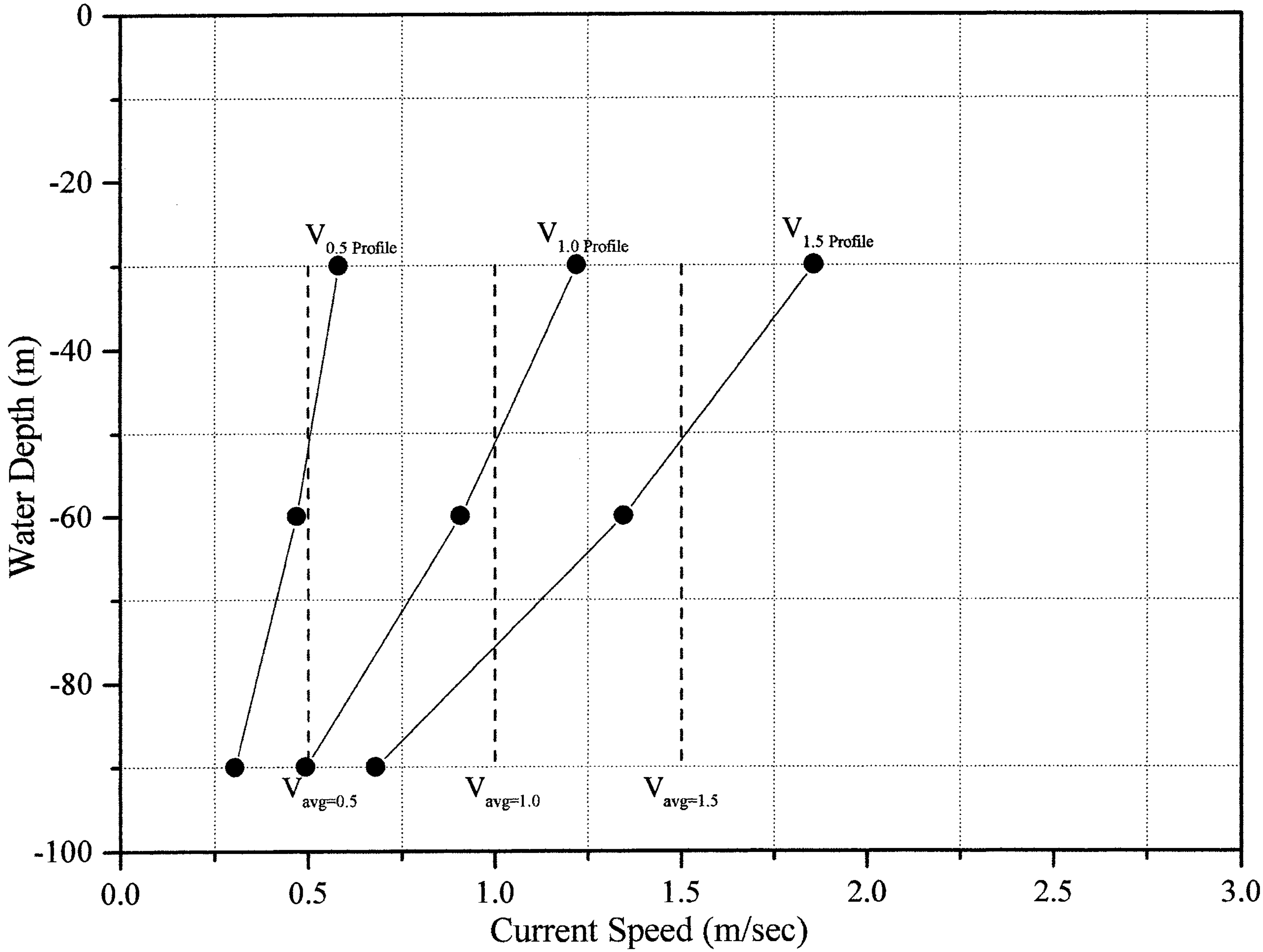


Figure 53. Relationship between depth-averaged velocities and near-bottom velocities

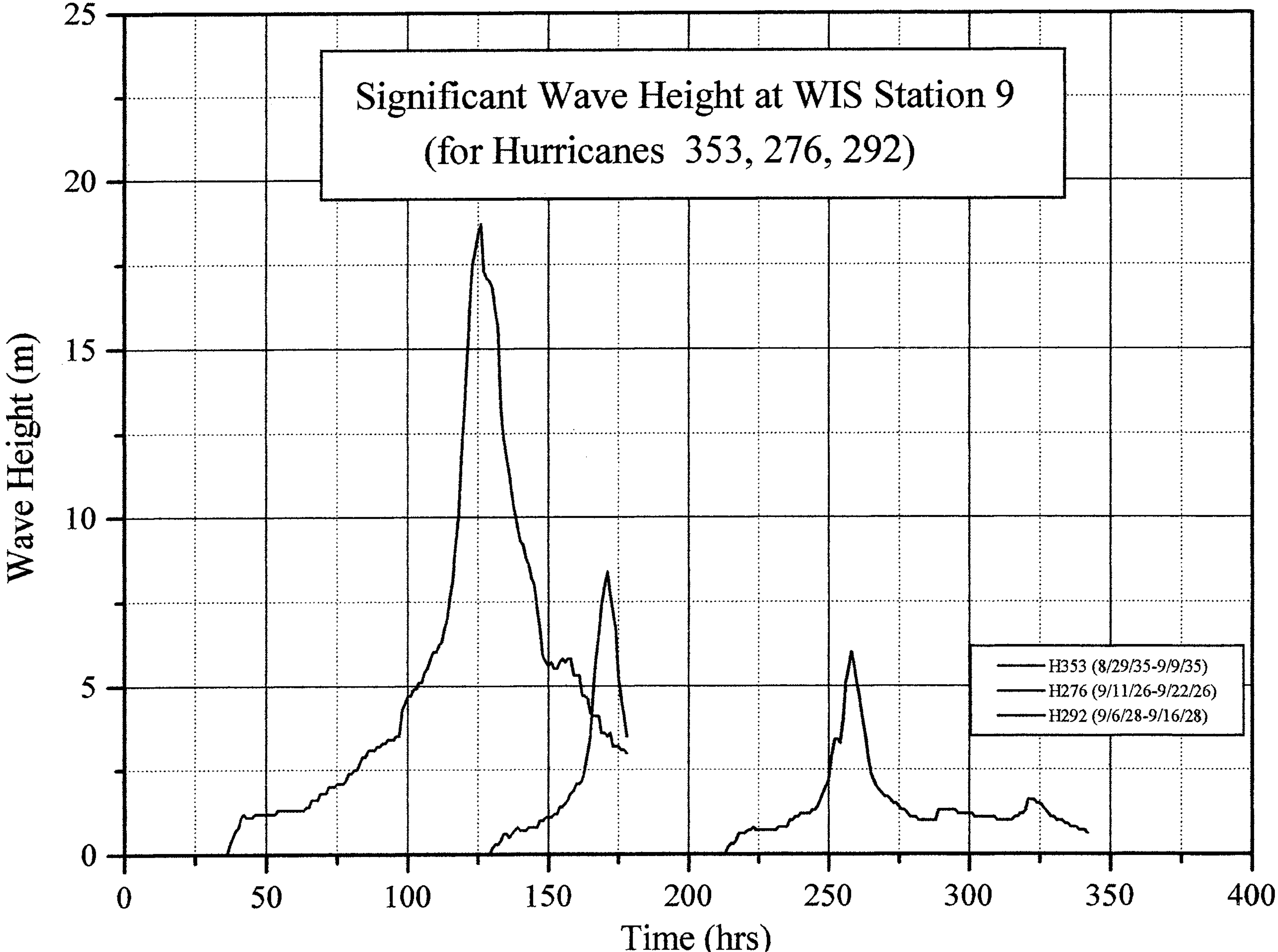


Figure 54. Wave heights for three largest storms at WIS Station 9

Extratropical Storm Simulation. An additional case was simulated for the Port Everglades site using the screening level erosion model. An estimate of conditions for a severe extratropical storm were made using available data. The maximum bottom velocity recorded by the ADCP over the three year period, 1995-1997, was linearly-extrapolated from a depth of 100 m to a depth of 200 m using the trend for the maximum velocity to decrease with depth that was evident in the measured data (Figure 55). The maximum measured velocity at the 100-m depth was 1.3 m/sec. Extrapolating to a 200-m depth would result in a bottom velocity of 0.5 m/sec. Assuming these conditions are associated with a extratropical storm of duration 24 hrs, maximum wave height of 10 m, peak period of 11 sec, and grain size of 0.12 mm results in a sediment flux of 5.1×10^{-8} $m^3/m/sec$ or a total volume loss of 410 m^3 over the 305 m by 305 m mound area. This loss is an estimate of what might be experienced during a very severe extratropical storm event, and is an order of magnitude less than the loss associated with the most severe tropical storm. Assessment of these results indicates that even the most severe storms will not significantly erode the mound. Therefore, LTFATE modeling will not be undertaken.

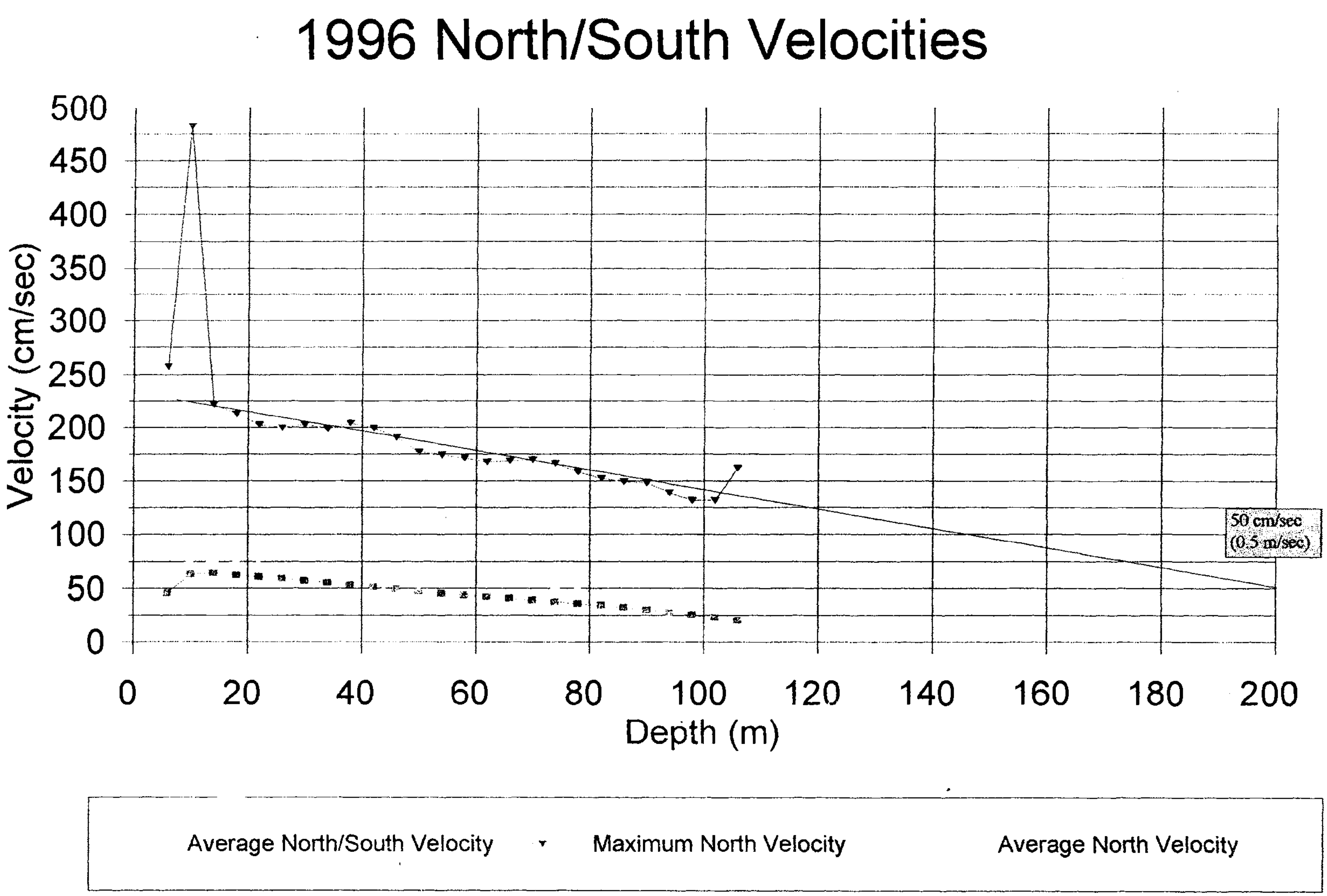


Figure 55. Extrapolated maximum near-bottom velocity from ADCP data

Table 8. Screening level erosion model inputs and results for Port Everglades			
	Storm 276	**Storm 292**	**Storm 353**
H_s (m)	8.4	6.0	18.7
T (sec)	11	11	17
D (m, msl)	-200	-200	-200
Z_{storm} (m, msl)	0.97	0.74	0.91
U_{storm} (m/sec)	0.082	0.035	0.199
V_{storm} (m/sec)	0.601	0.706	1.125
Z_{tidal} (m, msl)	0.45	0.45	0.45
U_{tidal} (m/sec)	.003	.003	.003
V_{tidal} (m/sec)	.09	.09	.09
d_{50} (mm)	0.12	0.12	0.12
V_{total} (m/sec)	0.70	0.80	1.2
$V_{reduced}$ (m/sec)	0.35	0.40	0.6
Flux (m^3/m/sec)	--0--	--0--	7.98×10^{-7}
Vol (m^3)	--0--	--0--	1069

Variable definitions:

H_s - significant wave height at peak of the storm
T - period associated with peak wave height
D - water depth
η_{storm} - water surface elevation at peak of storm
U_{storm} - east/west depth-averaged velocity component due to storm
V_{storm} - north/south depth-averaged velocity component due to storm
η_{tidal} - tidal elevation at ODMDS
U_{tidal} - east/west depth-averaged velocity component due to tides
V_{tidal} - north/south depth-averaged velocity component due to tides
d_{50} (mm) - median grain size
V_{total} (m/sec) - resultant velocity $((U_{storm}+U_{tidal})^2+(V_{storm}+V_{tidal})^2)^{1/2}$
$V_{reduced}$ (m/sec) - reduced velocity due to greater water depth
Flux (m^3/m/sec) - amount of sediment moving passed a 1-m segment in 1 sec at the peak of the storm
Volume Loss (m^3) - total volume eroded from a 305 m x 305 m mound, assuming the peak flux persists for a 4-hr storm duration

Table 9. Screening level erosion model inputs and results for Palm Beach			
	Storm 276	**Storm 292**	**Storm 353**
H_s (m)	8.0	6.5	16.7
T (sec)	11	11	17
D (m, msl)	-179	-170	-170
Z_{storm} (m, msl)	0.87	0.85	0.84
U_{storm} (m/sec)	0.095	0.077	0.202
V_{storm} (m/sec)	0.552	0.953	0.992
Z_{tidal} (m, msl)	0.51	0.51	0.51
U_{tidal} (m/sec)	.01	.01	.01
V_{tidal} (m/sec)	.066	.066	.066
d_{50} (mm)	0.12	0.12	0.12
V_{total} (m/sec)	0.63	1.02	1.08
$V_{reduced}$ (m/sec)	0.25	0.41	0.43
Flux (m^3/m/sec)	--0--	1.27×10^{-10}	6.92×10^{-7}
Vol (m^3)	--0--	--0--	927

4 Conclusions

The evaluation of ODMDSs located 7.4-8.3 km off of Port Everglades and Palm Beach Harbors was accomplished by numerically simulating the disposal, descent, and collapse of the dredged material plume as well as the long-term fate of the disposal mound. Of primary concern was the possible movement of material in the direction of environmentally-sensitive reefs located approximately 1-3 km offshore (5.3-6.1 km from the disposal sites). Results indicate that the potential for sediment movement onto the reefs is remote.

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. In all Port Everglades applications sediment was disposed 6100 m (20,000 ft) from the grid origin (reef location). Two sediment compositions were simulated, 60% and 70% solids by weight, with 38% and 5% fines, respectively. Results indicate silt-clay concentrations diminish to approximately 1 mg/l or less within 1500 m (5000 ft) of the disposal location (4500 m (15,000 ft) from the reef location). Higher current speeds carry sediment from the disposal location more rapidly, but silt-clay concentrations still drop below about 1 mg/l within 1500 m (5000 ft) of the disposal location. A major portion of the dredged material is sand. Sand concentrations diminish to 1 mg/l or less within 2440 m (8000 ft) of the disposal location (3660 m (12,000 ft) from reef location). The majority of the sand in the dredged material settles rapidly, but some remains in the water column for longer time/distances as indicated by these results.

In all Palm Beach applications sediment was disposed 5300 m (17,500 ft) from the grid origin (reef location). Two sediment compositions were simulated, 80% and 85% solids by weight, with 6% fines. Silt-clay concentrations diminish rapidly to 1 mg/l or less within 1500 m (5000 ft) of the disposal location (12500 ft from the reef location). Higher current speeds carry sediment from the disposal location more rapidly, but silt-clay concentrations still drop below 1 mg/l within 1500 m (5000 ft) of the disposal location. A major portion of the dredged material is sand. Sand concentrations diminish to 1 mg/l or less within 2400 m (8000 ft) of the disposal location (2900 m (9500 ft) from reef location). The majority of the sand in the dredged material settles rapidly, but some remains in the water column for longer time/distances as indicated by these results.

A screening level erosion model is the site evaluation tool used to estimate the long-term response of the dredged material mounds at the Port Everglades and Palm Beach ODMDSs to local environmental forcing functions. The model simulates the dispersion characteristics (or conversely, site stability) of a dredged material mound over time periods of days for storms to years for ambient conditions using coupled hydrodynamic, sediment transport, and bathymetric change submodels. A screening level erosion model was run to address the potential for sediment transport from the dredged material mound. The screening level erosion model indicated little (less than 3%) to no potential for sediment movement for the most severe storms to impact the area in 100+ years. Therefore, these sites can be considered stable and the reef will not be adversely affected by up to 100-year return period events.

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Appendix L

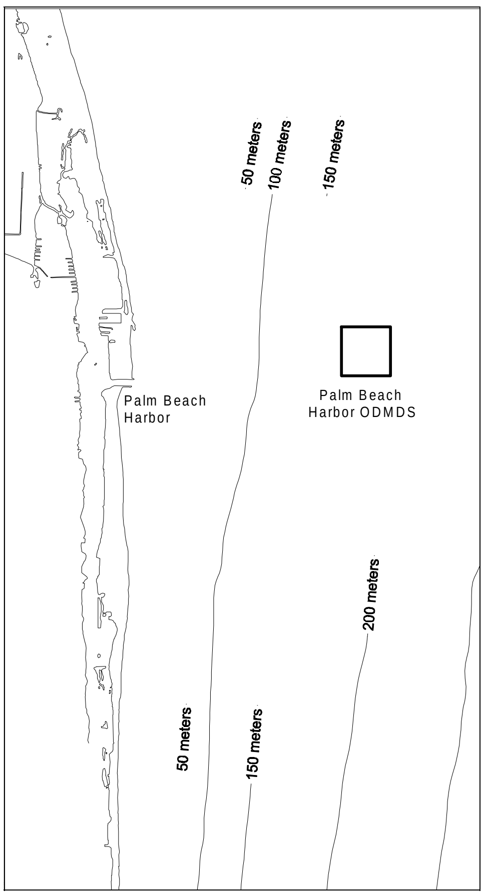
SITE MANAGEMENT AND MONITORING PLANS

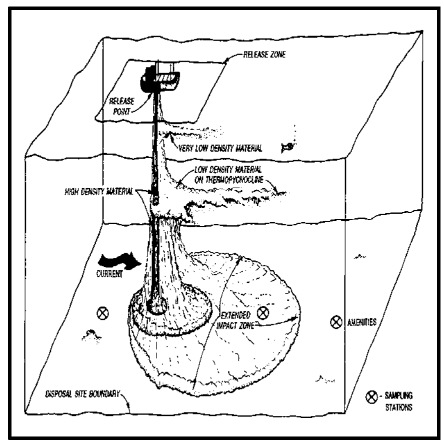
July 2004

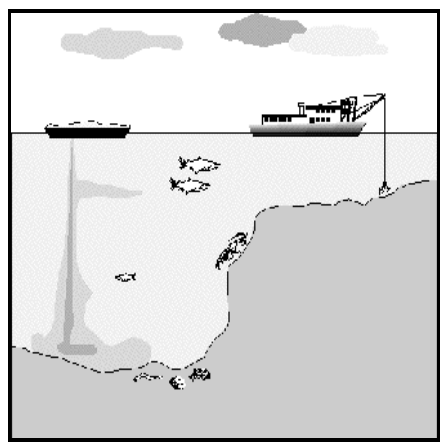
U.S. Army Corps
of Engineers

PALM BEACH HARBOR
OCEAN DREDGED MATERIAL DISPOSAL SITE

DRAFT
SITE MANAGEMENT
AND MONITORING PLAN







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The following Site Management and Monitoring Plan for the Palm Beach Harbor ODMDS has been developed and agreed to pursuant to the Water Resources Development Act Amendments of 1992 (WRDA 92) to the Marine Protection, Research, and Sanctuaries Act of 1972 for the management and monitoring of ocean disposal activities, as resources allow, by the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers.

Robert M. Carpenter Date
Colonel, U.S. Army
District Engineer
Jacksonville District
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, Florida

James D. Giattina Date
Director
Water Management Division
U.S. Environmental Protection Agency
Region 4
Atlanta, Georgia

This plan is effective from the date of signature for a period not to exceed 10 years. The plan shall be reviewed and revised more frequently if site use and conditions at site indicate a need for revision.

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DRAFT
PALM BEACH HARBOR OCEAN DREDGED MATERIAL DISPOSAL SITE (ODMDS)
SITE MANAGEMENT AND MONITORING PLAN

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INTRODUCTION

It is the responsibility of the U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (COE) under the Marine Protection, Research, and Sanctuaries Act (MPRSA) of 1972 to manage and monitor each of the Ocean Dredged Material Disposal Sites (ODMDSs) designated by the EPA pursuant to Section 102 of MPRSA. The MPRSA, the Water Resources Development Act (WRDA) of 1992, and a Memorandum of Agreement between EPA and COE require the development of a site management and monitoring plan (SMMP) to specifically address the disposal of dredged material at the Palm Beach Harbor ODMDS. SMMP provisions shall establish requirements for all dredged material disposal activities at the site. All Section 103 (MPRSA) ocean disposal permits or evaluations shall be conditioned as necessary to assure consistency with the SMMP.

Site Management and Monitoring Plan Team. An interagency SMMP team has been established to assist EPA and COE in finalizing this SMMP. The team consists of the following agencies and their respective representatives:

Jacksonville District Corps of Engineers

State of Florida

EPA Region 4

Port of Palm Beach

U.S. Coast Guard

NOAA

Other agencies such as the National Marine Fisheries Service (NMFS) and the Fish and Wildlife Service (FWS) will be asked to participate where appropriate. The SMMP team will assist EPA in evaluating existing monitoring data, the type of disposal (i.e., O&M vs. construction), the type of material (i.e., sand vs. mud), location of placement within the ODMDS and quantity of material. The team will assist EPA and COE on deciding on appropriate monitoring techniques, the level of monitoring, the significance of results and potential management options.

SITE MANAGEMENT

Section 228.3 of the Ocean Dumping Regulations (40 CFR 220-229) states: "Management of a site consists of regulating times, rates, and methods of disposal and quantities and types of materials disposed of; developing and maintaining effective ambient monitoring programs for the site; conducting disposal site evaluation studies; and recommending modifications in site use and/or designation." This plan may be modified if it is determined that such changes are warranted as a result of information obtained during the monitoring process.

Disposal Site Characteristics

The Palm Beach Harbor ODMDS is a 1 nmi by 1 nmi square area centered at the coordinates 26° 47.00'N latitude and 79° 56.59'W longitude (NAD83) or state plane coordinates 891846.0 N and 1000961.1 E (NAD83). The corner coordinates are as follows:

Geographic (NAD83)		**State Plane (Florida East 0901 U.S. Feet NAD83)**	
26°47.50'N	79°57.15'W	894850.2 N	997890.9 E
26°47.50'N	79°56.03'W	894900.8 N	1003980.9 E
26°46.50'N	79°57.15'W	888791.3 N	997940.8 E
26°46.50'N	79°56.03'W	888841.9 N	1004031.7 E

The site is 4.8 nmi offshore, has a depth range of 160 to 190 meters (525 to 625 feet), and an area of 1 nmi^2.

Management Objectives. There are three primary objectives in the management of each ODMDS. These are:

- Protection of the marine environment;
- Beneficial use of dredged material whenever practical; and
- Documentation of disposal activities at the ODMDS.

The following sections provide the framework for meeting these objectives to the extent possible.

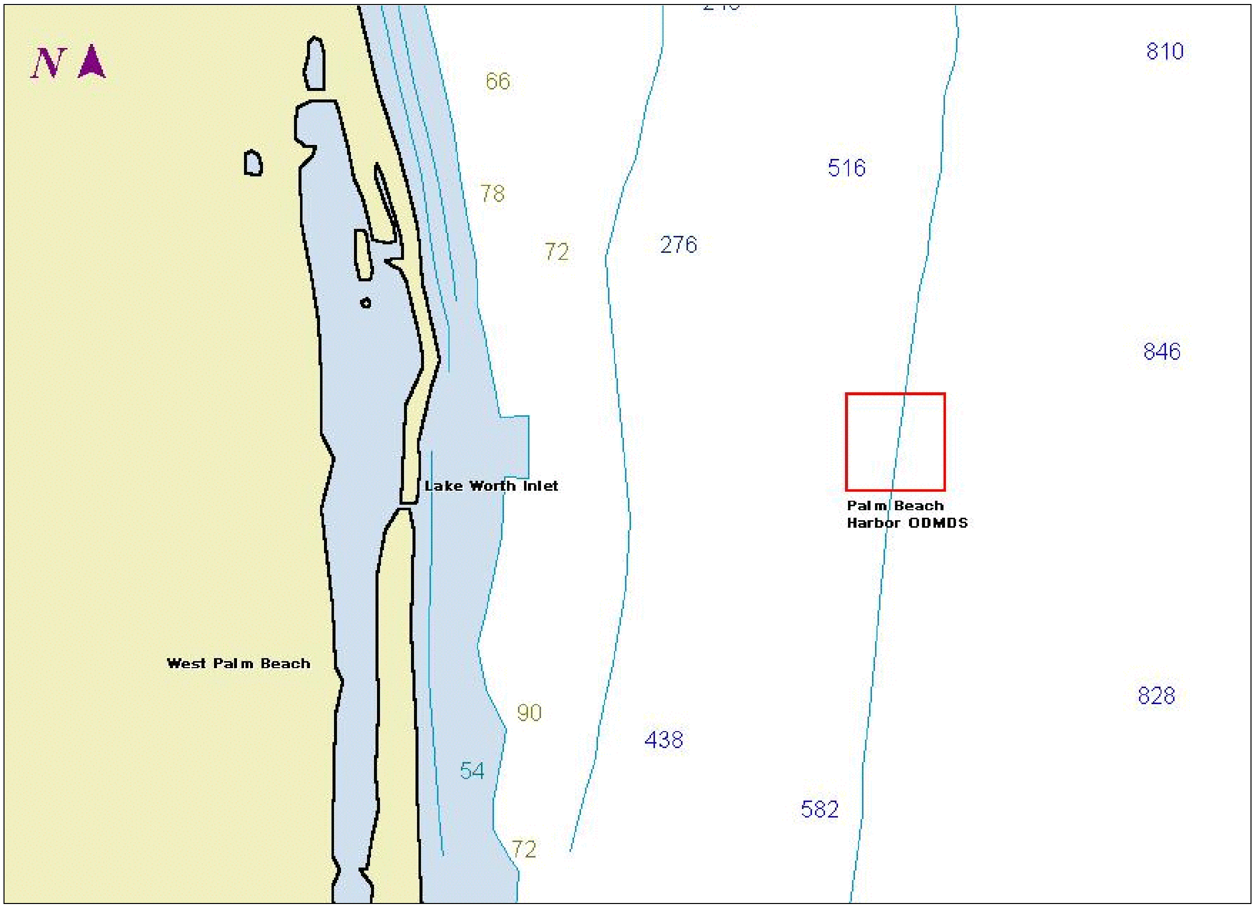

Figure 1: Palm Beach Harbor ODMDS Location Map

Material Volumes. It is intended that the Palm Beach Harbor ODMDS will be used for disposal of dredged material (both maintenance and construction or new work material) from the Palm Beach Harbor and vicinity. The primary user of the ODMDS will be the U.S. Army Corps of Engineers for maintenance of the Palm Beach Harbor Federal Project. The Palm Beach Harbor ODMDS has not been previously used for disposal of dredged material. The interim site located approximately 3 nautical miles from shore was previously used for ocean disposal of dredged material from Palm Beach Harbor. 516,000 cubic yards of dredged material had been disposed at the Interim site since 1976 with the last disposal of 184,000 cubic yards occurring in 1983 (WES, 1999).

The Jacksonville District Corps of Engineers has projected annual average disposal rates of 30,000 cubic yards. However, annual disposal events are unlikely. Dredging project sizes have ranged from 14,000 cubic yards to 179,000 cubic yards including portions used for beneficial uses (Murphy, 1998). Disposal volumes at the ODMDS will therefore likely be within these ranges. Maintenance disposal quantities are not expected to exceed 200,000 cubic yards

(Murphy, 2004). Future potential projects include proposed construction dredging at Palm Beach Harbor. Dredged material volumes from this project have been estimated at up to 1 million cubic yards. The COE will perform a feasibility study to examine the plan in greater detail and evaluate disposal alternatives.

The capacity of the Palm Beach Harbor ODMDS has not been determined. Modeling conducted by the Coastal Engineering Research Center (CERC) was conducted for a single project volume up to 500,000 cubic yards. Therefore, use of the ODMDS will be restricted to 500,000 cubic yards of dredged material per project. Projects in excess of 500,000 cubic yards of dredged material will require additional capacity studies prior to utilization of the ODMDS.

Material Suitability. Material from Palm Beach Harbor is predominately sand with some silts. Sampling in the basin in 1997 showed that the material was 6% silts by weight and the remainder consisting of sand. The disposition of any significant quantities of beach compatible sand from future projects will be determined during permitting activities for any such projects. It is expected that the State of Florida will exercise its authority and responsibility, regarding beach nourishment, to the full extent during any future permitting activities. Utilization of any significant quantities of beach compatible dredged material for beach nourishment is strongly encouraged and supported by EPA.

The suitability of dredged material for ocean disposal must be verified by the COE and agreed to (concurred) by EPA prior to disposal. Verification will be valid for three years from the time last verified. Verification will involve: 1) a case-specific evaluation against the exclusion criteria (40 CFR 227.13(b)), 2) a determination of the necessity for testing including bioassay (toxicity and bioaccumulation) testing for non-excluded material based on the potential for contamination of the sediment since last tested, and 3) carrying out the testing (where needed) and determining that the non-excluded, tested material is suitable for ocean disposal.

Documentation of verification will be completed prior to use of the site. Documentation will be in the form of a MPRSA Section 103 Evaluation. The Evaluation and any testing will follow the procedures outlined in the 1991 EPA/COE Dredged Material Testing Manual and 1993 Regional Implementation Manual (RIM) or the appropriate updated versions. This includes how dredging projects will be subdivided into project segments for sampling and analysis. The MPRSA Section 103 Evaluation will be in the form outlined in Appendix B of the RIM. Only material determined to be suitable through the verification process by the COE and EPA will be placed at the Palm Beach Harbor ODMDS.

Time of disposal. At present no restrictions have been determined to be necessary for disposal related to seasonal variations in ocean current or biotic activity. As monitoring results are compiled, should any such restrictions appear necessary, disposal activities will be scheduled so as to avoid adverse impacts. Additionally, if new information indicates that endangered or threatened species are being adversely impacted, restrictions may be imposed.

Disposal Technique. No specific disposal technique is required for this site. Standard surveillance and evasive measures to protect sea turtles and marine mammals shall be employed during all disposal operations at the ODMDS.

Disposal Location. Based on modeling efforts, disposal should occur within 600 feet of the center of the Palm Beach Harbor ODMDS to prevent the disposal mound from exceeding site boundaries (EPA, 1999). This release zone can be modified based on results from any capacity study and post-disposal bathymetric surveys.

Permit and Contract Conditions. The disposal monitoring and post-disposal monitoring requirements described under Site Monitoring will be included with the management requirements described in this section as permit conditions on all MPRSA Section 103 permits and will be incorporated in the contract language for all federal projects. A summary of the management and monitoring requirements to be included are listed in Table 1. Appendix B contains a template for standard permit conditions for MPRSA 103 permits for the Palm Beach Harbor ODMDS and Appendix C contains a template for standard contract conditions for civil works project use of the ODMDS.

Table 1. Summary of Permit and Contract Conditions

Condition	Reference
Dredged Material Suitability and Term of Verification	Palm Beach Harbor ODMDS SMMP page 4 Regional Implementation Manual
Disposal Zone	Palm Beach Harbor ODMDS SMMP page 5
Pre and Post Bathymetric Surveys	Palm Beach Harbor ODMDS SMMP page 8 and 11
Disposal Monitoring	Palm Beach Harbor ODMDS SMMP page 11
Reporting Requirements	Palm Beach Harbor ODMDS SMMP page 16

Permit Process. The permit process is outlined in Figure 2 and consists of 10 main steps:

1. **Preapplication Consultation**: Includes discussion of alternatives and the qualitative and quantitative information required by the District Engineer for use in evaluating the proposed dredged material.
2. **Evaluation of Dredged Material Proposed for Ocean Disposal**: Includes development, approval and implementation of sampling and analysis plan (see Section on Material Suitability). This step should include close coordination between EPA Region 4, the Jacksonville District Corps of Engineers and the applicant.
3. **Permit Application**: According to 33 CFR 325.1, a permit application must include the

following:

a. A complete description of the proposed activity, including necessary drawings, sketches, or plans.

b. The location, purpose, and need for the proposed activity; scheduling of the activity; names and addresses of adjoining property owners; location and dimension of adjacent structures

c. A list of authorizations required by other Federal, interstate, State, or local agencies for the work, including all approvals received or denials already made

d. The source of the material; the purpose of the disposal and a description of the type, composition, and quantity of the material (this includes information necessary to determine if the material is in compliance with the criteria); the method of transportation and disposal of the material; and the location of the disposal site.

4. **Review of Application for Completeness**: Additional information is requested if the application is incomplete.
5. **Public Notice**: Per 33 CFR 325.3, Public Notices issued by the USACE for dredged material disposal must include all of the information in 40 CFR 225.2(a) (see RIM). A supplemental, revised or corrected Public Notice will be issued if the District Engineer believes that the new information affects the review of the proposal.
6. **EPA MPRSA Review**: Independent review of the information to determine whether the disposal activity complies with the criteria found in 40 CFR 227 and 228.
7. **District Engineer Completes Evaluation**: The District Engineer addresses comments and holds public meeting if needed.
8. **USACE Public Interest Review**: The USACE must consider all comments, suggestions, and concerns provided by all commenters and incorporate their comments into the administrative record of the application.
9. **Permit Issued**: A decision to issue or deny a permit is discussed in either a Statement of Findings or Record of Decision.
10. **Permit Public Notice**: A list of permit decisions is published and distributed to all interested parties each month.

Information Management of Dredged Material Placement Activities. As discussed in the following sections, a substantial amount of diverse data regarding use of the Palm Beach Harbor ODMDS and effects of disposal is required from many sources (EPA, COE, Port Authority or other site user). If this information is readily available and in a useable format it can be used to answer many questions typically asked about a disposal site:

- What is being dredged?
- How much is being dredged?
- Where did the dredged material come from?
- Where was the dredged material placed?
- Was dredged material dredged correctly? placed correctly?
- What will happen to the environment at the disposal site?

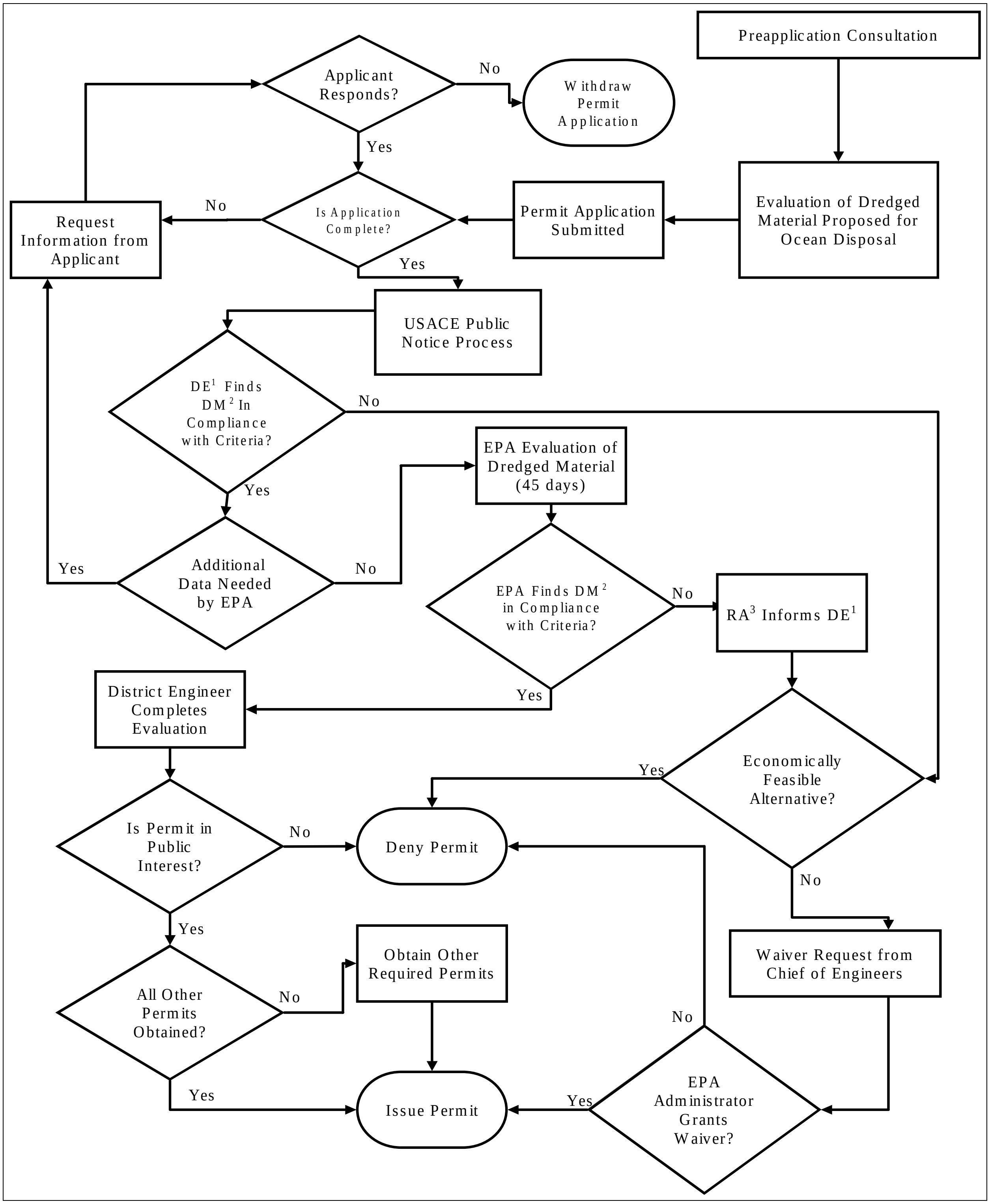

Figure 2: Permit Application/Evaluation Procedure
[1]District Engineer; [2]Dredged Material; [3]Regional Administrator

As part of site management, EPA and the COE will investigate alternatives for appropriate data management.

SITE MONITORING

The MPRSA establishes the need for including a monitoring program as part of the Site Management Plan. Site monitoring is conducted to ensure the environmental integrity of a disposal site and the areas surrounding the site and to verify compliance with the site designation criteria, any special management conditions, and with permit requirements. Monitoring programs should be flexible, cost effective, and based on scientifically sound procedures and methods to meet site-specific monitoring needs. A monitoring program should have the ability to detect environmental change as a result of disposal activities and assist in determining regulatory and permit compliance. The intent of the program is to provide the following:

(1) Information indicating whether the disposal activities are occurring in compliance with the permit and site restrictions; and/or

(2) Information concerning the short-term and long-term environmental impacts of the disposal; and/or

(3) Information indicating the short-term and long-term fate of materials disposed of in the marine environment.

The main purpose of a disposal site monitoring program is to determine whether dredged material site management practices, including disposal operations, at the site need to be changed to avoid significant adverse impacts.

Baseline Monitoring. Site characterization surveys of the ODMDS have been conducted by EPA and the COE as part of the designation process. These are summarized in Table 2. Results from these surveys can be used in part as baseline data for the monitoring of impacts associated with use of the Palm Beach Harbor ODMDS.

A high resolution bathymetric survey will be conducted by the COE or site user within three (3) months prior to initial use of the ODMDS. For subsequent projects, the need for pre-disposal bathymetric surveys will depend on project volumes. Pre-disposal surveys will be required within (3) months prior to dredging cycle or project disposal for projects greater than 100,000 cubic yards. Bathymetric surveys will be used to monitor the disposal mound to assist in verification of material placement, to monitor bathymetry changes and trends and to insure that the site capacity is not exceeded, ie., the mound does not exceed the site boundaries. Surveys will conform to the minimum performance standards for Corps of Engineers Hydrographic Surveys for navigation and dredging support surveys-soft bottom as described in the COE

Engineering Manual, EM1110-2-1003, "Hydrographic Surveying" dated January 1, 2002 to the extent practicable. The number and length of transects required will be sufficient to encompass the ODMDS and a 500 foot wide area around the site. The surveys will be taken along lines spaced at 500-foot intervals or less (200 feet for high resolution survey) with a depth recording density of 20 to 70 feet (less than 20 feet for high resolution survey). Depth precision of the surveys will be $\pm$ 0.1 feet and an accuracy of $\pm$ 2.0 feet. Horizontal location of the survey lines and depth sounding points will be determined by an automated positioning system utilizing either a microwave line of sight system or differential global positioning system. The vertical datum will be referenced to prescribed NOAA Mean Lower Low Water (MLLW) datum. The horizontal datum will be Florida State Plane (zone 0901 FL East) or Geographic (NAD 1983). Horizontal positioning accuracy will be 6 feet. Copies of these surveys shall be provided to EPA Region 4 when completed. No additional pre-disposal monitoring at this site is required.

Table 2. Surveys Conducted at the Palm Beach Harbor ODMDS

Survey Title	Conducted by	Date	Purpose	Conclusion
Benthic Macroinfaunal Analysis of the Port Everglades and Palm Beach, Florida ODMDS Surveys	Battelle for EPA	1984	Characterization (sediment analysis, benthic biota) Survey	Characterization of benthos for February & November 1984
Final Report for a Field Survey of an ODMDS off Palm Beach Harbor, Florida	Continental Shelf Associates for COE	1989	Characterization (bathymetry, video, water column profiles, water quality, sediment chemistry, benthic and epifauna biota) Survey	Conditions at the site are relatively pristine. Sediments consists of mostly fine sand and have low level of contaminants. No critical habitats within survey area.
Sediment & Water Quality of Candidate Ocean Dredged Material Disposal Sites for Port Evergades and Palm Beach, Florida	U.S. EPA Region 4	1999	Characterization (water column profiles, water quality, sediment characteristics, benthic bioata) survey	Conditions at the site are relatively pristine. Water column is clear with low suspended sediment concentrations (2-20mg/l). Sediments consists of mostly fine sand (70%) and have low level of contaminants.
Sidescan Survey of Candidate Ocean Dredged Material Disposal Sites for Port Evergades and Palm Beach, Florida	U.S. EPA Region 4	1999	Look for presence of natural resources (critical habitats) and presence of man made obstructions on the bottom.	The side-scan 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. No areas of hard bottom or potential wrecks were identified through the side-scan record within the site or north or south of the site

Disposal Monitoring. For all disposal activities, the dredging contractor will be required to prepare and operate under an approved electronic verification plan for all disposal operations. As part of this plan, the contractor will provide an automated system that will continuously track (1 to 5 minute intervals) the horizontal location and draft condition (vertical) of the disposal vessel from the point of dredging to the disposal area, and return to the point of dredging. Required digital data are as follows:

(a) Date;

(b) Time;

(c) Vessel Name;

(d) Dump Number;

(e) Map Number on which dump is plotted (if appropriate);

(f) Beginning and ending coordinates of the dredging area for each load (source of dredged material);

(g) Actual location (in degrees and minutes of longitude and latitude) at points of initiation and completion of disposal event;

(h) Brief description of material disposed;

(I) Volume of material disposed; and

(j) Disposal technique used.

The user will be required to prepare and submit to the COE daily reports of operations and a monthly report of operations for each month or partial month's work. The user is also required to notify the COE and the EPA if a violation of the permit and/or contract conditions occur during disposal operations.

Post Discharge Monitoring. As a follow-up to the pre-disposal bathymetric survey, the COE or other site user will conduct a bathymetric survey within 30 days after disposal project completion. The number of transects required will be the same as in the pre-disposal survey. Bathymetric survey results will be used to insure that unacceptable mounding is not occurring and to aid in environmental effects monitoring.

The post-disposal bathymetric survey will be required for the initial use of the ODMDS and for each project greater than 100,000 cubic yards.

Potential Environmental Impacts. The main environmental concerns regarding disposal of dredged material at the Palm Beach Harbor ODMDS are: (1) disposal of sediments that may cause significant mortality or bioaccumulation of contaminants within the disposal site or adjacent to the site boundaries, and (2) adverse ecological changes to the ODMDS and the surrounding sea floor. The first concern is addressed through the permitting/evaluation process in which the sediments are evaluated (see Material Suitability under Site Management). The second concern is addressed through monitoring of the ODMDS. Changes in the benthic community inside the ODMDS are expected because different grain size characteristics in the dredged material may promote colonization of the site by different benthic species. If dredged material is detected outside of the ODMDS, benthic community changes adjacent to the site may be evaluated to determine whether these changes are acceptable. Additionally, at the Palm Beach Harbor ODMDS there are concerns about potential impacts to nearshore living coral and coralline algal reef systems along the coastline to the west of the site.

Monitoring Strategy. Monitoring of the Palm Beach Harbor ODMDS will follow a tiered approach utilizing management action thresholds. These thresholds will trigger either additional monitoring following the tiered approach or management actions. Monitoring will consist of physical, chemical and biological monitoring. Physical monitoring will provide information about the plume behavior in the water column and dredged material footprint on the bottom. Chemical monitoring provides data on sediment quality and will evaluate bioaccumulation of contaminants in benthic organisms if threshold concentrations of contaminants in sediments are exceeded. Biological monitoring will provide information on the effects of dredged material disposal on the benthic invertebrate communities and on the nearshore living coral and coralline algal reef systems. In the event that the physical monitoring shows that the dredged material footprint extends outside of the designated ODMDS, impacts on the benthos will be investigated. In the event that the physical monitoring shows that the dredged material disposal plume reaches the reef systems, then impacts on the reef systems will be investigated. Some of the monitoring activities will be applied at one or more of the three southeast Florida deepwater ODMDSs (Palm Beach Harbor, Port Everglades Harbor, Miami). Results of those studies will be applied to the Palm Beach Harbor ODMDS where applicable. In addition, 40 CFR 228.9(a) recommends trend assessment surveys be conducted at disposal sites used on a continuing basis.

A summary of the monitoring strategies for the Palm Beach Harbor ODMDS and thresholds for management actions are presented in Table 3. Should future disposal at the Palm Beach Harbor ODMDS result in unacceptable adverse impacts, further studies may be required to determine the persistence of these impacts, the extent of the impacts within the marine system, and/or possible means of mitigation. In addition, the management plan presented may require revision based on the outcome of any monitoring program.

Table 3. Palm Beach Harbor ODMDS Monitoring Strategies and Thresholds for Action

Goal	Technique	Sponsor	Rationale	Frequency	Threshold for Action	Management Options	
						Threshold Not Exceeded	Threshold Exceeded
Measure Extent of Disposal Mound Footprint	Bathymetric Surveys	COE/ Site User	Determine areal influence of dredged material and potential for effects outside of boundaries	Initial site use and for significant projects (>100,000cy)	Disposal mound footprint occurs outside ODMDS boundaries	Continue to use site without restrictions	-Restrict disposal volumes -Modify disposal method/placement -Institute Chemical and Biological Monitoring to determine impact (Environmental Effects).
	Sediment Profile Imaging	COE/ EPA	Determine extent of disposal mound ‘apron’	following significant project at one of the SE FL ODMDSs	Disposal mound footprint occurs outside ODMDS boundaries (5cm)	Continue to use site without restrictions	-Restrict disposal volumes -Modify disposal method/placement -Institute Chemical and Biological Monitoring to determine impact (Environmental Effects).
Determine Likelihood of Disposal Plume Reaching Reefs	DiPRiS[1]	EPA/ NOAA	Determine potential for impact to nearshore reefs	In progress	Suspended sediment concentrations at reefs are elevated due to dredged material disposal	Continue monitoring with unrestricted disposal	-Restrict disposal during onshore current events -Implement Reef Impact Study
Environmental Effects Monitoring	Chemical Monitoring	EPA/ COE	Determine if chemical contaminants are significantly elevated[2] within and outside of site boundaries	Implement if disposal mounds extends beyond site boundaries	Contaminants are found to be elevated[2]	Discontinue monitoring unless disposal quantities, type of material or frequency of use significantly changes	-Institue Advanced Chemical and/or Biological Monitoring to determine impact. (Advanced Environmental Effects) -Restrict Disposal
	Benthic Monitoring & Sediment Profile Imaging	EPA/ COE	Determine whether there are adverse changes in the benthic populations outside of the site and evaluate recovery rates		Adverse changes observed outside of site that may endanger the marine environement		-Limit quantity of dredged material to prevent impacts outside boundaries -Create berms to restrict dredged material movement -Cease site use

Table 3 (Continued). Palm Beach Harbor ODMDS Monitoring Strategies and Thresholds for Action

Goal	Technique	Sponsor	Rationale	Frequency	Threshold for Action	Management Options	
						Threshold Not Exceeded	Threshold Exceeded
Advanced Environmental Effects Monitoring	Chemical Tissue Analysis	EPA/ COE	Determine if site is source of adverse bioaccumulation which may endanger the marine environment	Implement if environmental effects monitoring warrants.	Benthic body burdens greater within footprint than outside	Discontinue monitoring unless disposal quantities, type of material or frequency of use significantly changes	-Discontinue site use -Implement case specific management options (ie. remediation,limits on quantities or types of material).
	Benthic Monitoring	EPA/ COE	Determine if site is source of adverse sublethal changes in benthic organisms which may endanger the marine environment		Sub-lethal effects are unacceptable		
Compliance	Disposal Site Use Records	Site User	-Insure management requirements are being met -To assist in site monitoring	Daily during any project	Disposal records required by SMMP are not submitted or are incomplete	Continue Monitoring	-Restrict site use until requirements are met
					Review of records indicates a dump occurred outside ODMDS boundary	Continue Monitoring	-Notify EPA Region 4/COE, and investigate why egregious dump(s) occurred. Take appropriate enforcement action.
					Review of records indicates a dump occurred in the ODMDS but not in target area	Continue Monitoring	-Direct placement to occur as specified.

Table 3 (Continued). Palm Beach Harbor ODMDS Monitoring Strategies and Thresholds for Action

Goal	Technique	Sponsor	Rationale	Frequency	Threshold for Action	Management Options	
						Threshold Not Exceeded	Threshold Exceeded
Trend Assessment Survey	Chemical and/or Biological Measurements (40CFR 228.13)	EPA/ COE	Document and assess changes at the disposal site	As funding allows. Goal is once every 10 years.	Not applicable	Not applicable	Not applicable

[1] Disposal Plume Reef Impact Study: This study is currently being conducted at the Miami ODMDS. Results are expected to be applicable to the Port Everglades ODMDS.
[2] Significantly elevated: Concentrations above the range of contaminant levels in dredged sediments that the Regional Administrator and the District engineer found to be suitable for disposal at the ODMDS.

Reporting and Data Formatting. The user will be required to prepare daily reports of operations and submit to the COE a monthly report of operations for each month or partial month's work. Disposal monitoring data shall be delivered to the COE on a weekly basis. The user is also required to notify the COE and the EPA within 24 hours if a violation of the permit and/or contract conditions related to MPRSA Section 103 or SMMP requirements occur during disposal operations.

Disposal summary reports shall be provided by the COE to EPA within 90 days after project completion. These should consist of dates of disposal, volume of disposal, approximate location of disposal (summary plot) and pre and post disposal bathymetric survey results in both hard and electronic formats. Other disposal monitoring data shall be made available upon request. In addition, EPA should be notified by the Corps of Engineers 15 days prior to the beginning of a dredging cycle or project disposal.

Material tracking, disposal effects monitoring and any other data collected shall be coordinated with and be provided to SMMP team members and federal and state agencies as appropriate. Data will be provided to other interested parties requesting such data to the extent possible. Data will be provided for all surveys in a report generated by the action agency. The report should indicate how the survey relates to the SMMP and previous surveys at the Palm Beach Harbor ODMDS and should provide data interpretations, conclusions, and recommendations, and should project the next phase of the SMMP.

MODIFICATION OF THE PALM BEACH HARBOR ODMDS SMMP

Should the results of the monitoring surveys or valid reports from other sources indicate that continued use of the ODMDS would lead to unacceptable effects, then the ODMDS SMMP will be modified to mitigate the adverse impacts. The SMMP will be reviewed and revised if appropriate at a minimum of every ten years. The SMMP will be reviewed and updated as necessary if site use changes significantly. For example, the SMMP will be reviewed if the quantity or type of dredged material placed at the site changes significantly or if conditions at the site indicate a need for revision. Modification will be preceded by contact of all participating team members regarding issues and proposed changes. If any member requests a meeting, a meeting or conference call will be held to discuss issues and proposed changes. Significant changes to the SMMP will be noticed in a local paper for public comment.

REFERENCES

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Pequegnat, Willis E., Gallaway, Benny J., and Wright, Thomas D., 1990. *Revised Procedural Guide for Designation Surveys of Ocean Dredged Material Disposal Sites*, Technical Report D-90-8, US Army Engineer Waterways Experiment Station, Vicksburg, MS.

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PALM BEACH HARBOR ODMDS SMMP
APPENDIX A

WATER COLUMN EVALUATIONS
NUMERICAL MODEL (STFATE) INPUT PARAMETERS

Water Column Evaluations
Numerical Model (STFATE) Input Parameters
Palm Beach Harbor ODMDS

SITE DESCRIPTION

Parameter	Value	Units
Number of Grid Points (left to right)	40	
Number of Grid Points (top to bottom)	40	
Spacing Between Grid Points (left to right)	500	ft
Spacing Between Grid Points (top to bottom)	500	ft
Constant Water Depth	558	ft
Roughness Height at Bottom of Disposal Site	.005[1]	ft
Slope of Bottom in X-Direction	0	Deg.
Slope of Bottom in Z-Direction	1	Deg.
Number of Points in Ambient Density Profile[2] Point	4	
Ambient Density at Depth = 0 ft	1.0247	g/cc
Ambient Density at Depth = 82 ft	1.0249	g/cc
Ambient Density at Depth = 164 ft	1.0259	g/cc
Ambient Density at Depth = 558 ft	1.0279	g/cc

AMBIENT VELOCITY DATA[3]

Parameter	Value	Units
Profile	2-Point	
X-Direction Velocity at Depth of 33 feet	- 2.7	ft/sec
Z-Direction Velocity at Depth of 197 feet	+1.1	ft/sec
X-Direction Velocity at Depth of 33 feet	- 2.2	ft/sec
Z-Direction Velocity at Depth of 197 feet	+0.9	ft/sec

DISPOSAL OPERATION DATA

Parameter	Value	Units
Location of Disposal Point from Top of Grid	14,000	ft
Location of Disposal Point from Left Edge of Grid	10,000	ft
Dumping Over Depression	0	

INPUT, EXCECUTION AND OUTPUT

Parameter	Value	Units
Location of the Upper Left Corner of the Disposal Site - Distance from Top Edge	11,000	ft
Location of the Upper Left Corner of the Disposal Site - Distance from Left Edge	7,000	ft
Location of the Lower Right Corner of the Disposal Site - Distance from Top Edge	17,000	ft
Location of the Lower Right Corner of the Disposal Site - Distance from Left Edge	13,000	ft
Duration of Simulation	14,400	sec
Long Term Time Step	600	sec

COEFFICIENTS

Parameter	Keyword	Value
Settling Coefficient	BETA	0.000[1]
Apparant Mass Coefficient	CM	1.000[1]
Drag Coefficient	CD	0.500[1]
Form Drag for Collapsing Cloud	CDRAG	1.000[1]
Skin Friction for Collapsing Cloud	CFRIC	0.010[1]
Drag for an Ellipsoidal Wedge	CD3	0.100[1]
Drag for a Plate	CD4	1.000[1]
Friction Between Cloud and Bottom	FRICTN	0.010[1]
4/3 Law Horizontal Diffusion Dissipation Factor	ALAMDA	0.001[1]
Unstratified Water Vertical Diffusion Coefficient	AKYO	Pritchard Expression

Parameter	Keyword	Value
Cloud/Ambient Density Gradient Ratio	GAMA	0.250[1]
Turbulent Thermal Entrainment	ALPHAO	0.390[4]
Entrainment in Collapse	ALPHAC	0.100[1]
Stripping Factor	CSTRIP	0.003[1]

[1]Model Default Value
[2]Profiles from EPA 1998 measurements
[3]Velocity data represents average conditions. Determined from WES 1998 analysis of ADCP data offshore Ft. Lauderdale, FL.
[4]Calculated from NOAA Field Work at Miami (1991)

Dilution Rates for Generic Material:
Minimum dilution outside disposal site: 15,000 to 1
Minimum dilution after 4 hours: 36,000 to 1

PALM BEACH HARBOR ODMDS SMMP
APPENDIX B

TEMPLATE FOR MPRSA 103 STANDARD PERMIT CONDITIONS

TEMPLATE
GENERIC SPECIAL CONDITIONS
FOR MPRSA SECTION 103 PERMITS
PALM BEACH HARBOR, FL ODMDS

I. DISPOSAL OPERATIONS

A. For this permit, the term disposal operations shall mean: navigation of any vessel used in disposal of operations, transportation of dredged material from the dredging site to the Palm Beach Harbor, FL ODMDS, proper disposal of dredged material at the disposal area within the Palm Beach Harbor, FL ODMDS, and transportation of the hopper dredge or disposal barge or scow back to the dredging site.

B. The Palm Beach Harbor, FL ODMDS is defined as the rectangle with center coordinates of 26°47.00' North latitude by 79°56.59' West longitude (NAD 83) or state plane coordinates 891846.0 N and 1000961.1 E (NAD83). The corner coordinates are as follows:

Geographic (NAD83)		State Plane (Florida East 0901 U.S. Feet NAD83)	
26°47.50' N	79°57.15' W	894850.2 N	997890.9 E
26°47.50' N	79°56.03' W	894900.8 N	1003980.9 E
26°46.50' N	79°57.15' W	888791.3 N	997940.8 E
26°46.50' N	79°56.03' W	888841.9 N	1004031.7 E

C. No more than [NUMBER] cubic yards of dredged material excavated at the location defined in [REFERENCE LOCATION IN PERMIT] are authorized for disposal at the Palm Beach Harbor, FL ODMDS.

D. The permittee shall use an electronic positioning system to navigate to and from the Palm Beach Harbor, FL ODMDS. For this section of the permit, the electronic positioning system is defined as: a differential global positioning system or a microwave line of site system. Use of LORAN-C alone is not an acceptable electronic positioning system for disposal operations at the Palm Beach Harbor, FL ODMDS. If the electronic positioning system fails or navigation problems are detected, all disposal operations shall cease until the failure or navigation problems are corrected.

E. The permittee shall certify the accuracy of the electronic positioning system proposed for use during disposal operations at the Palm Beach Harbor, FL ODMDS. The certification shall be accomplished by direct comparison of the electronic positioning system's accuracy with a known fixed point.

F. The permittee shall not allow any water or dredged material placed in a hopper dredge or disposal barge or scow to flow over the sides or leak from such vessels during transportation to the Palm Beach Harbor, FL ODMDS.

G. A disposal operations inspector and/or captain of any tug boat, hopper dredge or other vessel used to transport dredged material to the Palm Beach Harbor, FL ODMDS shall insure compliance with disposal operation conditions defined in this permit.

1. If the disposal operations inspector or the captain detects a violation, he shall report the violation to the permittee immediately.

2. The permittee shall contact the U.S. Army Corps of Engineers, Jacksonville District's Regulatory Branch [TELEPHONE NUMBER] and EPA Region 4 at (404) 562-9391 to report the violation within twenty-four (24) hours after the violation occurs. A complete written explanation of any permit violation shall be included in the post-dredging report.

H. When dredged material is disposed, no portion of the hopper dredge or disposal barge or scow shall be outside of the boundaries of the Palm Beach ODMDS as defined in Special Condition B. Additionally, disposal shall occur within the disposal zone defined as a 600 foot radius with center at:

26º47.00' North latitude by 79º56.59' West longitude (NAD 83)

I. The permittee shall use an automated disposal verification system that will continuously track (1 to 5 minute intervals) the horizontal location and draft condition of the disposal vessel (hopper dredge or disposal barge or scow) to and from the Palm Beach Harbor ODMDS. This information shall be available in electronic format to the Jacksonville District Corps of Engineers and EPA Region 4 upon request.

1. Required digitally recorded data are: date, time, vessel name, captain of vessel, beginning and ending coordinates of the dredging area for each load, location at points of initiation and completion of disposal, description of material disposed (sand, clay or silt), volume of load, and disposal technique. This information will be available to the Jacksonville District Corps of Engineers on a daily basis.

2. The permittee shall use Florida State Plane or latitude and longitude coordinates (North American Datum 1983 or 1927). State Plane coordinates shall be reported to the nearest 0.10 foot and latitude and longitude coordinates shall be reported as degrees and decimal minutes to the nearest 0.01 minutes.

J. The permittee shall conduct a bathymetric survey of the Palm Beach Harbor ODMDS within 30 days following project completion.

1. The number and length of the survey transects shall be sufficient to encompass the Palm Beach ODMDS and a 500 foot wide area around the site. The transects shall be spaced at 500-foot intervals or less with a depth recording density of 20 to 70 feet..

2. Vertical accuracy of the survey shall be ±0.1 feet. Horizontal location of the survey lines and depth sounding points will be determined by an automated positioning system utilizing either microwave line of site system or differential global positioning system. The vertical datum will be referenced to prescribed NOAA Mean Lower Low Water (MLLW) datum. MLLW is 1.8 feet below NGVD 1929. The horizontal datum will be Florida State Plane (zone 0901 FL East) or Geographic (NAD 1983). State Plane coordinates shall be reported to the nearest 0.10 foot and latitude and longitude coordinates shall be reported as degrees and decimal minutes to the nearest 0.01 minutes.

K. The permittee has read and agrees to assure that they are in compliance with the requirements of the Palm Beach ODMDS Site Management and Monitoring Plan.

II. REPORTING REQUIREMENTS

A. The permittee shall send the U.S. Army Corps of Engineers, Jacksonville District's Regulatory Branch and EPA Region 4' s Wetlands, Coastal and Watersheds Branch (61 Forsyth Street, Atlanta, GA 30303) a notification of commencement of work at least fifteen (15) days before initiation of any dredging operations authorized by this permit.

B. The permittee shall submit to the U.S. Army Corps of Engineers weekly disposal monitoring reports. These reports shall contain the information described in Special Condition I.I.

C. The permittee shall send one (1) copy of the disposal summary report to the Jacksonville District's Regulatory Branch and one (1) copy of the disposal summary report to EPA Region 4 documenting compliance with all general and special conditions defined in this permit. The disposal summary report shall be sent within 90 days after completion of the disposal operations authorized by this permit. The disposal summary report shall include the following information:

1. The report shall indicate whether all general and special permit conditions were met. Any violations of the permit shall be explained in detail.

2. The disposal summary report shall include the following information: Corps permit number, actual start date and completion date of dredging and disposal operations, total cubic yards disposed at the Palm Beach Harbor, FL ODMDS, locations of disposal events, and post disposal bathymetric survey results (in hard and electronic formats).

III. PERMIT LIABILITY

A. The permittee shall be responsible for ensuring compliance with all conditions of this permit.

B. The permittee and all contractors or other third parties who perform an activity authorized by this permit on behalf of the permittee shall be separately liable for a civil penalty of up to $50,000 for each violation of any term of this permit thy commit alone or in concert with the permittee or other parties. This liability shall be individual, rather than joint and several, and shall not be reduced in any fashion to reflect the liability assigned to and civil penalty assessed against the permittee or any other third party as defined in 33 U.S.C. Section 1415(a).

C. If the permittee or any contractor or other third party knowingly violates any term of this permit (either alone or in concert), the permittee, contractor or other party shall be individually liable for the criminal penalties set forth in 33 U.S.C. Section 1415(b).

PALM BEACH HARBOR ODMDS SMMP

Appendix C

Jacksonville District Corps of Engineers
Contract Specification Language

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Jacksonville District Corps of Engineers Contract Specification Language

3.3 DISPOSAL OF EXCAVATED MATERIAL

3.3.1 General

Material excavated shall be transported to and deposited in the disposal areas designated on the drawings. The average distance to which the material will have to be transported is approximately 4.9 miles and the maximum distance will be approximately 6.6 miles.

3.3.2 General [Ocean Dredged Material Disposal Site (ODMDS)]

The material excavated shall be transported to and deposited in the ODMDS designated as "Ocean Disposal Area - O" as shown on the drawings. The material shall be dumped within <u>600 feet</u> of the center of the ODMDS (X,Y Coordinates: 1000961.1 E, 891846.0 N) or (Geographic Coordinates: 26° W 47.00′ N; 079° 56.59′ W). The state plane coordinates are based on the Transverse Mercator Projection for Florida, East Zone, North Atlantic Datum 1983. Dredged material shall not be placed higher than elevation -30 feet MLLW in "Ocean Disposal Area - O".

3.3.17 Electronic Tracking System (ETS) for Ocean Disposal Vessels

The Contractor shall furnish an ETS for surveillance of the movement and disposition of dredged material during [excavation and ocean disposal] [excavation and disposal (nearshore and ocean)]. This ETS shall be established, operated and maintained by the Contractor to continuously track in real-time the horizontal location and draft condition of the disposal vessel for the entire dredging cycle, including dredging area and disposal area. The ETS shall be capable of displaying and recording in real-time the disposal vessel's draft and location.

3.3.17.1 ETS Standards

The Contractor shall provide automated (computer) system and components to perform in accordance with COE EM 1110-1-2909. A copy of the EM can be downloaded from the following web site: http://www.usace.army.mil/inet/usace-docs'eng-manuals/em.htm. Horizontal location shall have an accuracy equal to or better than a standard DGPS system, equal to or better than plus/minus 10 feet (horizontal repeatability). Vertical (draft) data shall have an accuracy of plus/minus 0.5 foot. Horizontal location and vertical data shall be collected in sets and each data set shall be referenced in real-time to date and local time (to nearest minute), and shall be referenced to the same state plane coordinate system used for the survey(s) shown in the contract plans. The ETS shall be calibrated, as required, in the presence of the Contracting Officer at the work location before disposal operations have started, and at 30-day intervals while work is in progress. The Contracting Officer shall have access to the ETS in order to observe its operation. Disposal operations will not commence until the ETS to be used by the Contractor is certified by the Contracting Officer to be operational and within acceptable accuracy. It is the Contractor's responsibility to select a system that will operate properly at the work location. The complete system shall be subject to the Contracting Officer's approval.

3.3.17.2 ETS Data Requirements and Submissions

a. The ETS for each disposal vessel shall be in operation for all dredging and disposal activities and shall record the full round trip for each loading and disposal cycle. (NOTE: A dredging and disposal cycle constitutes the time from commencement of dredging to complete discharge of the material.) The Contracting Officer shall be notified immediately in the event of ETS failure and all dredging operations for the vessel shall cease until the ETS is fully operational. Any delays resulting from ETS failure shall be at the Contractor's expense.

b. All data shall be collected and stored on 3 1/2-inch discs or CD-ROM(s) in ASCII format and shall be readable by MS Windows compatible software. Each dredging and disposal cycle shall be a separate and distinct ASCII file, labeled by the trip number. More than one file may be stored on the disc(s) or CD-ROM(s).

c. Data shall be collected, during the dredging and disposal cycle, every 500 feet (at least) during travel to the disposal area, and every minute or every 200 feet, whichever is smaller, while approaching within 1,000 feet and within the disposal area.

d. The required digital data to be collected for each dredging and disposal cycle includes the following:

(1) Trip Number
(2) Date
(3) Time
(4) Vessel ID
(5) Vessel Captain
(6) State Plane X Coordinate - in accordance with subparagraph c. above
(7) State Plane Y Coordinate - in accordance with subparagraph c. above
(8) Vessel Draft
(9) Type of Disposal Vessel
(10) Exact State Plane X and Y coordinate at start of dump
(11) Volume of Material Disposed

e. Plot Reporting (2 types):

(1) Tracking Plot - For each disposal event, data collected while the disposal vessel is in the vicinity of the disposal area shall be plotted in chart form, in 200-foot intervals, to show the track and draft of the disposal vessel approaching and traversing the disposal area. The plot shall identify the exact position at which the dump commenced. A sample Track and Draft Plot Diagram is on the web site indicated in paragraph CONSTRUCTION FORMS AND DETAILS below.

(2) Scatter Plot - Following completion of all disposal events, a single and separate plot will be prepared to show the exact disposal locations of all dumps. Every plotted location shall coincide with the beginning of the respective dump. Each dump shall be labeled with the corresponding Trip Number and shall be at a small but readable scale. A sample Scatter Plot Diagram is on the web site indicated in paragraph CONSTRUCTION FORMS AND DETAILS below.

(3) Summary Table - A spreadsheet which contains all of the information described in subparagraph d. above shall be prepared and shall correspond to the exact dump locations represented on the Scatter Plot Diagram. A sample Summary Table spreadsheet is on the web site indicated in paragraph CONSTRUCTION FORMS AND DETAILS below.

f. All digital ETS data shall be furnished to the Contracting Officer within 24 hours of collection. The digital plot files should be in an easily readable format such as Adobe Acrobat PDF file, Microstation DGN file, JPEG, BMP, TIFF, or similar. The hard copy of the ETS data and tracking plots shall be both maintained onboard the vessel and submitted to the Contracting Officer on a weekly basis.

SAMPLE SUMMARY SPREADSHEET

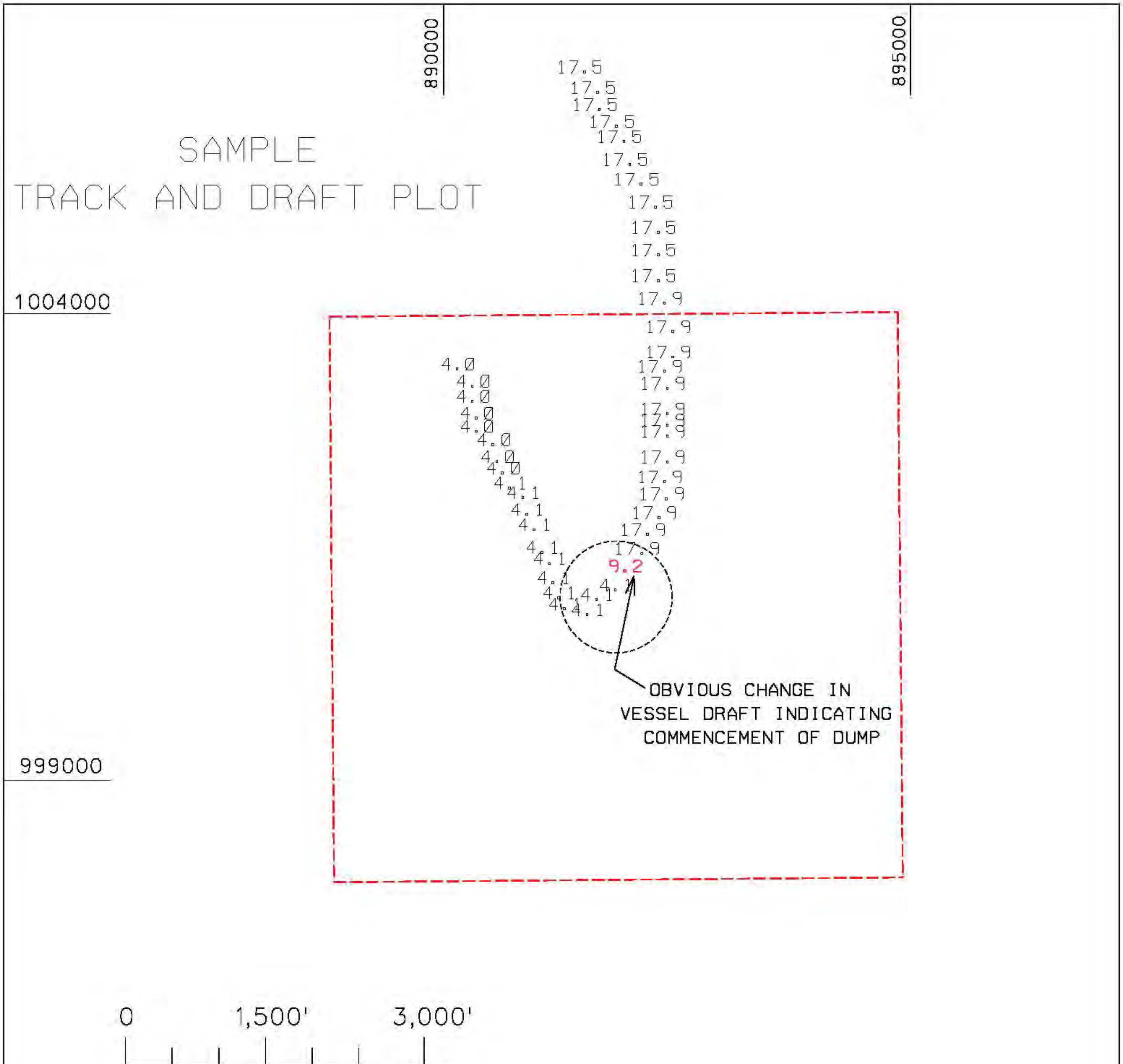
ETS Date Sheet: Palm Beach Harbor MD, W912P-XX-X-XXXX
Master ETS Dump Log to Accompany Scatter Plots

--Data to be extracted from ETS ASCII Data files--

DATE	TIME	LOADNO	CHAN	CUYDS	CAPTAIN	DRAFT*	EQUIPMENT	**BEGDUMPN**	**BEGDUMPE**	ENDUMPN	ENDUMPE
06/15/02	1400	0001	AS1		Nichols	10.8	Scow 3002	**1448772**	**814016**	1448677	814060
06/15/02	1320	0002	AS1	2,453	Nichols	9.7	Scow 3001	**1448465**	**814471**	1448383	814563
06/16/02	0800	0003	AS1	2,567	Nichols	4.3	Scow 3002	**1447989**	**813558**	1447861	813622
06/16/02	1400	0004	AS1	2,567	Nichols	4.3	Scow 3001	**1448049**	**813706**	1447981	813755
06/16/02	1320	0005	AS1	2,818	Nichols	9	Scow 3002	**1447967**	**814014**	1447843	814118
06/16/02	0800	0006	AS1	2,567	Nichols	12.2	Scow 3001	**1449087**	**814761**	1449015	814832
06/16/02	1430	0007	AS1	2,453	Nichols	4.3	Scow 3002	**1448123**	**814497**	1448034	814552
06/16/02	1400	0008	AS1	1,517	Nichols	5	Scow 3001	**1448487**	**813889**	1448448	813917
06/17/02	1320	0009	AS1	1,563	Nichols	4.2	Scow 3002	**1446384**	**813383**	1446198	813476
06/17/02	0800	0010	AS1	2,589	Nichols	11.4	Scow 3001	**1448097**	**813833**	1448028	813893
06/17/02	1400	0011	AS1	2,886	Nichols	10.7	Scow 3002	**1445275**	**814369**	1445151	814465
06/17/02	1320	0012	AS1	2,772	Nichols	12.2	Scow 3001	**1445293**	**815594**	1445308	815682
06/17/02	0800	0013	AS1	2,681	Nichols	4.7	Scow 3002	**1444986**	**815579**	1444940	815741
06/17/02	1430	0014	AS1	2,567	Nichols	10.5	Scow 3001	**1445861**	**815663**	1445856	815760
06/17/02	1400	0015	AS1	2,749	Nichols	11.8	Scow 3002	**1444683**	**815297**	1444761	815422
06/18/02	1320	0016	AS1	2,521	Nichols	4.3	Scow 3001	**1445098**	**815121**	1445136	815220
06/18/02	0800	0017	AS1	2,886	Nichols	5.1	Scow 3002	**1445633**	**813658**	1445624	813816
06/18/02	1400	0018	AS1	2,818	Nichols	5.2	Scow 3001	**1445551**	**815476**	1445616	815549
06/18/02	1320	0019	AS1	2,612	Nichols	11	Scow 3002	**1445509**	**813621**	1445500	813761
06/18/02	0800	0020	AS1	2,567	Nichols	4.3	Scow 3001	**1445180**	**814844**	1445127	814944
				2,795							

* DRAFT AT COMMENCEMENT OF DUMP

SAMPLE
TRACK AND DRAFT PLOT



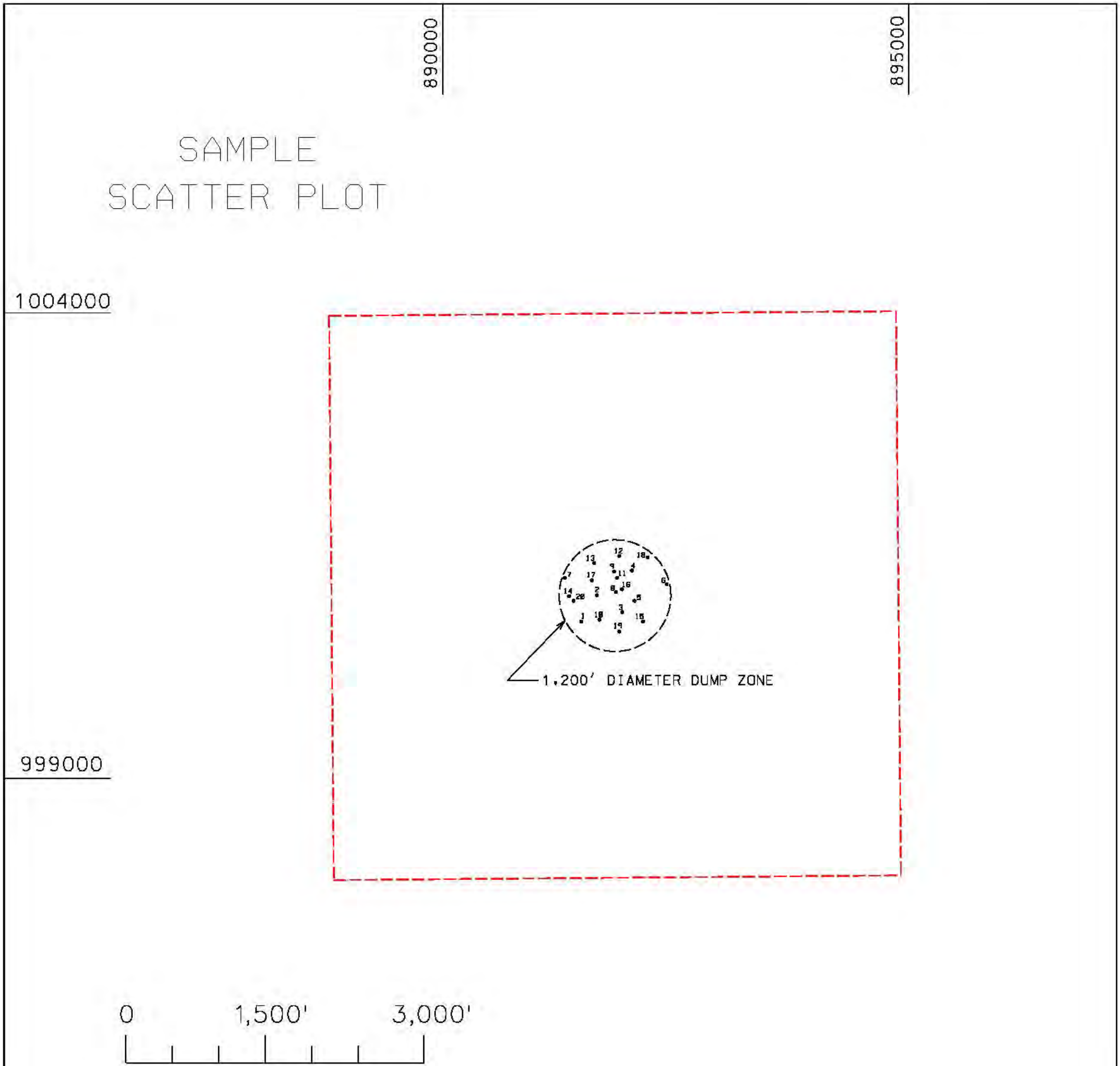
PALM BEACH ODMDS

PROJECT NAME: PALM BEACH, MAINTENANCE DREDGING

CONTRACT NUMBER: W912EP-XX-X-XXXX

DATE OF TRIP: 1 JUN 01 TRIP NUMBER: 1-20

SAMPLE
SCATTER PLOT



PALM BEACH ODMDS

PROJECT NAME: PALM BEACH, MAINTENANCE DREDGING

CONTRACT NUMBER: W912EP-XX-X-XXXX

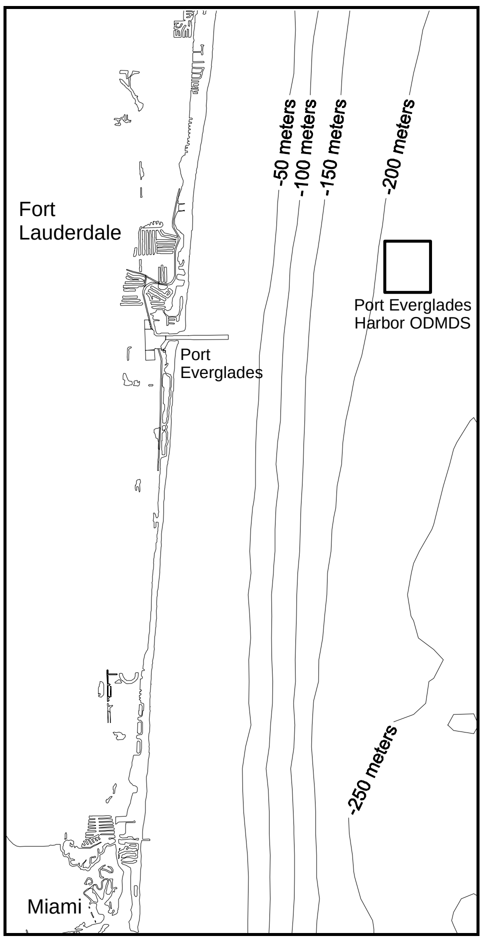
DATE OF TRIP: 1 JUN 01 TRIP NUMBER: 20

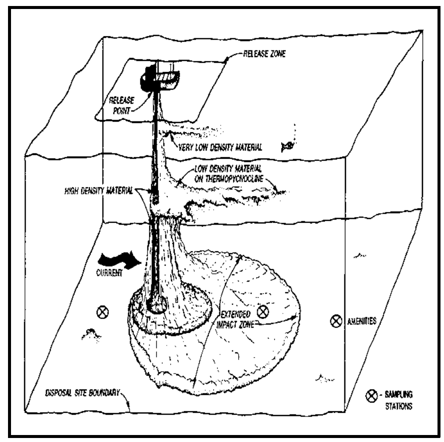
July 2004

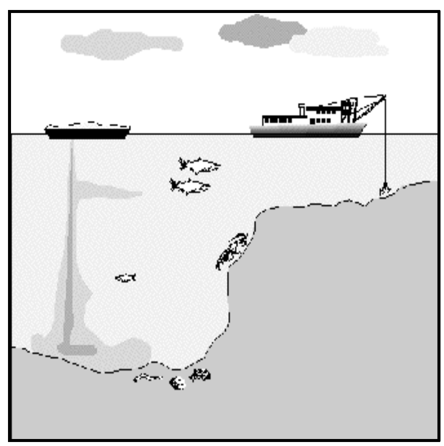
PORT EVERGLADES HARBOR
OCEAN DREDGED MATERIAL DISPOSAL SITE

U.S. Army Corps
of Engineers

DRAFT
SITE MANAGEMENT
AND MONITORING PLAN







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The following Site Management and Monitoring Plan for the Palm Beach Harbor ODMDS has been developed and agreed to pursuant to the Water Resources Development Act Amendments of 1992 (WRDA 92) to the Marine Protection, Research, and Sanctuaries Act of 1972 for the management and monitoring of ocean disposal activities, as resources allow, by the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers.

Robert M. Carpenter	Date	James D. Giattina	Date
Colonel, U.S. Army		Director	
District Engineer		Water Management Division	
Jacksonville District		U.S. Environmental Protection Agency	
U.S. Army Corps of Engineers		Region 4	
P.O. Box 4970		Atlanta, Georgia	
Jacksonville, Florida			

This plan is effective from the date of signature for a period not to exceed 10 years. The plan shall be reviewed and revised more frequently if site use and conditions at site indicate a need for revision.

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PORT EVERGLADES HARBOR OCEAN DREDGED MATERIAL DISPOSAL SITE (ODMDS)
SITE MANAGEMENT AND MONITORING PLAN

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INTRODUCTION

It is the responsibility of the U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (COE) under the Marine Protection, Research, and Sanctuaries Act (MPRSA) of 1972 to manage and monitor each of the Ocean Dredged Material Disposal Sites (ODMDSs) designated by the EPA pursuant to Section 102 of MPRSA. The MPRSA, the Water Resources Development Act (WRDA) of 1992, and a Memorandum of Agreement between EPA and COE require the development of a site management and monitoring plan (SMMP) to specifically address the disposal of dredged material at the Port Everglades Harbor ODMDS. SMMP provisions shall establish requirements for all dredged material disposal activities at the site. All Section 103 (MPRSA) ocean disposal permits or evaluations shall be conditioned as necessary to assure consistency with the SMMP.

Site Management and Monitoring Plan Team. An interagency SMMP team has been established to assist EPA and COE in finalizing this SMMP. The team consists of the following agencies and their respective representatives:

Jacksonville District Corps of Engineers

State of Florida

EPA Region 4

Port of Port Everglades

U.S. Coast Guard

NOAA

Other agencies such as the National Marine Fisheries Service (NMFS) and the Fish and Wildlife Service (FWS) will be asked to participate where appropriate. The SMMP team will assist EPA in evaluating existing monitoring data, the type of disposal (i.e., O&M vs. construction), the type of material (i.e., sand vs. mud), location of placement within the ODMDS and quantity of material. The team will assist EPA and COE on deciding on appropriate monitoring techniques, the level of monitoring, the significance of results and potential management options.

SITE MANAGEMENT

Section 228.3 of the Ocean Dumping Regulations (40 CFR 220-229) states: "Management of a site consists of regulating times, rates, and methods of disposal and quantities and types of materials disposed of; developing and maintaining effective ambient monitoring programs for the site; conducting disposal site evaluation studies; and recommending modifications in site use and/or designation." This plan may be modified if it is determined that such changes are warranted as a result of information obtained during the monitoring process.

Disposal Site Characteristics

The Port Everglades Harbor ODMDS is a 1 nmi by 1 nmi square area centered at the coordinates 26º 07.00'N latitude and 80º 01.50'W longitude (NAD83) or state plane coordinates 649292.4 N and 976098.2 E (NAD83). The corner coordinates are as follows:

Geographic (NAD83)		**State Plane (Florida East 0901 U.S. Feet NAD83)**	
26º07.50'N	80º02.00'W	652301.1 N	973341.1 E
26º07.50'N	80º01.00'W	652342.1 N	978810.0 E
26º06.50'N	80º02.00'W	646242.9 N	973386.1 E
26º06.50'N	80º01.00'W	646283.9 N	978855.7 E

The site is 4 nmi offshore, has a depth range of 195 to 215 meters (640 to 705 feet), and an area of 1 nmi^2.

Management Objectives. There are three primary objectives in the management of each ODMDS. These are:

- o Protection of the marine environment;
- o Beneficial use of dredged material whenever practical; and
- o Documentation of disposal activities at the ODMDS.

The following sections provide the framework for meeting these objectives to the extent possible.

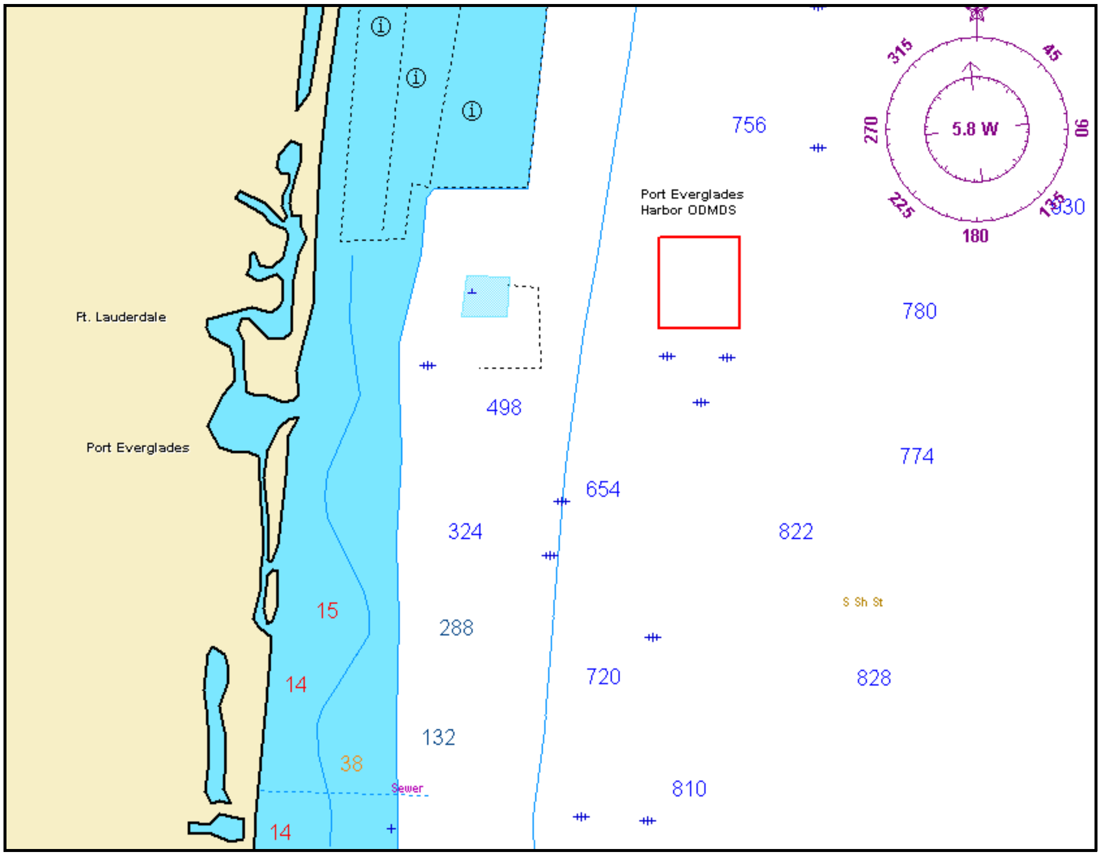

Figure 1: Port Everglades ODMDS Location Map

Material Volumes. It is intended that the Port Everglades Harbor ODMDS will be used for disposal of dredged material (both maintenance and construction or new work material) from the Port Everglades Harbor and vicinity. The primary user of the ODMDS will be the U.S. Army Corps of Engineers for maintenance of the Port Everglades Harbor Federal Project. The Port Everglades Harbor ODMDS has not been previously used for disposal of dredged material. The interim site located approximately 1.6 nautical miles from shore was previously used for ocean disposal of dredged material from Port Everglades Harbor. 219,000 cubic yards of dredged material had been disposed at the Interim site since 1976 with the last disposal of 16,400 cubic yards occurring in 1982 (WES, 1999).

The Jacksonville District Corps of Engineers has projected annual average disposal rates of 30,000 cubic yards. However, annual disposal events are unlikely. Maintenance dredging project sizes have ranged from 26,000 cubic yards to 144,000 cubic yards including portions used for beneficial uses (Brodehl, 2003). Maintenance disposal volumes at the ODMDS will likely fall within or less than these ranges. Future potential additional projects include a construction project at Port Everglades Harbor. Dredged material volumes from this project have been estimated at 7 million cubic yards. The COE is in the process of developing a Draft General Re-Evaluation Report which will provide disposal volumes and evaluate alternatives.

The capacity of the Port Everglades Harbor ODMDS has not been determined. Modeling conducted by the Coastal Engineering Research Center (CERC) was conducted for a single project volume up to 500,000 cubic yards. Therefore, use of the ODMDS will be restricted to 500,000 cubic yards of dredged material per project. Projects in excess of 500,000 cubic yards of dredged material will require additional capacity studies prior to utilization of the ODMDS.

Material Suitability. Material from Port Everglades Harbor is variable depending on location. Sampling in the basin in 1997 showed that the material from the bay was 38% fines by weight. Material from the inlet was only 5% fines. The disposition of any significant quantities of beach compatible sand from future projects will be determined during permitting activities for any such projects. It is expected that the State of Florida will exercise its authority and responsibility, regarding beach nourishment, to the full extent during any future permitting activities. Utilization of any significant quantities of beach compatible dredged material for beach nourishment is strongly encouraged and supported by EPA.

The suitability of dredged material for ocean disposal must be verified by the COE and agreed to (concurred) by EPA prior to disposal. Verification will be valid for three years from the time last verified. Verification will involve: 1) a case-specific evaluation against the exclusion criteria (40 CFR 227.13(b)), 2) a determination of the necessity for testing including bioassay (toxicity and bioaccumulation) testing for non-excluded material based on the potential for contamination of the sediment since last tested, and 3) carrying out the testing (where needed) and determining that the non-excluded, tested material is suitable for ocean disposal.

Documentation of verification will be completed prior to use of the site. Documentation will be in the form of a MPRSA Section 103 Evaluation. The Evaluation and any testing will follow the procedures outlined in the 1991 EPA/COE Dredged Material Testing Manual and 1993 Regional Implementation Manual (RIM) or the appropriate updated versions. This includes how dredging projects will be subdivided into project segments for sampling and analysis. The MPRSA Section 103 Evaluation will be in the form outlined in Appendix B of the RIM. Only material determined to be suitable through the verification process by the COE and EPA will be placed at the Port Everglades Harbor ODMDS.

Time of disposal. At present no restrictions have been determined to be necessary for disposal related to seasonal variations in ocean current or biotic activity. As monitoring results are compiled, should any such restrictions appear necessary, disposal activities will be scheduled so as to avoid adverse impacts. Additionally, if new information indicates that endangered or threatened species are being adversely impacted, restrictions may be imposed.

Disposal Technique. No specific disposal technique is required for this site. Standard surveillance and evasive measures to protect sea turtles and marine mammals shall be employed during all disposal operations at the ODMDS.

Disposal Location. Based on modeling efforts, disposal should occur within 600 feet of the center of the Port Everglades Harbor ODMDS to prevent the disposal mound from exceeding site boundaries (EPA, 1999). This release zone can be modified based on results from any capacity study and post-disposal bathymetric surveys.

Permit and Contract Conditions. The disposal monitoring and post-disposal monitoring requirements described under Site Monitoring will be included with the management requirements described in this section as permit conditions on all MPRSA Section 103 permits and will be incorporated in the contract language for all federal projects. A summary of the management and monitoring requirements to be included are listed in Table 1. Appendix B contains a template for standard permit conditions for MPRSA 103 permits for the Port Everglades Harbor ODMDS and Appendix C contains a template for standard contract conditions for civil works project use of the ODMDS.

Table 1. Summary of Permit and Contract Conditions

Condition	Reference
Dredged Material Suitability and Term of Verification	Port Everglades Harbor ODMDS SMMP page 4 Regional Implementation Manual
Disposal Zone	Port Everglades Harbor ODMDS SMMP page 5
Pre and Post Bathymetric Surveys	Port Everglades Harbor ODMDS SMMP page 8 and 11
Disposal Monitoring	Port Everglades Harbor ODMDS SMMP page 11
Reporting Requirements	Port Everglades Harbor ODMDS SMMP page 16

Permit Process. The permit process is outlined in Figure 2 and consists of 10 main steps:

1. **Preapplication Consultation**: Includes discussion of alternatives and the qualitative and quantitative information required by the District Engineer for use in evaluating the proposed dredged material.
2. **Evaluation of Dredged Material Proposed for Ocean Disposal**: Includes development, approval and implementation of sampling and analysis plan (see Section on Material Suitability). This step should include close coordination between EPA Region 4, the Jacksonville District Corps of Engineers and the applicant.
3. **Permit Application**: According to 33 CFR 325.1, a permit application must include the following:

a. A complete description of the proposed activity, including necessary drawings, sketches, or plans.
b. The location, purpose, and need for the proposed activity; scheduling of the activity; names and addresses of adjoining property owners; location and dimension of adjacent structures
c. A list of authorizations required by other Federal, interstate, State, or local agencies for the work, including all approvals received or denials already made
d. The source of the material; the purpose of the disposal and a description of the type, composition, and quantity of the material (this includes information necessary to determine if the material is in compliance with the criteria); the method of transportation and disposal of the material; and the location of the disposal site.

4. **Review of Application for Completeness**: Additional information is requested if the application is incomplete.
5. **Public Notice**: Per 33 CFR 325.3, Public Notices issued by the USACE for dredged material disposal must include all of the information in 40 CFR 225.2(a) (see RIM). A supplemental, revised or corrected Public Notice will be issued if the District Engineer believes that the new information affects the review of the proposal.
6. **EPA MPRSA Review**: Independent review of the information to determine whether the disposal activity complies with the criteria found in 40 CFR 227 and 228.
7. **District Engineer Completes Evaluation**: The District Engineer addresses comments and holds public meeting if needed.
8. **USACE Public Interest Review**: The USACE must consider all comments, suggestions, and concerns provided by all commenters and incorporate their comments into the administrative record of the application.
9. **Permit Issued**: A decision to issue or deny a permit is discussed in either a Statement of Findings or Record of Decision.
10. **Permit Public Notice**: A list of permit decisions is published and distributed to all interested parties each month.

<u>Information Management of Dredged Material Placement Activities.</u> As discussed in the following sections, a substantial amount of diverse data regarding use of the Port Everglades Harbor ODMDS and effects of disposal is required from many sources (EPA, COE, Port Authority or other site user). If this information is readily available and in a useable format it can be used to answer many questions typically asked about a disposal site:

- What is being dredged?
- How much is being dredged?
- Where did the dredged material come from?
- Where was the dredged material placed?
- Was dredged material dredged correctly? placed correctly?
- What will happen to the environment at the disposal site?

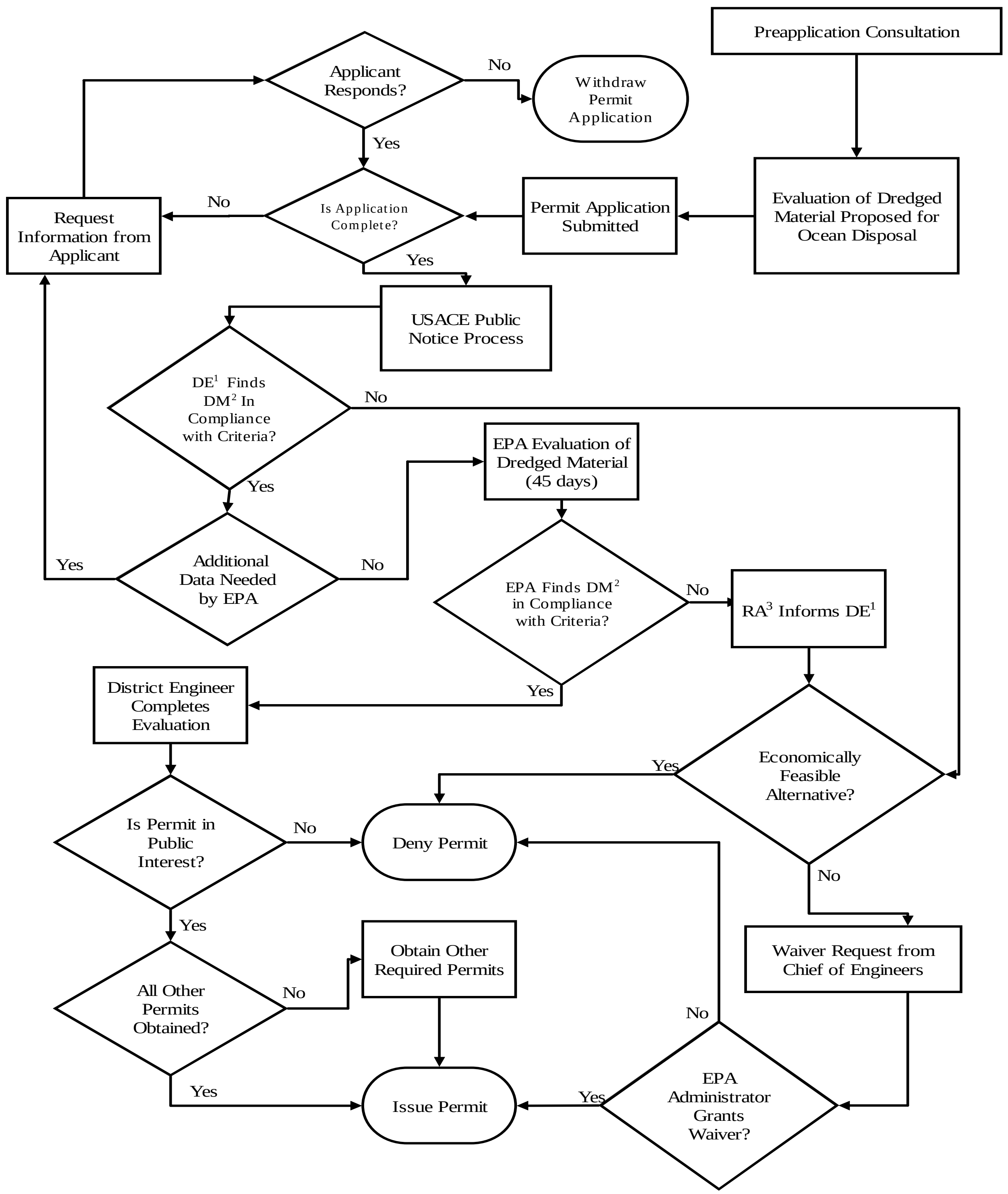

Figure 2: Permit Application/Evaluation Procedure
[1]District Engineer; [2]Dredged Material; [3]Regional Administrator

As part of site management, EPA and the COE will investigate alternatives for appropriate data management.

SITE MONITORING

The MPRSA establishes the need for including a monitoring program as part of the Site Management Plan. Site monitoring is conducted to ensure the environmental integrity of a disposal site and the areas surrounding the site and to verify compliance with the site designation criteria, any special management conditions, and with permit requirements. Monitoring programs should be flexible, cost effective, and based on scientifically sound procedures and methods to meet site-specific monitoring needs. A monitoring program should have the ability to detect environmental change as a result of disposal activities and assist in determining regulatory and permit compliance. The intent of the program is to provide the following:

(1) Information indicating whether the disposal activities are occurring in compliance with the permit and site restrictions; and/or

(2) Information concerning the short-term and long-term environmental impacts of the disposal; and/or

(3) Information indicating the short-term and long-term fate of materials disposed of in the marine environment.

The main purpose of a disposal site monitoring program is to determine whether dredged material site management practices, including disposal operations, at the site need to be changed to avoid significant adverse impacts.

Baseline Monitoring. Site characterization surveys of the ODMDS have been conducted by EPA and the COE as part of the designation process. These are summarized in Table 2. Results from these surveys can be used in part as baseline data for the monitoring of impacts associated with use of the Port Everglades Harbor ODMDS.

A high resolution bathymetric survey will be conducted by the COE or site user within three (3) months prior to initial use of the ODMDS. For subsequent projects, the need for pre-disposal bathymetric surveys will depend on project volumes. Pre-disposal surveys will be required within (3) months prior to dredging cycle or project disposal for projects greater than 100,000 cubic yards. Bathymetric surveys will be used to monitor the disposal mound to assist in verification of material placement, to monitor bathymetry changes and trends and to insure that the site capacity is not exceeded, ie., the mound does not exceed the site boundaries. Surveys will conform to the minimum performance standards for Corps of Engineers Hydrographic Surveys for navigation and dredging support surveys-soft bottom as described in the COE

Engineering Manual, EM1110-2-1003, "Hydrographic Surveying" dated January 1, 2002 to the extent practicable. The number and length of transects required will be sufficient to encompass the ODMDS and a 500 foot wide area around the site. The surveys will be taken along lines spaced at 500-foot intervals or less (200 feet for high resolution survey) with a depth recording density of 20 to 70 feet (less than 20 feet for high resolution survey). Depth precision of the surveys will be ± 0.1 feet and an accuracy of ± 2.0 feet. Horizontal location of the survey lines and depth sounding points will be determined by an automated positioning system utilizing either a microwave line of sight system or differential global positioning system. The vertical datum will be referenced to prescribed NOAA Mean Lower Low Water (MLLW) datum. The horizontal datum will be Florida State Plane (zone 0901 FL East) or Geographic (NAD 1983). Horizontal positioning accuracy will be 6 feet. Copies of these surveys shall be provided to EPA Region 4 when completed. No additional pre-disposal monitoring at this site is required.

Table 2. Surveys Conducted at the Port Everglades Harbor ODMDS

Survey Title	Conducted by	Date	Purpose	Conclusion
Benthic Macroinfaunal Analysis of the Port Everglades and Palm Beach, Florida ODMDS Surveys	Battelle for EPA	1984	Characterization (sediment analysis, benthic biota) Survey	Characterization of benthos for February & November 1984
Field Studies in Nearshore Areas at Port Everglades, Palm Beach County, and Brevard County, Florida	Continental Shelf Associates for EPA	1986	Benthic characterization of one square mile candidate site (4 mile candidate site) through sidescan and bathymetry.	No high relief ledges, rock outcrops or steep slopes detected. Occasional rubble or cobbles and some low relief rock outcrop
Video, Still Camera, and Side-Scan Sonar Survey of the Seafloor Within and Downcurrent of a Tentative Alternative ODMDS off Port Everglades, Florida.	Continental Shelf Associates for EPA	1986	Look for presence of natural resources (critical habitats) and presence of man made obstructions on the bottom and. down current of site.	Data showed a predominately fine-to-coarse sediment covered bottom with scattered rocks, areas of rock rubble and sand ripples.
Sediment & Water Quality of Candidate Ocean Dredged Material Disposal Sites for Port Evergades and Palm Beach, Florida	U.S. EPA Region 4	1999	Characterization (water column profiles, water quality, sediment characteristics, benthic bioata) survey	Conditions at the site are relatively pristine. Water column is clear with low suspended sediment concentrations (2-20mg/l). Sediments consists of mostly fine sand (70%) and have low level of contaminants.
Sidescan Survey of Candidate Ocean Dredged Material Disposal Sites for Port Evergades and Palm Beach, Florida	U.S. EPA Region 4	1999	Look for presence of natural resources (critical habitats) and presence of man made obstructions on the bottom.	The side-scan 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. No areas of hard bottom or potential wrecks were identified through the side-scan record within the site or north or south of the site.

Disposal Monitoring. For all disposal activities, the dredging contractor will be required to prepare and operate under an approved electronic verification plan for all disposal operations. As part of this plan, the contractor will provide an automated system that will continuously track (1 to 5 minute intervals) the horizontal location and draft condition (vertical) of the disposal vessel from the point of dredging to the disposal area, and return to the point of dredging. Required digital data are as follows:

(a) Date;

(b) Time;

(c) Vessel Name;

(d) Dump Number;

(e) Map Number on which dump is plotted (if appropriate);

(f) Beginning and ending coordinates of the dredging area for each load (source of dredged material);

(g) Actual location (in degrees and minutes of longitude and latitude) at points of initiation and completion of disposal event;

(h) Brief description of material disposed;

(I) Volume of material disposed; and

(j) Disposal technique used.

The user will be required to prepare and submit to the COE daily reports of operations and a monthly report of operations for each month or partial month's work. The user is also required to notify the COE and the EPA if a violation of the permit and/or contract conditions occur during disposal operations.

Post Discharge Monitoring. As a follow-up to the pre-disposal bathymetric survey, the COE or other site user will conduct a bathymetric survey within 30 days after disposal project completion. The number of transects required will be the same as in the pre-disposal survey. Bathymetric survey results will be used to insure that unacceptable mounding is not occurring and to aid in environmental effects monitoring.

The post-disposal bathymetric survey will be required for the initial use of the ODMDS and for each project greater than 100,000 cubic yards.

Potential Environmental Impacts. The main environmental concerns regarding disposal of dredged material at the Port Everglades Harbor ODMDS are: (1) disposal of sediments that may cause significant mortality or bioaccumulation of contaminants within the disposal site or adjacent to the site boundaries, and (2) adverse ecological changes to the ODMDS and the surrounding sea floor. The first concern is addressed through the permitting/evaluation process in which the sediments are evaluated (see Material Suitability under Site Management). The second concern is addressed through monitoring of the ODMDS. Changes in the benthic community inside the ODMDS are expected because different grain size characteristics in the dredged material may promote colonization of the site by different benthic species. If dredged material is detected outside of the ODMDS, benthic community changes adjacent to the site may be evaluated to determine whether these changes are acceptable. Additionally, at the Port Everglades Harbor ODMDS there are concerns about potiential impacts to nearshore living coral and coralline algal reef systems along the coastline to the west of the site.

Monitoring Strategy. Monitoring of the Palm Beach Harbor ODMDS will follow a tiered approach utilizing management action thresholds. These thresholds will trigger either additional monitoring following the tiered approach or management actions. Monitoring will consist of physical, chemical and biological monitoring. Physical monitoring will provide information about the plume behavior in the water column and dredged material footprint on the bottom. Chemical monitoring provides data on sediment quality and will evaluate bioaccumulation of contaminants in benthic organisms if threshold concentrations of contaminants in sediments are exceeded. Biological monitoring will provide information on the effects of dredged material disposal on the benthic invertebrate communities and on the nearshore living coral and coralline algal reef systems. In the event that the physical monitoring shows that the dredged material footprint extends outside of the designated ODMDS, impacts on the benthos will be investigated. In the event that the physical monitoring shows that the dredged material disposal plume reaches the reef systems, then impacts on the reef systems will be investigated. Some of the monitoring activities will be applied at one or more of the three southeast Florida deepwater ODMDSs (Palm Beach Harbor, Port Everglades Harbor, Miami). Results of those studies will be applied to the Palm Beach Harbor ODMDS where applicable. In addition, 40 CFR 228.9(a) recommends trend assessment surveys be conducted at disposal sites used on a continuing basis.

A summary of the monitoring strategies for the Port Everglades Harbor ODMDS and thresholds for management actions are presented in Table 3. Should future disposal at the Port Everglades Harbor ODMDS result in unacceptable adverse impacts, further studies may be required to determine the persistence of these impacts, the extent of the impacts within the marine system, and/or possible means of mitigation. In addition, the management plan presented may require revision based on the outcome of any monitoring program.

Table 3. Port Everglades Harbor ODMDS Monitoring Strategies and Thresholds for Action

Goal	Technique	Sponsor	Rationale	Frequency	Threshold for Action	Management Options	
						Threshold Not Exceeded	Threshold Exceeded
Measure Extent of Disposal Mound Footprint	Bathymetric Surveys	COE/ Site User	Determine areal influence of dredged material and potential for effects outside of boundaries	Initial site use and for significant projects (>100,000cy)	Disposal mound footprint occurs outside ODMDS boundaries	Continue to use site without restrictions	-Restrict disposal volumes -Modify disposal method/placement -Institute Chemical and Biological Monitoring to determine impact (Environmental Effects).
	Sediment Profile Imaging	COE/ EPA	Determine extent of disposal mound 'apron'	following significant project at one of the SE FL ODMDSs	Disposal mound footprint occurs outside ODMDS boundaries (5cm)	Continue to use site without restrictions	-Restrict disposal volumes -Modify disposal method/placement -Institute Chemical and Biological Monitoring to determine impact (Environmental Effects).
Determine Likelihood of Disposal Plume Reaching Reefs	DiPRiS[1]	EPA/ NOAA	Determine potential for impact to nearshore reefs	In progress	Suspended sediment concentrations at reefs are elevated due to dredged material disposal	Continue monitoring with unrestricted disposal	-Restrict disposal during onshore current events -Implement Reef Impact Study
Environmental Effects Monitoring	Chemical Monitoring	EPA/ COE	Determine if chemical contaminants are significantly elevated[2] within and outside of site boundaries	Implement if disposal mounds extends beyond site boundaries	Contaminants are found to be elevated[2]	Discontinue monitoring unless disposal quantities, type of material or frequency of use significantly changes	-Institue Advanced Chemical and/or Biological Monitoring to determine impact. (Advanced Environmental Effects) -Restrict Disposal
	Benthic Monitoring & Sediment Profile Imaging	EPA/ COE	Determine whether there are adverse changes in the benthic populations outside of the site and evaluate recovery rates		Adverse changes observed outside of site that may endanger the marine environement		-Limit quantity of dredged material to prevent impacts outside boundaries -Create berms to restrict dredged material movement -Cease site use

Table 3 (Continued). Port Everglades Harbor ODMDS Monitoring Strategies and Thresholds for Action

Goal	Technique	Sponsor	Rationale	Frequency	Threshold for Action	Management Options	
						Threshold Not Exceeded	Threshold Exceeded
Advanced Environmental Effects Monitoring	Chemical Tissue Analysis	EPA/ COE	Determine if site is source of adverse bioaccumulation which may endanger the marine environment	Implement if environmental effects monitoring warrants.	Benthic body burdens greater within footprint than outside	Discontinue monitoring unless disposal quantities, type of material or frequency of use significantly changes	-Discontinue site use -Implement case specific management options (ie. remediation,limits on quantities or types of material).
	Benthic Monitoring	EPA/ COE	Determine if site is source of adverse sublethal changes in benthic organisms which may endanger the marine environment		Sub-lethal effects are unacceptable		
Compliance	Disposal Site Use Records	Site User	-Insure management requirements are being met -To assist in site monitoring	Daily during any project	Disposal records required by SMMP are not submitted or are incomplete	Continue Monitoring	-Restrict site use until requirements are met
					Review of records indicates a dump occurred outside ODMDS boundary	Continue Monitoring	-Notify EPA Region 4/COE, and investigate why egregious dump(s) occurred. Take appropriate enforcement action.
					Review of records indicates a dump occurred in the ODMDS but not in target area	Continue Monitoring	-Direct placement to occur as specified.

Table 3 (Continued). Port Everglades Harbor ODMDS Monitoring Strategies and Thresholds for Action

Goal	Technique	Sponsor	Rationale	Frequency	Threshold for Action	Management Options	
						Threshold Not Exceeded	Threshold Exceeded
Trend Assessment Survey	Chemical and/or Biological Measurements (40CFR 228.13)	EPA/ COE	Document and assess changes at the disposal site	As funding allows. Goal is once every 10 years.	Not applicable	Not applicable	Not applicable

1. Disposal Plume Reef Impact Study: This study is currently being conducted at the Miami ODMDS. Results are expected to be applicable to the Port Everglades ODMDS.

2. Significantly elevated: Concentrations above the range of contaminant levels in dredged sediments that the Regional Administrator and the District engineer found to be suitable for disposal at the ODMDS.

Reporting and Data Formatting. The user will be required to prepare daily reports of operations and submit to the COE a monthly report of operations for each month or partial month's work. Disposal monitoring data shall be delivered to the COE on a weekly basis. The user is also required to notify the COE and the EPA within 24 hours if a violation of the permit and/or contract conditions related to MPRSA Section 103 or SMMP requirements occur during disposal operations.

Disposal summary reports shall be provided by the COE to EPA within 90 days after project completion. These should consist of dates of disposal, volume of disposal, approximate location of disposal (summary plot) and pre and post disposal bathymetric survey results in both hard and electronic formats. Other disposal monitoring data shall be made available upon request. In addition, EPA should be notified by the Corps of Engineers 15 days prior to the beginning of a dredging cycle or project disposal.

Material tracking, disposal effects monitoring and any other data collected shall be coordinated with and be provided to SMMP team members and federal and state agencies as appropriate. Data will be provided to other interested parties requesting such data to the extent possible. Data will be provided for all surveys in a report generated by the action agency. The report should indicate how the survey relates to the SMMP and previous surveys at the Port Everglades Harbor ODMDS and should provide data interpretations, conclusions, and recommendations, and should project the next phase of the SMMP.

MODIFICATION OF THE Port Everglades Harbor ODMDS SMMP

Should the results of the monitoring surveys or valid reports from other sources indicate that continued use of the ODMDS would lead to unacceptable effects, then the ODMDS SMMP will be modified to mitigate the adverse impacts. The SMMP will be reviewed and revised if appropriate at a minimum of every ten years. The SMMP will be reviewed and updated as necessary if site use changes significantly. For example, the SMMP will be reviewed if the quantity or type of dredged material placed at the site changes significantly or if conditions at the site indicate a need for revision. Modification will be preceded by contact of all participating team members regarding issues and proposed changes. If any member requests a meeting, a meeting or conference call will be held to discuss issues and proposed changes. Significant changes to the SMMP will be noticed in a local paper for public comment.

REFERENCES

Brodehl, Brian. 2003. November 14 email from Brian Brodehl, USACE Jacksonville District to Christopher McArthur, USEPA Region 4.

Fredette, Thomas J., Nelson, David A., Clausner, James E., and Anders, Fred J. 1990. *Guidelines for Physical and Biological Monitoring of Aquatic Dredged Material Disposal Sites*, Technical Report D-90-12, US Army Engineer Waterways Experiment Station, Vicksburg, MS.

Pequegnat, Willis E., Gallaway, Benny J., and Wright, Thomas D., 1990. *Revised Procedural Guide for Designation Surveys of Ocean Dredged Material Disposal Sites*, Technical Report D-90-8, US Army Engineer Waterways Experiment Station, Vicksburg, MS.

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U.S. Environmental Protection Agency and U.S. Army Corps of Engineers, 1991. *Evaluation of Dredged Material Proposed for Ocean Disposal (Testing Manual)*, February 1991. Prepared by Environmental Protection Agency Office of Marine and Estuarine Protection and Department of Army United States Army Corps of Engineers under EPA Contract No. 68-C8-0105.

U.S. Environmental Protection Agency and U.S. Army Corps of Engineers, 1996. *Guidance Document for Development of Site Management Plans for Ocean Dredged Material Disposal Sites*, February 1996. Prepared by Environmental Protection Agency Office of Water and Department of Army United States Army Corps of Engineers.

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PORT EVERGLADES HARBOR ODMDS SMMP
APPENDIX A

WATER COLUMN EVALUATIONS
NUMERICAL MODEL (STFATE) INPUT PARAMETERS

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Water Column Evaluations
Numerical Model (STFATE) Input Parameters
Port Everglades Harbor ODMDS

SITE DESCRIPTION

Parameter	Value	Units
Number of Grid Points (left to right)	40	
Number of Grid Points (top to bottom)	40	
Spacing Between Grid Points (left to right)	500	ft
Spacing Between Grid Points (top to bottom)	500	ft
Constant Water Depth	645	ft
Roughness Height at Bottom of Disposal Site	.005[1]	ft
Slope of Bottom in X-Direction	0.0	Deg.
Slope of Bottom in Z-Direction	1.0	Deg.
Number of Points in Ambient Density Profile[2] Point	5	
Ambient Density at Depth = 0 ft	1.0246	g/cc
Ambient Density at Depth = 65 ft	1.0248	g/cc
Ambient Density at Depth = 328 ft	1.0272	g/cc
Ambient Density at Depth = 492 ft	1.0280	g/cc
Ambient Density at Depth = 645 ft	1.0282	g/cc

AMBIENT VELOCITY DATA[3]

Parameter	Value	Units
Profile	2-Point	
X-Direction Velocity at Depth of 33 feet	- 2.7	ft/sec
Z-Direction Velocity at Depth of 33 feet	+1.1	ft/sec
X-Direction Velocity at Depth of 197 feet	- 2.2	ft/sec
Z-Direction Velocity at Depth of 197 feet	+0.9	ft/sec

DISPOSAL OPERATION DATA

Parameter	Value	Units
Location of Disposal Point from Top of Grid	14,000	ft
Location of Disposal Point from Left Edge of Grid	10,000	ft
Dumping Over Depression	0	

INPUT, EXCECUTION AND OUTPUT

Parameter	Value	Units
Location of the Upper Left Corner of the Disposal Site - Distance from Top Edge	11,000	ft
Location of the Upper Left Corner of the Disposal Site - Distance from Left Edge	7,000	ft
Location of the Lower Right Corner of the Disposal Site - Distance from Top Edge	17,000	ft
Location of the Lower Right Corner of the Disposal Site - Distance from Left Edge	13,000	ft
Duration of Simulation	14,400	sec
Long Term Time Step	600	sec

COEFFICIENTS

Parameter	Keyword	Value
Settling Coefficient	BETA	0.000[1]
Apparant Mass Coefficient	CM	1.000[1]
Drag Coefficient	CD	0.500[1]
Form Drag for Collapsing Cloud	CDRAG	1.000[1]
Skin Friction for Collapsing Cloud	CFRIC	0.010[1]
Drag for an Ellipsoidal Wedge	CD3	0.100[1]
Drag for a Plate	CD4	1.000[1]
Friction Between Cloud and Bottom	FRICTN	0.010[1]
4/3 Law Horizontal Diffusion Dissipation Factor	ALAMDA	0.001[1]

Parameter	Keyword	Value
Unstratified Water Vertical Diffusion Coefficient	AKYO	Pritchard Expression
Cloud/Ambient Density Gradient Ratio	GAMA	0.250[1]
Turbulent Thermal Entrainment	ALPHAO	0.39[4]
Entrainment in Collapse	ALPHAC	0.100[1]
Stripping Factor	CSTRIP	0.003[1]

[1]Model Default Value
[2]Profiles from EPA 1998 measurements
[3]Velocity data represents average conditions. Determined from WES 1998 analysis of ADCP data offshore Ft. Lauderdale, FL.
[4]Calculated from NOAA Field Work at Miami (1991)

Dilution Rates for Generic Material:
Minimum dilution outside disposal site: 6,600 to 1
Minimum dilution after 4 hours: 15,700 to 1

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Port Everglades HARBOR ODMDS SMMP
APPENDIX B

TEMPLATE FOR MPRSA 103 STANDARD PERMIT CONDITIONS

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TEMPLATE
GENERIC SPECIAL CONDITIONS
FOR MPRSA SECTION 103 PERMITS
Port Everglades HARBOR, FL ODMDS

I. DISPOSAL OPERATIONS

A. For this permit, the term disposal operations shall mean: navigation of any vessel used in disposal of operations, transportation of dredged material from the dredging site to the Port Everglades Harbor, FL ODMDS, proper disposal of dredged material at the disposal area within the Port Everglades Harbor, FL ODMDS, and transportation of the hopper dredge or disposal barge or scow back to the dredging site.

B. The Port Everglades Harbor, FL ODMDS is defined as the rectangle with center coordinates of 26º 07.00'N latitude and 80º 01.50'W longitude (NAD83) or state plane coordinates 649292.4 N and 976098.2 E (NAD83). The corner coordinates are as follows:

Geographic (NAD83)		**State Plane (Florida East 0901 U.S. Feet NAD83)**	
26º07.50'N	80º02.00'W	652301.1 N	973341.1 E
26º07.50'N	80º01.00'W	652342.1 N	978810.0 E
26º06.50'N	80º02.00'W	646242.9 N	973386.1 E
26º06.50'N	80º01.00'W	646283.9 N	978855.7 E

C. No more than [NUMBER] cubic yards of dredged material excavated at the location defined in [REFERENCE LOCATION IN PERMIT] are authorized for disposal at the Port Everglades Harbor, FL ODMDS.

D. The permittee shall use an electronic positioning system to navigate to and from the Port Everglades Harbor, FL ODMDS. For this section of the permit, the electronic positioning system is defined as: a differential global positioning system or a microwave line of site system. Use of LORAN-C alone is not an acceptable electronic positioning system for disposal operations at the Port Everglades Harbor, FL ODMDS. If the electronic positioning system fails or navigation problems are detected, all disposal operations shall cease until the failure or navigation problems are corrected.

E. The permittee shall certify the accuracy of the electronic positioning system proposed for use during disposal operations at the Port Everglades Harbor, FL ODMDS. The certification shall be accomplished by direct comparison of the electronic positioning system's accuracy with a known fixed point.

F. The permittee shall not allow any water or dredged material placed in a hopper dredge or disposal barge or scow to flow over the sides or leak from such vessels during transportation to the Port Everglades Harbor, FL ODMDS.

G. A disposal operations inspector and/or captain of any tug boat, hopper dredge or other vessel used to transport dredged material to the Port Everglades Harbor, FL ODMDS shall insure compliance with disposal operation conditions defined in this permit.

1. If the disposal operations inspector or the captain detects a violation, he shall report the violation to the permittee immediately.

2. The permittee shall contact the U.S. Army Corps of Engineers, Jacksonville District's Regulatory Branch [TELEPHONE NUMBER] and EPA Region 4 at (404) 562-9391 to report the violation within twenty-four (24) hours after the violation occurs. A complete written explanation of any permit violation shall be included in the post-dredging report.

H. When dredged material is disposed, no portion of the hopper dredge or disposal barge or scow shall be outside of the boundaries of the Port Everglades ODMDS as defined in Special Condition B. Additionally, disposal shall occur within the disposal zone defined as a 600 foot radius with center at:

26º 07.00'N latitude and 80º 01.50'W longitude (NAD83)

or

state plane coordinates 649292.4 N and 976098.2 E (NAD83)

I. The permittee shall use an automated disposal verification system that will continuously track (1 to 5 minute intervals) the horizontal location and draft condition of the disposal vessel (hopper dredge or disposal barge or scow) to and from the Port Everglades Harbor ODMDS. This information shall be available in electronic format to the Jacksonville District Corps of Engineers and EPA Region 4 upon request.

1. Required digitally recorded data are: date, time, vessel name, captain of vessel, beginning and ending coordinates of the dredging area for each load, location at points of initiation and completion of disposal, description of material disposed (sand, clay or silt), volume of load, and disposal technique. This information will be available to the Jacksonville District Corps of Engineers on a daily basis.

2. The permittee shall use Florida State Plane or latitude and longitude coordinates (North American Datum 1983 or 1927). State Plane coordinates shall be reported to the nearest 0.10 foot and latitude and longitude coordinates shall be reported as degrees and decimal minutes to the nearest 0.01 minutes.

J. The permittee shall conduct a bathymetric survey of the Port Everglades Harbor ODMDS within 30 days following project completion.

1. The number and length of the survey transects shall be sufficient to encompass the Port Everglades ODMDS and a 500 foot wide area around the site. The transects shall be spaced at 500-foot intervals or less with a depth recording density of 20 to 70 feet..

2. Vertical accuracy of the survey shall be ±0.1 feet. Horizontal location of the survey lines and depth sounding points will be determined by an automated positioning system utilizing either microwave line of site system or differential global positioning system. The vertical datum will be referenced to prescribed NOAA Mean Lower Low Water (MLLW) datum. MLLW is 1.8 feet below NGVD 1929. The horizontal datum will be Florida State Plane (zone 0901 FL East) or Geographic (NAD 1983). State Plane coordinates shall be reported to the nearest 0.10 foot and latitude and longitude coordinates shall be reported as degrees and decimal minutes to the nearest 0.01 minutes.

K. The permittee has read and agrees to assure that they are in compliance with the requirements of the Port Everglades ODMDS Site Management and Monitoring Plan.

II. REPORTING REQUIREMENTS

A. The permittee shall send the U.S. Army Corps of Engineers, Jacksonville District’s Regulatory Branch and EPA Region 4's Wetlands, Coastal and Watersheds Branch (61 Forsyth Street, Atlanta, GA 30303) a notification of commencement of work at least fifteen (15) days before initiation of any dredging operations authorized by this permit.

B. The permittee shall submit to the U.S. Army Corps of Engineers weekly disposal monitoring reports. These reports shall contain the information described in Special Condition I.I.

C. The permittee shall send one (1) copy of the disposal summary report to the Jacksonville District’s Regulatory Branch and one (1) copy of the disposal summary report to EPA Region 4 documenting compliance with all general and special conditions defined in this permit. The disposal summary report shall be sent within 90 days after completion of the disposal operations authorized by this permit. The disposal summary report shall include the following information:

1. The report shall indicate whether all general and special permit conditions were met. Any violations of the permit shall be explained in detail.

2. The disposal summary report shall include the following information: Corps permit number, actual start date and completion date of dredging and disposal operations, total cubic yards disposed at the Port Everglades Harbor, FL ODMDS, locations of disposal events, and post disposal bathymetric survey results (in hard and electronic formats).

III. PERMIT LIABILITY

A. The permittee shall be responsible for ensuring compliance with all conditions of this permit.

B. The permittee and all contractors or other third parties who perform an activity authorized by this permit on behalf of the permittee shall be separately liable for a civil penalty of up to $50,000 for each violation of any term of this permit thy commit alone or in concert with the permittee or other parties. This liability shall be individual, rather than joint and several, and shall not be reduced in any fashion to reflect the liability assigned to and civil penalty assessed against the permittee or any other third party as defined in 33 U.S.C. Section 1415(a).

C. If the permittee or any contractor or other third party knowingly violates any term of this permit (either alone or in concert), the permittee, contractor or other party shall be individually liable for the criminal penalties set forth in 33 U.S.C. Section 1415(b).

PORT EVERGLADES HARBOR ODMDS SMMP

Appendix C

Jacksonville District Corps of Engineers
Contract Specification Language

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Jacksonville District Corps of Engineers Contract Specification Language

3.3 DISPOSAL OF EXCAVATED MATERIAL

3.3.1 General

Material excavated shall be transported to and deposited in the disposal areas designated on the drawings. The average distance to which the material will have to be transported is approximately 5 miles and the maximum distance will be approximately 6.5 miles.

3.3.2 General [Ocean Dredged Material Disposal Site (ODMDS)]

The material excavated shall be transported to and deposited in the ODMDS designated as "Ocean Disposal Area - O" as shown on the drawings. The material shall be dumped within <u>600 feet</u> of the center of the ODMDS (X,Y Coordinates: 976098.2 E, 649292.4 N) or (Geographic Coordinates: 26° W 07.00′ N; 080° 01.50′ W). The state plane coordinates are based on the Transverse Mercator Projection for Florida, East Zone, North Atlantic Datum 1983. Dredged material shall not be placed higher than elevation -30 feet MLLW in "Ocean Disposal Area - O".

3.3.17 Electronic Tracking System (ETS) for Ocean Disposal Vessels

The Contractor shall furnish an ETS for surveillance of the movement and disposition of dredged material during [excavation and ocean disposal] [excavation and disposal (nearshore and ocean)]. This ETS shall be established, operated and maintained by the Contractor to continuously track in real-time the horizontal location and draft condition of the disposal vessel for the entire dredging cycle, including dredging area and disposal area. The ETS shall be capable of displaying and recording in real-time the disposal vessel's draft and location.

3.3.17.1 ETS Standards

The Contractor shall provide automated (computer) system and components to perform in accordance with COE EM 1110-1-2909. A copy of the EM can be downloaded from the following web site: http://www.usace.army.mil/inet/usace-docs'eng-manuals/em.htm. Horizontal location shall have an accuracy equal to or better than a standard DGPS system, equal to or better than plus/minus 10 feet (horizontal repeatability). Vertical (draft) data shall have an accuracy of plus/minus 0.5 foot. Horizontal location and vertical data shall be collected in sets and each data set shall be referenced in real-time to date and local time (to nearest minute), and shall be referenced to the same state plane coordinate system used for the survey(s) shown in the contract plans. The ETS shall be calibrated, as required, in the presence of the Contracting Officer at the work location before disposal operations have started, and at 30-day intervals while work is in progress. The Contracting Officer shall have access to the ETS in order to observe its operation. Disposal operations will not commence until the ETS to be used by the Contractor is certified by the Contracting Officer to be operational and within acceptable accuracy. It is the Contractor's responsibility to select a system that will operate properly at the work location. The complete system shall be subject to the Contracting Officer's approval.

3.3.17.2 ETS Data Requirements and Submissions

a. The ETS for each disposal vessel shall be in operation for all dredging and disposal activities and shall record the full round trip for each loading and disposal cycle. (NOTE: A dredging and disposal cycle constitutes the time from commencement of dredging to complete discharge of the material.) The Contracting Officer shall be notified immediately in the event of ETS failure and all dredging operations for the vessel shall cease until the ETS is fully operational. Any delays resulting from ETS failure shall be at the Contractor's expense.

b. All data shall be collected and stored on 3 1/2-inch discs or CD-ROM(s) in ASCII format and shall be readable by MS Windows compatible software. Each dredging and disposal cycle shall be a separate and distinct ASCII file, labeled by the trip number. More than one file may be stored on the disc(s) or CD-ROM(s).

c. Data shall be collected, during the dredging and disposal cycle, every 500 feet (at least) during travel to the disposal area, and every minute or every 200 feet, whichever is smaller, while approaching within 1,000 feet and within the disposal area.

d. The required digital data to be collected for each dredging and disposal cycle includes the following:

(1) Trip Number
(2) Date
(3) Time
(4) Vessel ID
(5) Vessel Captain
(6) State Plane X Coordinate - in accordance with subparagraph c. above
(7) State Plane Y Coordinate - in accordance with subparagraph c. above
(8) Vessel Draft
(9) Type of Disposal Vessel
(10) Exact State Plane X and Y coordinate at start of dump
(11) Volume of Material Disposed

e. Plot Reporting (2 types):

(1) Tracking Plot - For each disposal event, data collected while the disposal vessel is in the vicinity of the disposal area shall be plotted in chart form, in 200-foot intervals, to show the track and draft of the disposal vessel approaching and traversing the disposal area. The plot shall identify the exact position at which the dump commenced. A sample Track and Draft Plot Diagram is on the web site indicated in paragraph CONSTRUCTION FORMS AND DETAILS below.

(2) Scatter Plot - Following completion of all disposal events, a single and separate plot will be prepared to show the exact disposal locations of all dumps. Every plotted location shall coincide with the beginning of the respective dump. Each dump shall be labeled with the corresponding Trip Number and shall be at a small but readable scale. A sample Scatter Plot Diagram is on the web site indicated in paragraph CONSTRUCTION FORMS AND DETAILS below.

(3) Summary Table - A spreadsheet which contains all of the information described in subparagraph d. above shall be prepared and shall correspond to the exact dump locations represented on the Scatter Plot Diagram. A sample Summary Table spreadsheet is on the web site indicated in paragraph CONSTRUCTION FORMS AND DETAILS below.

f. All digital ETS data shall be furnished to the Contracting Officer within 24 hours of collection. The digital plot files should be in an easily readable format such as Adobe Acrobat PDF file, Microstation DGN file, JPEG, BMP, TIFF, or similar. The hard copy of the ETS data and tracking plots shall be both maintained onboard the vessel and submitted to the Contracting Officer on a weekly basis.

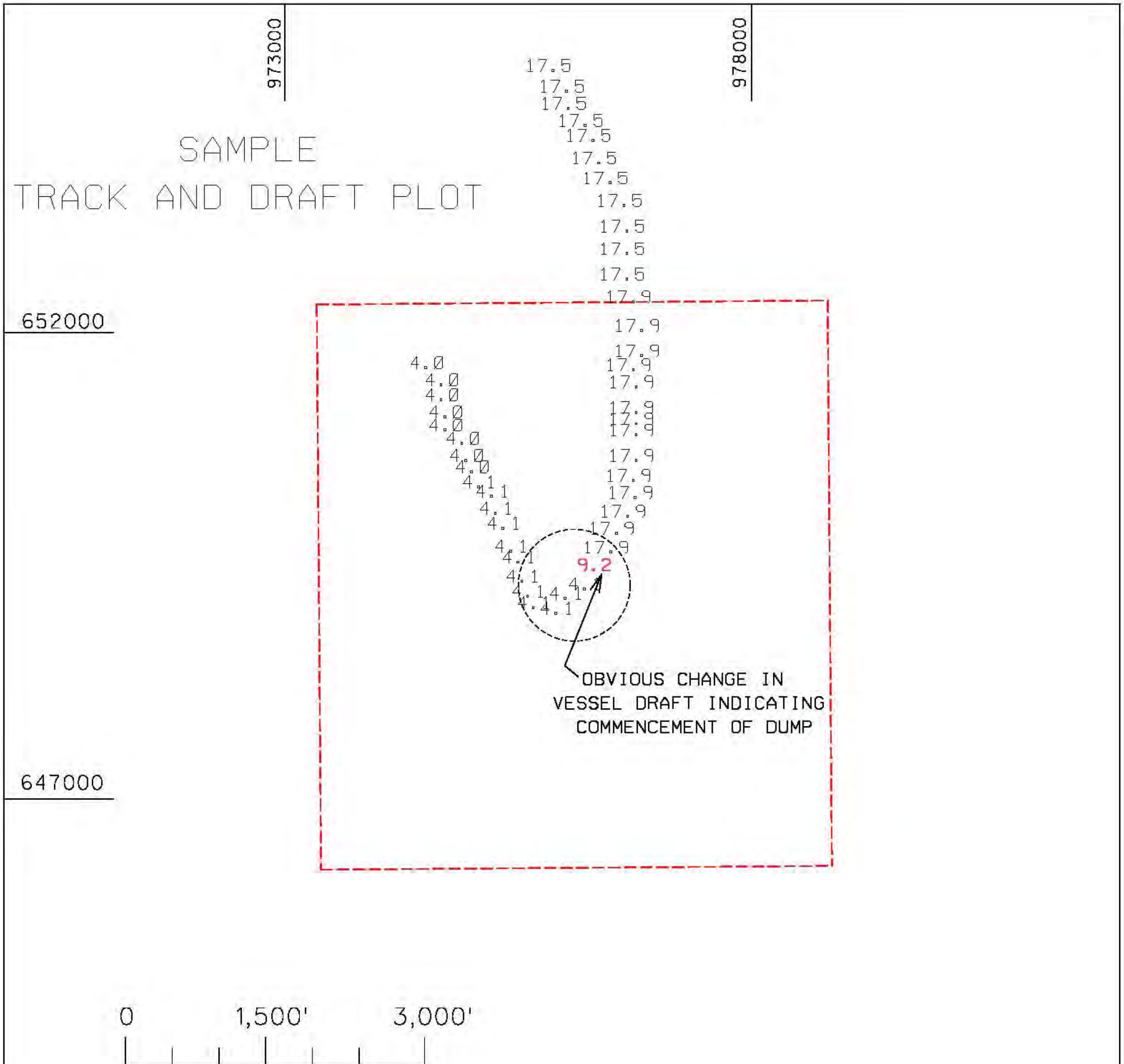
SAMPLE SUMMARY SPREADSHEET

ETS Date Sheet: Port Everglades Harbor MD, W912P-XX-X-XXXX
Master ETS Dump Log to Accompany Scatter Plots

--Data to be extracted from ETS ASCII Data files--

DATE	TIME	LOADNO	CHAN	CUYDS	CAPTAIN	DRAFT*	EQUIPMENT	**BEGDUMPN**	**BEGDUMPE**	ENDUMPN	ENDUMPE
06/15/02	1400	0001	AS1		Nichols	10.8	Scow 3002	**1448772**	**814016**	1448677	814060
06/15/02	1320	0002	AS1	2,453	Nichols	9.7	Scow 3001	**1448465**	**814471**	1448383	814563
06/16/02	0800	0003	AS1	2,567	Nichols	4.3	Scow 3002	**1447989**	**813558**	1447861	813622
06/16/02	1400	0004	AS1	2,567	Nichols	4.3	Scow 3001	**1448049**	**813706**	1447981	813755
06/16/02	1320	0005	AS1	2,818	Nichols	9	Scow 3002	**1447967**	**814014**	1447843	814118
06/16/02	0800	0006	AS1	2,567	Nichols	12.2	Scow 3001	**1449087**	**814761**	1449015	814832
06/16/02	1430	0007	AS1	2,453	Nichols	4.3	Scow 3002	**1448123**	**814497**	1448034	814552
06/16/02	1400	0008	AS1	1,517	Nichols	5	Scow 3001	**1448487**	**813889**	1448448	813917
06/17/02	1320	0009	AS1	1,563	Nichols	4.2	Scow 3002	**1446384**	**813383**	1446198	813476
06/17/02	0800	0010	AS1	2,589	Nichols	11.4	Scow 3001	**1448097**	**813833**	1448028	813893
06/17/02	1400	0011	AS1	2,886	Nichols	10.7	Scow 3002	**1445275**	**814369**	1445151	814465
06/17/02	1320	0012	AS1	2,772	Nichols	12.2	Scow 3001	**1445293**	**815594**	1445308	815682
06/17/02	0800	0013	AS1	2,681	Nichols	4.7	Scow 3002	**1444986**	**815579**	1444940	815741
06/17/02	1430	0014	AS1	2,567	Nichols	10.5	Scow 3001	**1445861**	**815663**	1445856	815760
06/17/02	1400	0015	AS1	2,749	Nichols	11.8	Scow 3002	**1444683**	**815297**	1444761	815422
06/18/02	1320	0016	AS1	2,521	Nichols	4.3	Scow 3001	**1445098**	**815121**	1445136	815220
06/18/02	0800	0017	AS1	2,886	Nichols	5.1	Scow 3002	**1445633**	**813658**	1445624	813816
06/18/02	1400	0018	AS1	2,818	Nichols	5.2	Scow 3001	**1445551**	**815476**	1445616	815549
06/18/02	1320	0019	AS1	2,612	Nichols	11	Scow 3002	**1445509**	**813621**	1445500	813761
06/18/02	0800	0020	AS1	2,567	Nichols	4.3	Scow 3001	**1445180**	**814844**	1445127	814944
				2,795							

* DRAFT AT COMMENCEMENT OF DUMP

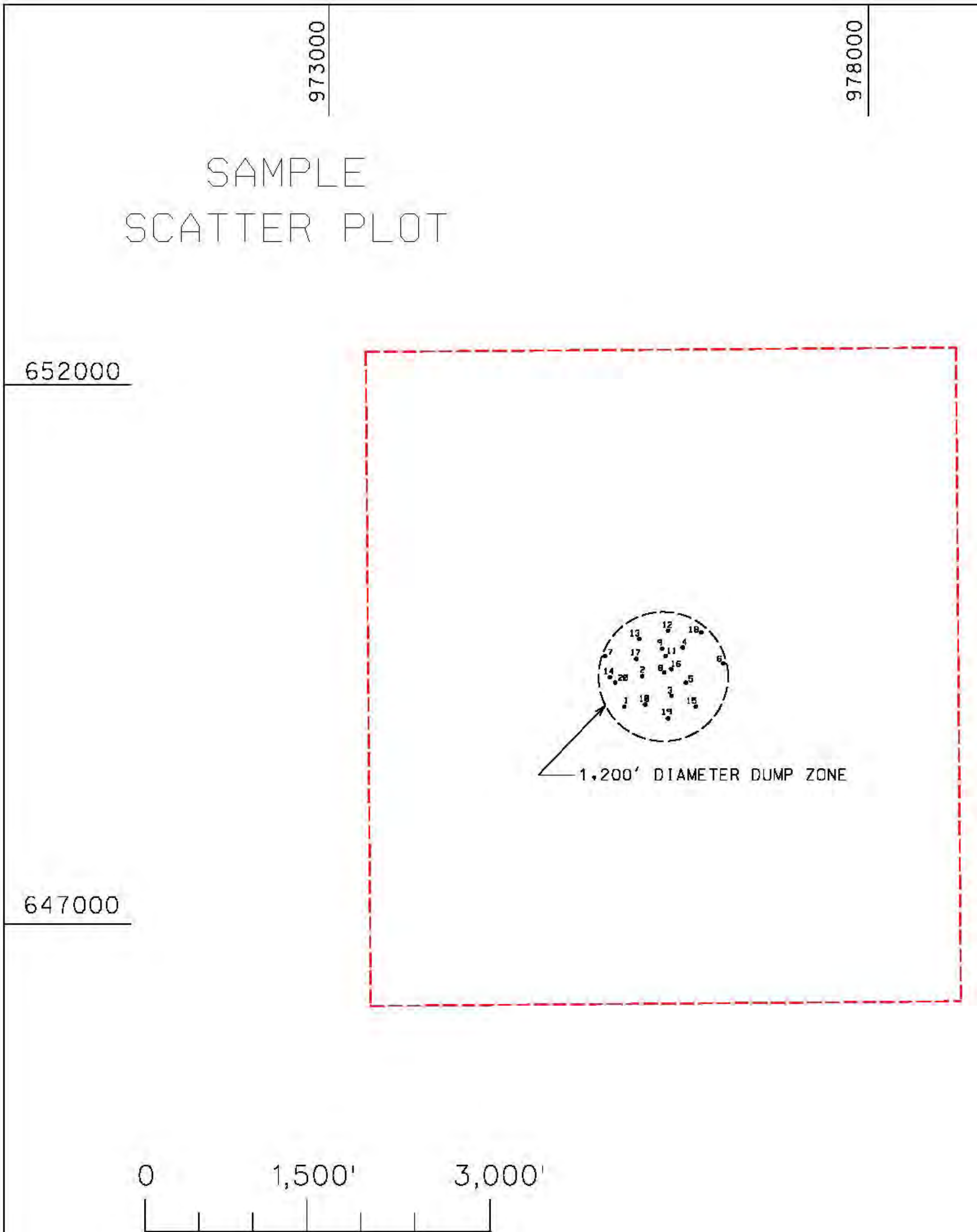


PORT EVERGLADES ODMDS

PROJECT NAME: PORT EVERGLADES, MAINTENANCE DREDGING

CONTRACT NUMBER: W912EP-XX-X-XXXX

DATE OF TRIP: 1 JUN 01 TRIP NUMBER: 1-20



PORT EVERGLADES ODMDS

PROJECT NAME: PORT EVERGLADES, MAINTENANCE DREDGING

CONTRACT NUMBER: W912EP-XX-X-XXXX

DATE OF TRIP: 1 JUN 01

TRIP NUMBER: 20

Appendix M

WATER EXPERIMENT STATION PORT EVERGLADES/ PALM BEACH DREDGED MATERIAL FATE STUDIES

Port Everglades/Palm Beach Dredged Material Fate Studies

Introduction

An evaluation of the Port Everglades and Palm Beach Ocean Dredged Material Disposal Sites (ODMDSs) was accomplished in a previous study (Cialone, M. A. and Lillycrop, L. S., 1998)[1]. However, additional work was requested by the U. S. Army Engineer District, Jacksonville (SAJ) to clarify, justify and further examine the study results.

The Port Everglades ODMDS is located east-northeast of Port Everglades and approximately 8 km offshore (Figure 1). The 3.4 km^2 site is defined by the following corner points:

26^o 07' 30"N, 80^o 02' 00"W
26^o 07' 30"N, 80^o 01' 00"W
26^o 06' 30"N, 80^o 02' 00"W
26^o 06' 30"N, 80^o 01' 00"W

The site is centered at 26^o 07' 00"N, 80^o 01' 00"W. The ODMDS is located on the upper continental shelf with depths ranging from 176 to 217 m (Figure 2).

The Palm Beach ODMDS is located east-northeast of Lake Worth Inlet and approximately 8 km offshore (Figure 3). The 3.4 km^2 site is defined by the following corner points:

26^o 47' 30"N, 79^o 57' 09"W
26^o 47' 30"N, 79^o 56' 02"W
26^o 46' 30"N, 79^o 56' 02"W
26^o 46' 30"N, 79^o 57' 09"W

The site is centered at 26^o 47' 00"N, 79^o 56' 33"W. The ODMDS is located on the

[1] Cialone, M. A., Lillycrop, L. S. (1998). “Dispersion Characteristics for Palm Beach and Port Everglades Ocean Dredged Material Disposal Sites (ODMDSs)” (Unpublished Miscellaneous Paper).

upper continental slope with depths ranging from 155 to 185 m (Figure 4).

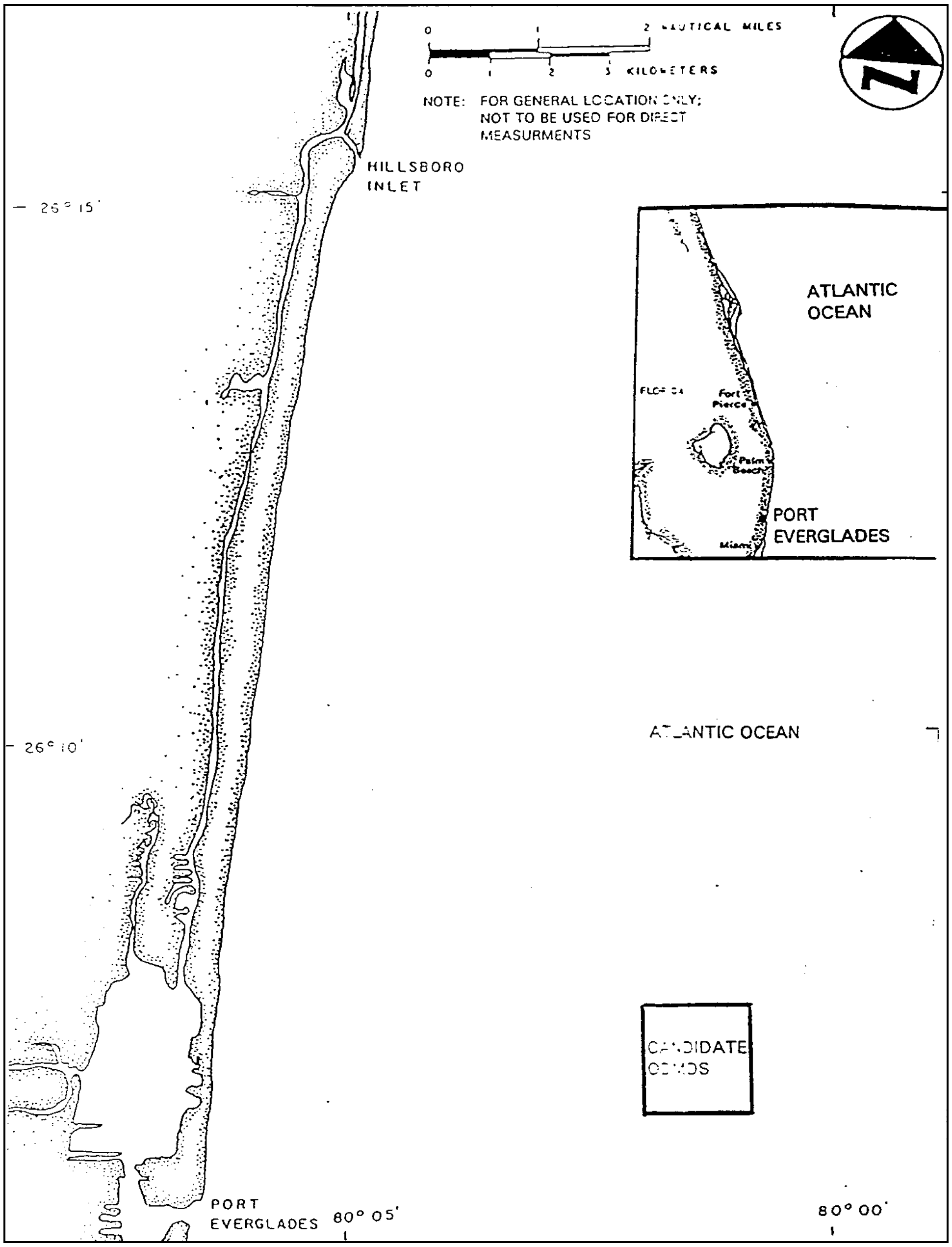


Figure 1. Location map of the Proposed ODMDS, Port Everglades, FL
(from Continental Shelf Associates, Inc. 1989)

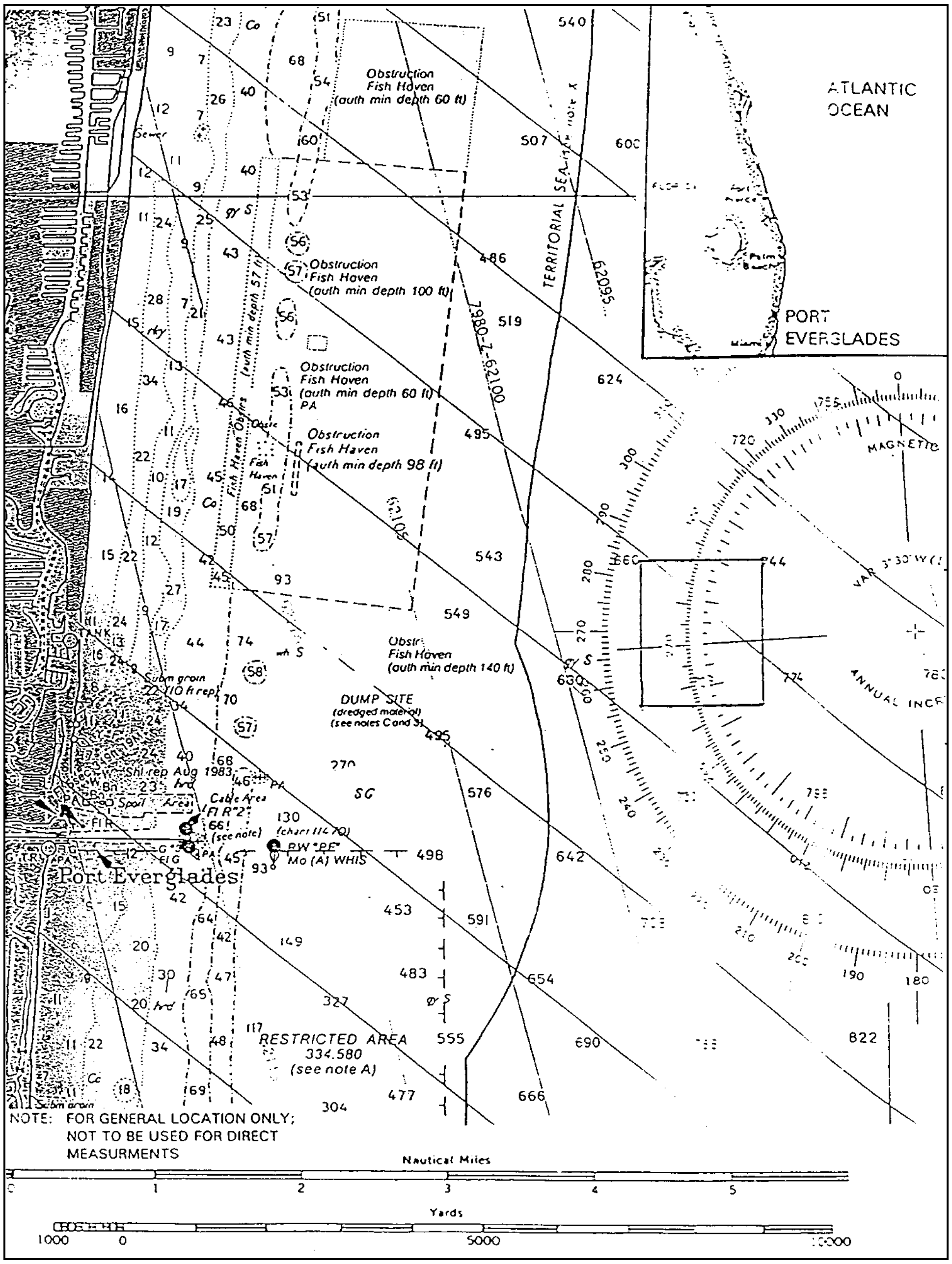


Figure 2. Bathymetry in the vicinity of the proposed Port Everglades ODMDS (from NOAA, 1989)

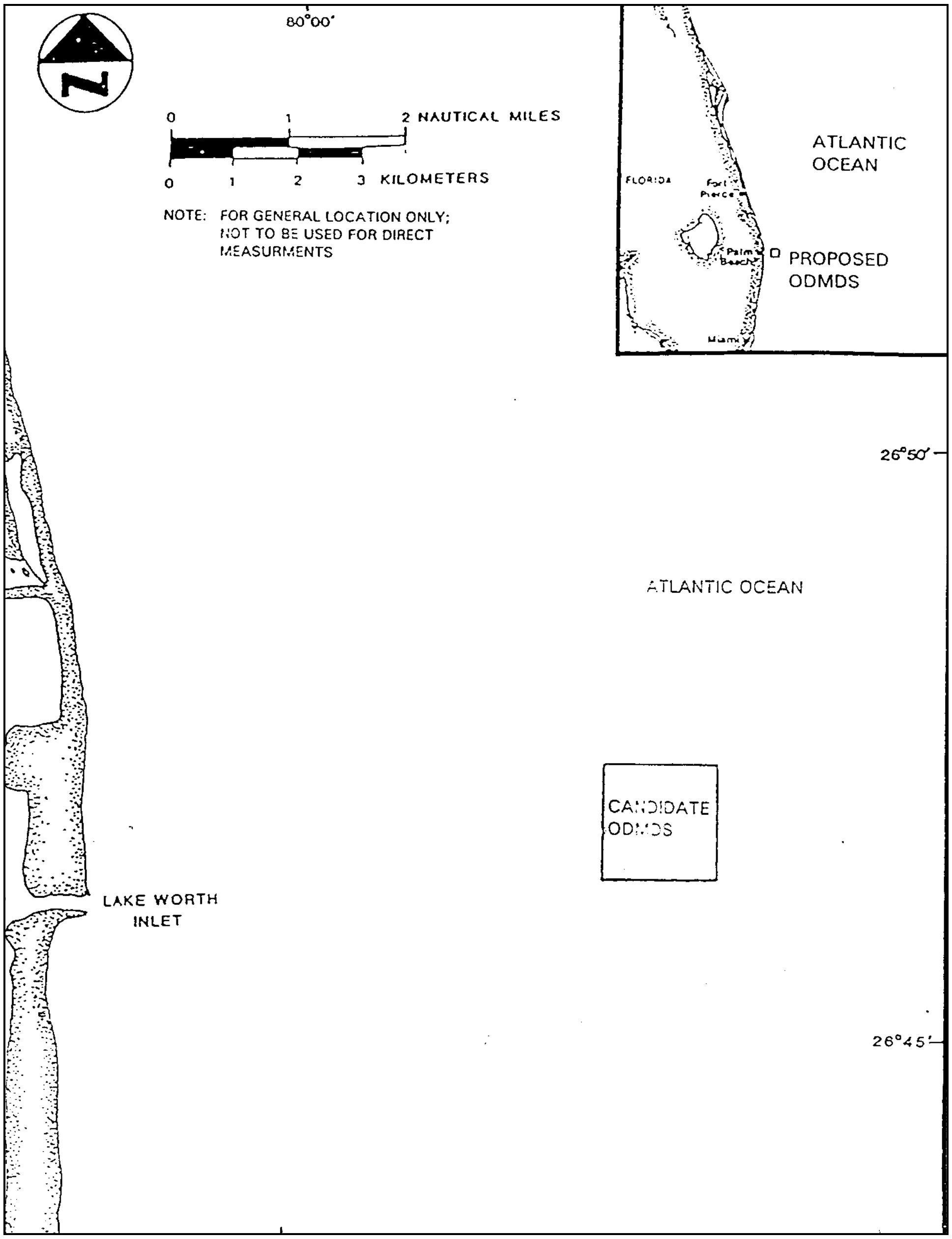


Figure 3. Location map of the proposed ODMDS, Palm Beach, FL
(from Continental Shelf Associates, Inc., 1989)

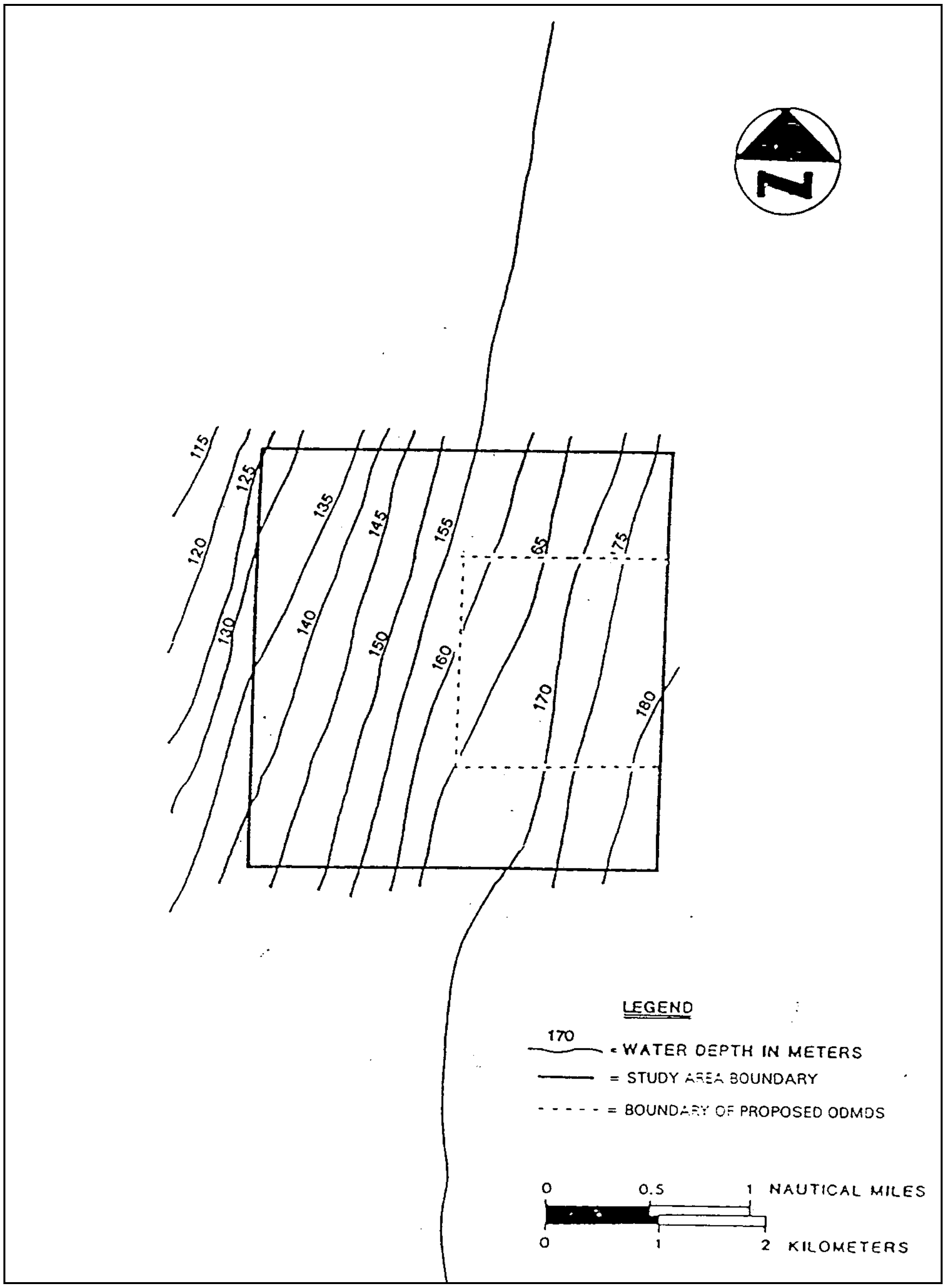


Figure 4. Bathymetry in the vicinity of the proposed Palm Beach ODMDS (from Continental Shelf Associates, Inc., 1989)

Acoustic Doppler Current Profiler (ADCP) data obtained from the National Oceanographic Data Center (NODC) for location (26^{o} 04.00'N, 80^{o} 03.50'W) in the vicinity of the project sites were analyzed to determine potential velocity profiles that disposed material might be subjected to. The depth at the ADCP deployment site was 110 m. NODC provided velocity profile data at 4-m depth intervals and 20-minute time intervals for the 1995-1997 time period.

The purpose of the previous study was to evaluate the dispersive characteristics of proposed disposal sites offshore of Palm Beach Harbor and Port Everglades Harbor. Both disposal sites are in deep water (approximately 170-200 m deep) and are in close proximity to the Gulf Stream and its spin-off eddies. There is concern that the proposed eddies could potentially carry material from the ODMDS to environmentally-sensitive coral reefs. Numerical model simulations were selected as the method of evaluating the potential for sediment transport during disposal and from the disposal mound.

This present study consisted of four main tasks to carry out the additional work requested by SAJ. Task 1 consisted of a) rescaling sediment concentration Short-Term Fate (STFATE) plots to show the entire plume decay in the direction of the reef and b) changing to total sediment concentration plots rather than separate sand and silt-clay concentrations. STFATE model results were available and retrievable for the Port Everglades site. For the Palm Beach site, in some cases data were not retrievable and assumptions were made and are stated in this report.

Task 2 consisted of searching for additional velocity data near Palm Beach and preparing a brief description of the Florida Current. The purpose of this task is to determine if the velocity data are representative of conditions at the Palm Beach ODMDS and justify the use of the ADCP data, which is about 70 km south of the Palm Beach ODMDS, as the velocity input for the Palm Beach site.

Task 3 consisted of STFATE modeling of a typical current profile to provide a description of the disposal event under "typical" current conditions at the ODMDS. The STFATE model was modified to adopt a four-point velocity profile.

Task 4 consisted of the application of a screening-level fate model to estimate the long-term response of the dredged material mound for more conservative volumes. The previous study evaluated the sediment movement of a 50,000 c. y. mound which represents the annual amount that each disposal site is expected to accommodate. The present study evaluates the sediment movement from mounds having larger volumes (500,000 c. y.). The screening level erosion modeling was completed for the three most energetic storms for both sites. An additional case of a severe extratropical storm was simulated for the Port Everglades site.

Where possible, results from the previous study were used or recreated as a basis for the additional work. However, all model results from the previous study were not retrievable and it was not feasible to recreate all the simulations. In these cases, assumptions were made and are stated in this report.

Total Concentration Plots

SAJ requested STFATE plots showing combined sand and silt-clay concentrations. The original plots were prepared to show the concentrations of sand and silt-clay separately. 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. Model simulation data requirements include local water depths, currents, density gradients, disposal description, and sediment characteristics. Model results from the original STFATE simulations for Port Everglades and Palm Beach were retrieved and used to produce total concentration plots.

Port Everglades

Model results from the original STFATE simulations were available and were retrieved. The maximum sand concentration was added to the maximum silt-clay concentration wherever the offshore distance and the alongshore distance coincided. The maximum concentration is the maximum within the grid over the duration of the simulation. For some cases the location of maximum concentrations of sand and silt-clay did not coincide and the calculations were not performed. The total concentrations were calculated at five water depths to describe the variation of the total concentration in the water column. Figures 5-20 show the reconstructed total concentrations versus offshore distances from the reef (grid origin) at each model simulation time step. In all plots westerly-directed and northwesterly-directed velocities are denoted in the figures with a W and N, respectively. Velocities with exceedances of 50% (V_{50}), 10% (V_{90}), 5% (V_{95}), and 1% (V_{99}) were identified in the figures with the designators 50, 90, 95, and 99 respectively. Table 1 shows the depth integrated velocities used in the simulations.

Table 1. Velocities simulated

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

Two sediment compositions, 60% and 70% solids by weight, were simulated.
Table 2 shows the volume fraction of sand and silt.

Table 2. Port Everglades sediment characteristics			
% solids by weight	% fines	Volume fraction fines	Volume fraction sand
60	38	.1401	.2247
70	5	.0239	.4460

The original model outputs contain maximum concentration values at offshore distances from the reef of no less than 2400 m. This distance is mainly a function of model simulation time, water depth, disposal location and grid boundaries.

In all previously simulated Port Everglades applications sediment was disposed 6100 m from the grid origin (reef location). The sand concentration diminished to a value of 1 mg/l within 3660 m of the reef location and the silt-clay concentrations diminished to approximately 1 mg/l within 4500 m of the reef location (Cialone, M. A. and Lillycrop, L. S., 1998). In the previous study each portion of the sediment was estimated separately and consequently the above-mentioned values represent concentrations at different distances from the reef and for different velocity input conditions.

The present results indicate that under the most severe conditions (N99: 70%), the maximum total sediment concentration within 4000 m from reef location was approximately 3 mg/l at a depth of 137 m. A major portion of the dredged material is sand and the sand concentration was 2.7 mg/l while the silt-clay concentration value was 0.5 mg/l.

The previous and the present studies describe the same model results and the difference in the stated concentration values and their offshore distances is due to the use of calculated total sediment concentration.

Palm Beach

For the Palm Beach site, the only available model results included maximum concentrations of sand and silt-clay, but did not include alongshore locations of the maximum sediment concentration for northwesterly-directed velocities. Therefore, a conservative approach was adopted, for northwesterly-directed velocity cases, by assuming the maximum sand and clay-silt concentrations have the same alongshore distance from the grid origin.

Figure 5. Total sediment concentration

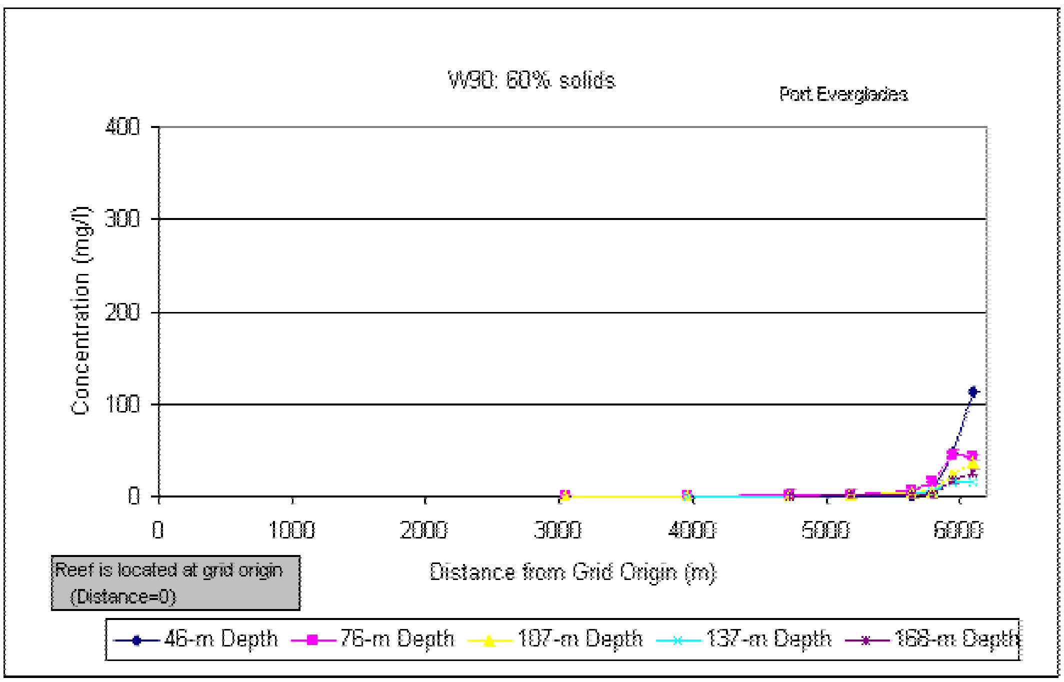


Figure 6. Total sediment concentration

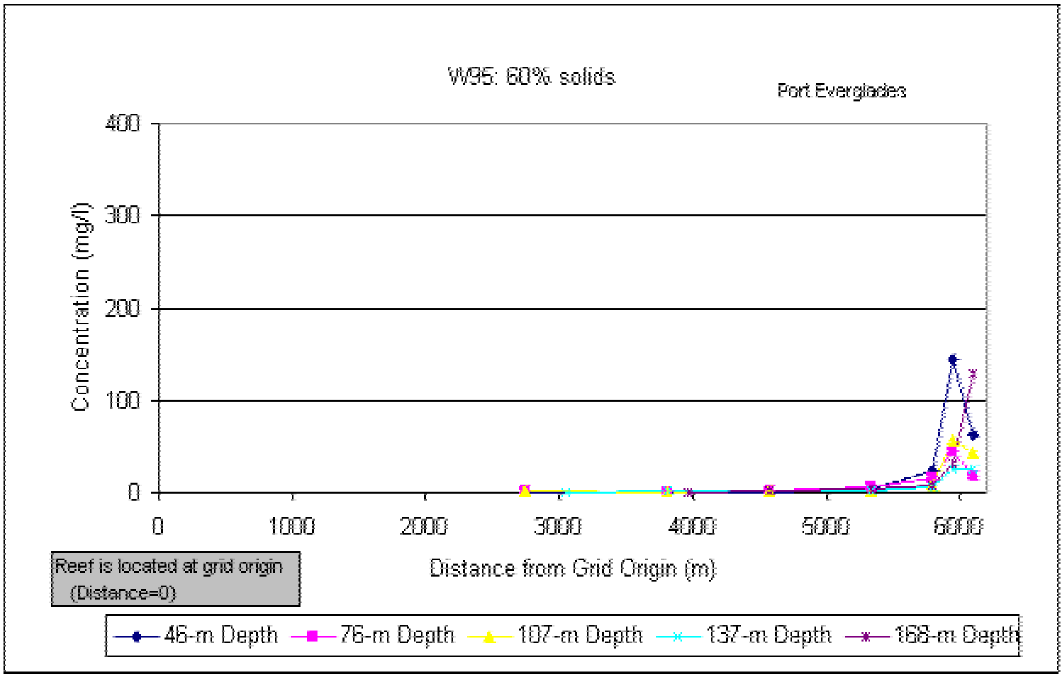


Figure 7. Total sediment concentration

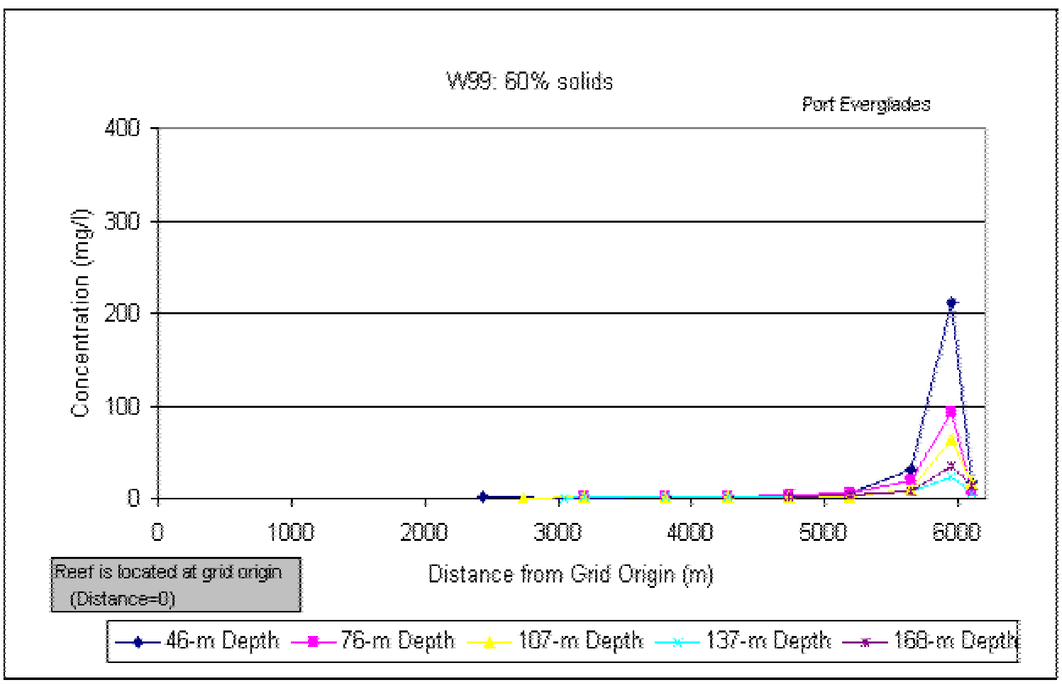


Figure 8. Total sediment concentration

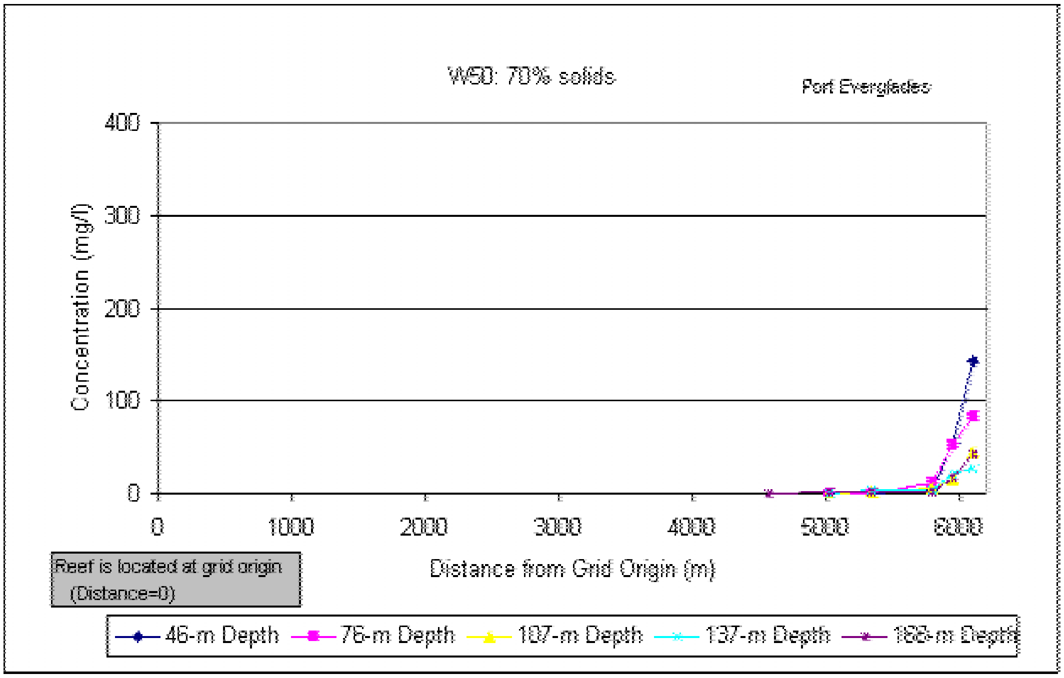


Figure 9. Total sediment concentration

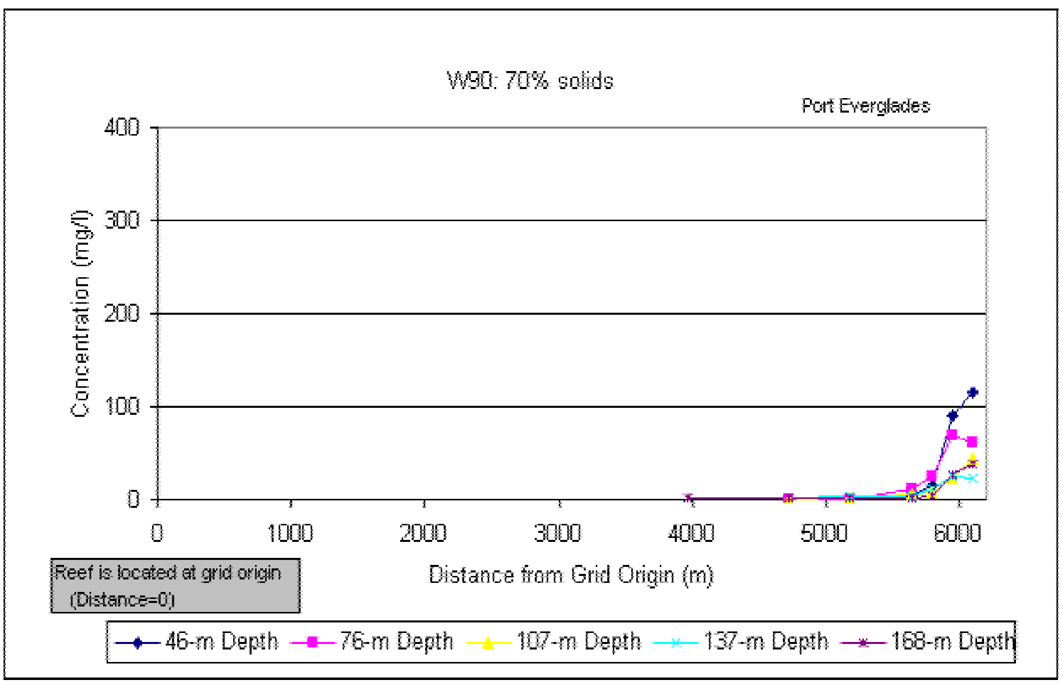


Figure 10. Total sediment concentration

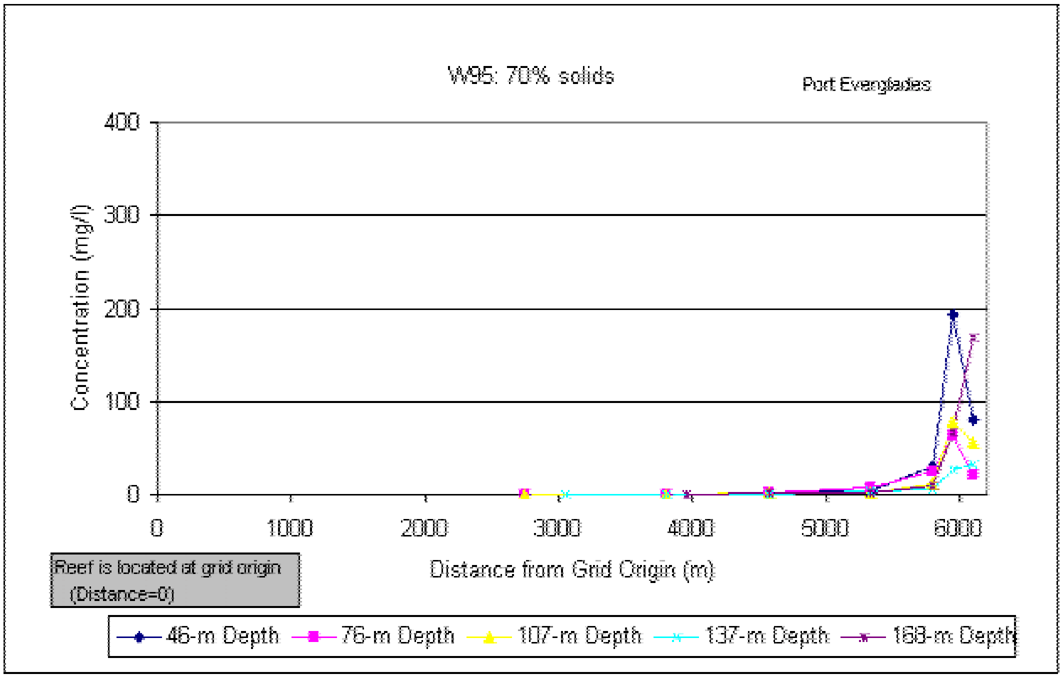


Figure 11. Total sediment concentration

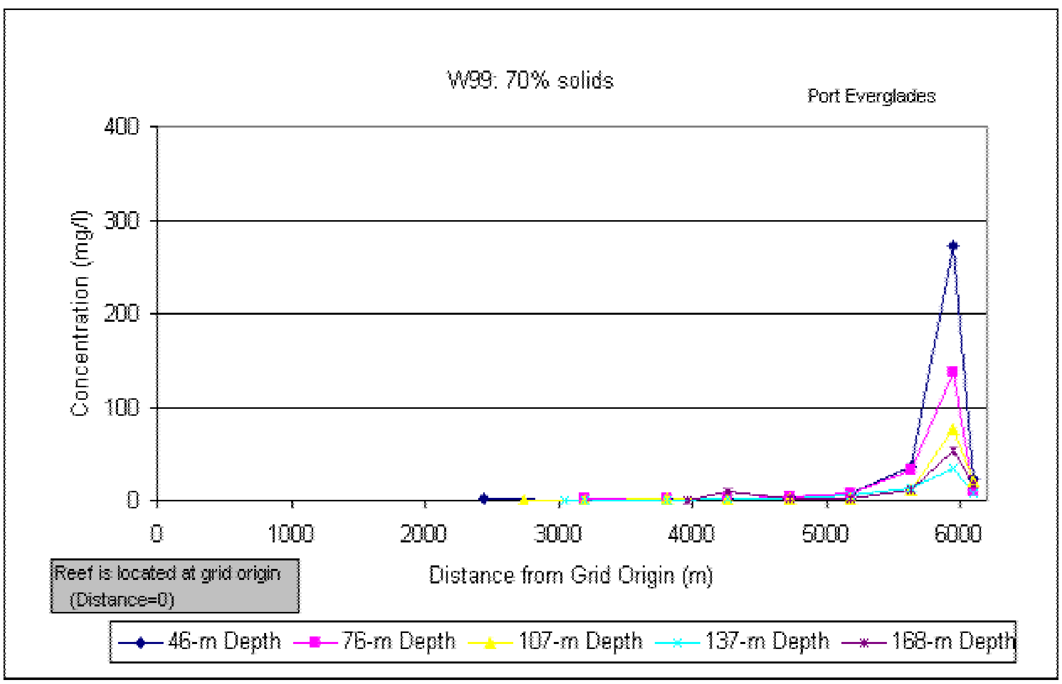


Figure 12. Total sediment concentration

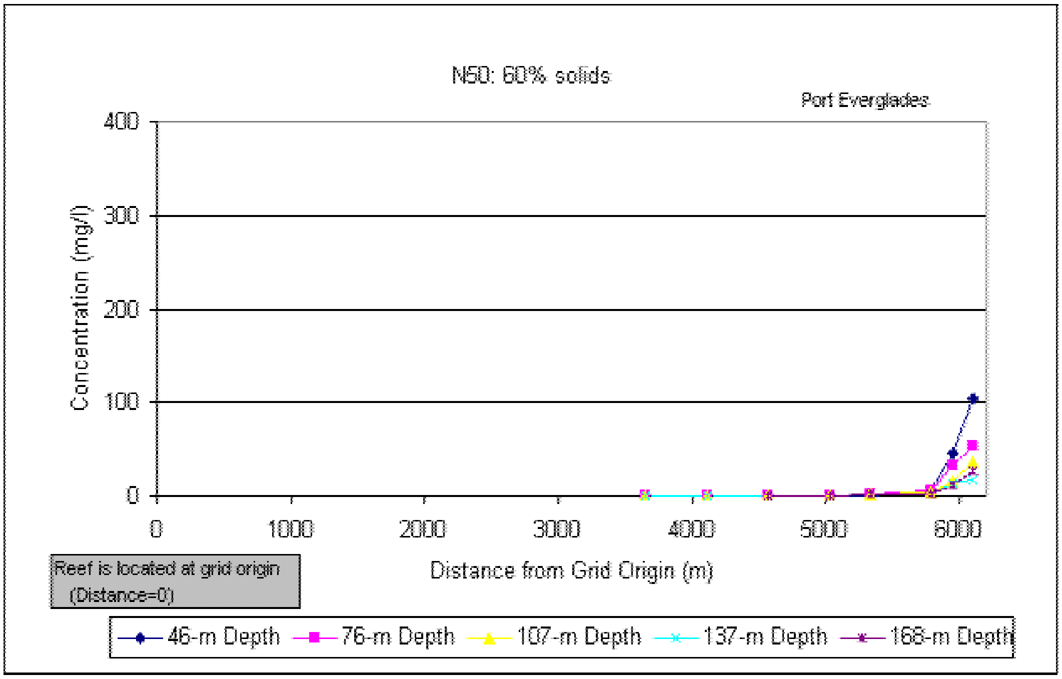


Figure 13. Total sediment concentration

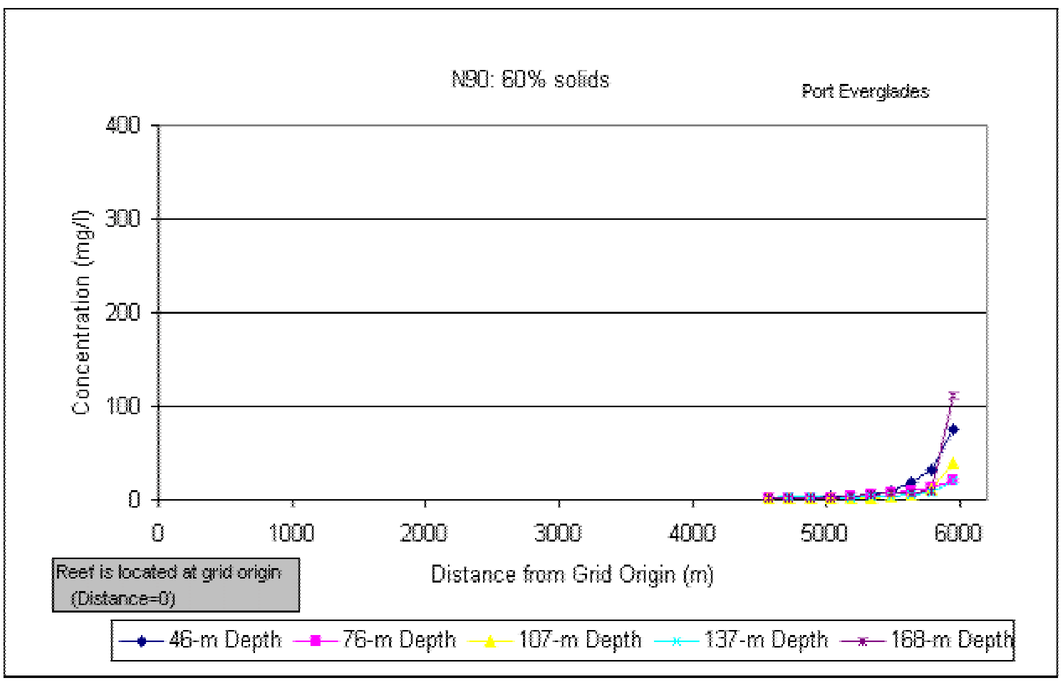


Figure 14. Total sediment concentration

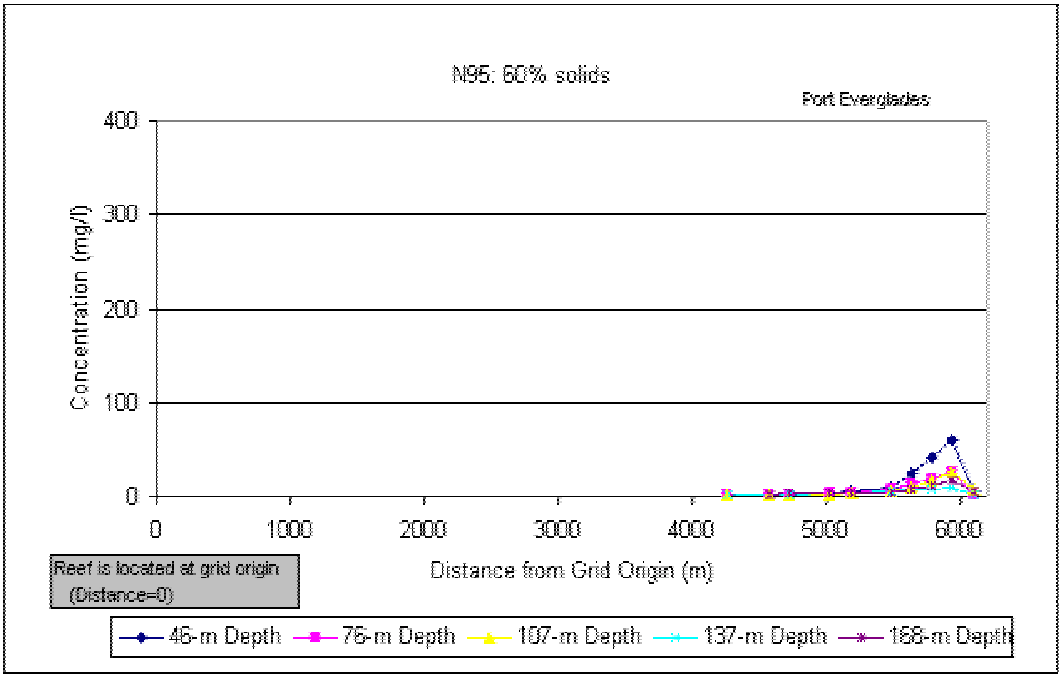


Figure 15. Total sediment concentration

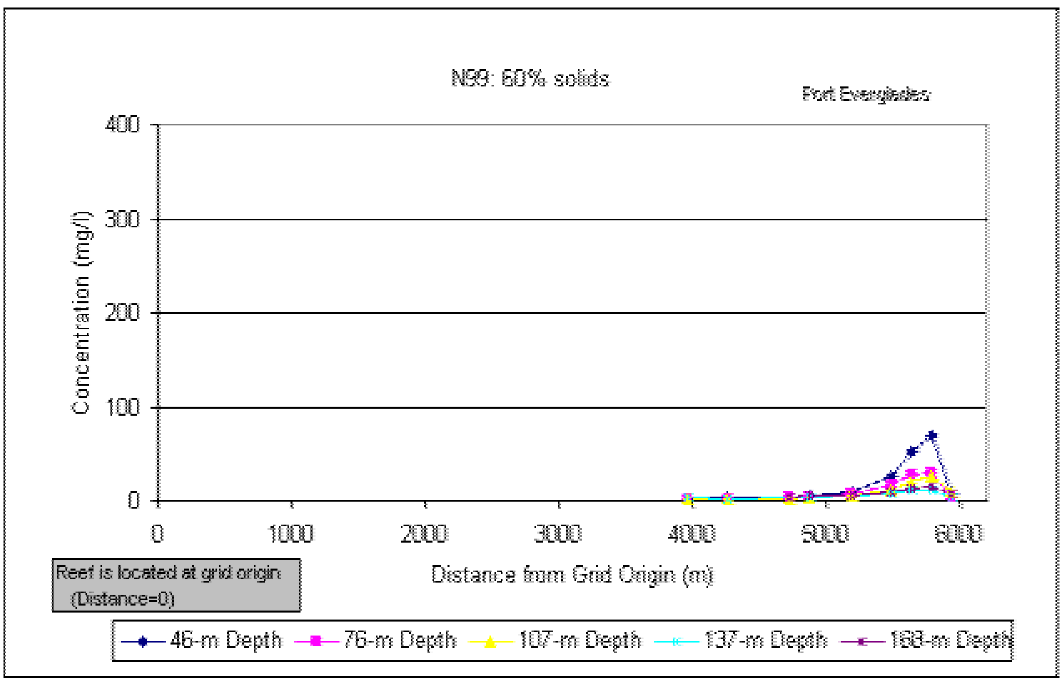


Figure 16. Total sediment concentration

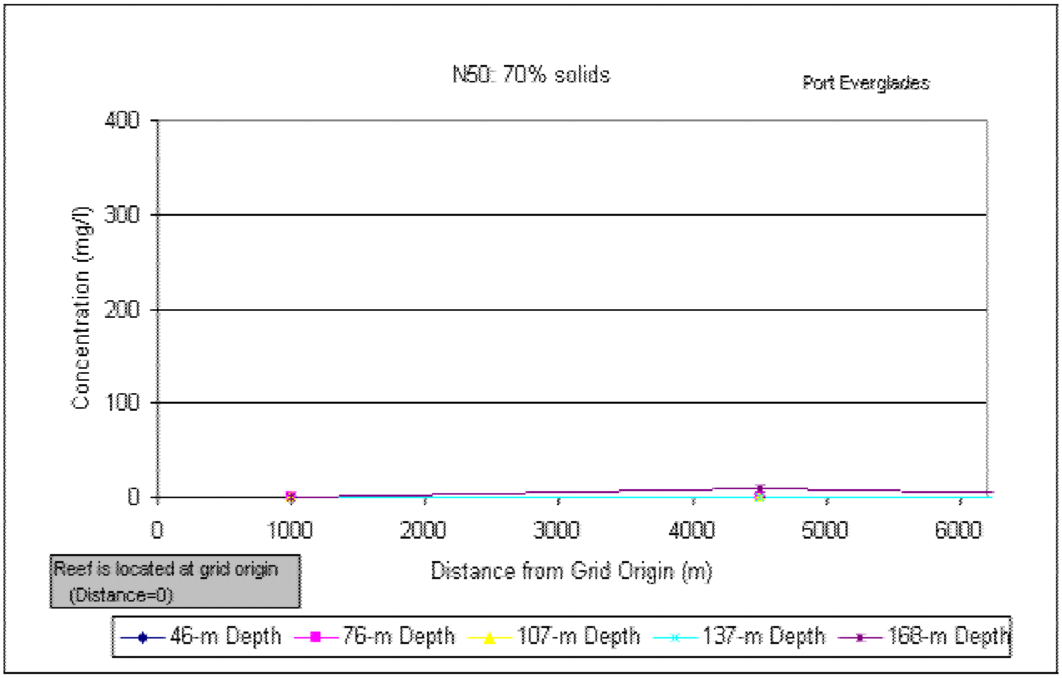


Figure 17. Total sediment concentration

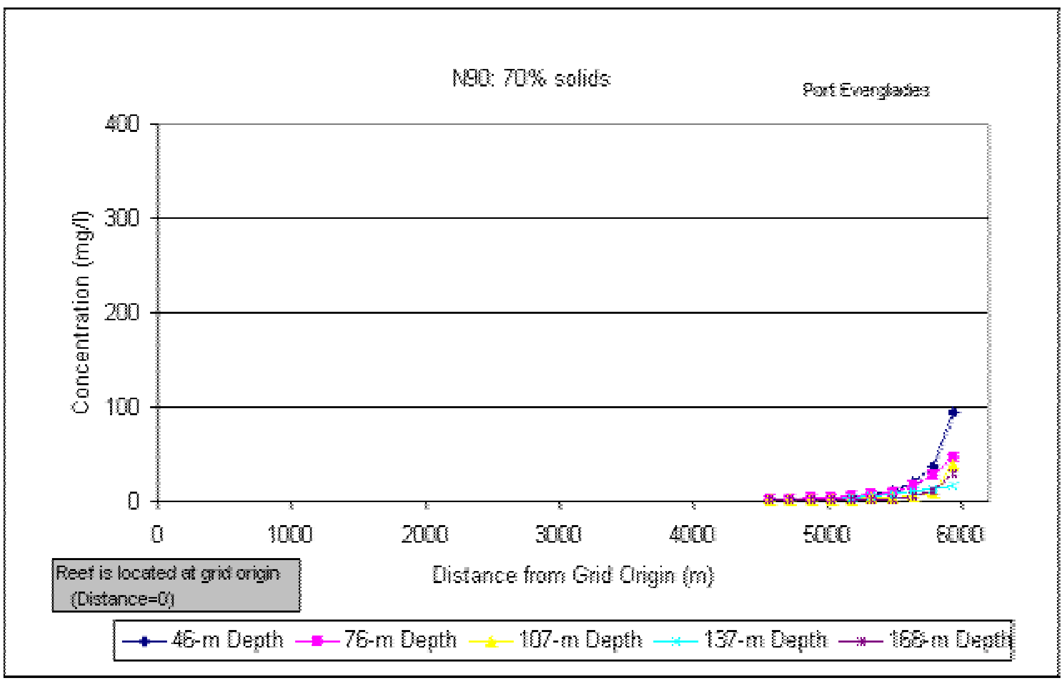


Figure 18. Total sediment concentration

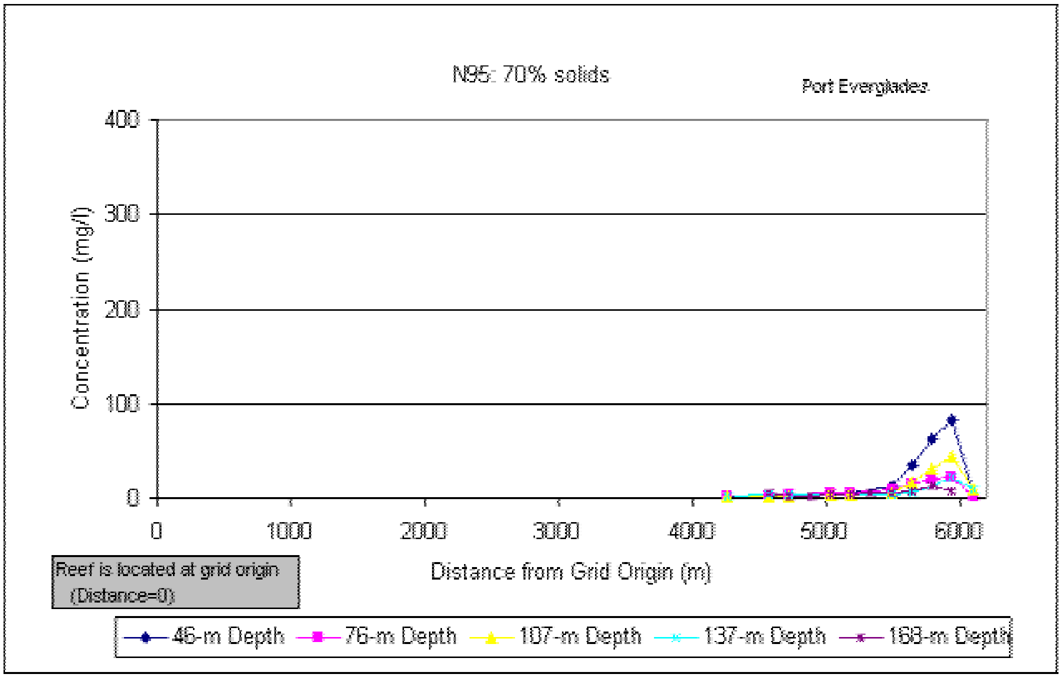


Figure 19. Total sediment concentration

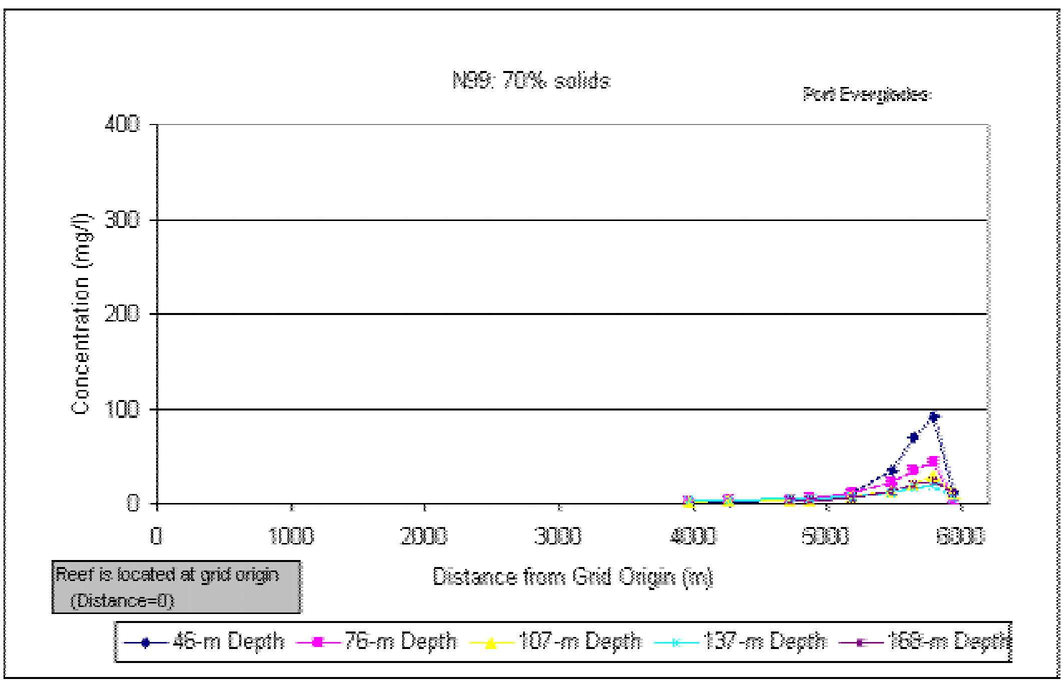


Figure 20. Total sediment concentration

To evaluate the validity of our conservative assumption, the offshore distance and the alongshore distance for all northwesterly-directed velocities at Port Everglades were examined and were found to coincide. It can be inferred from the coincidental locations at Port Everglades that the conservative approach of coincident maximum concentrations adopted for the northwesterly-directed velocities at Palm Beach can be considered a good assumption. Two sediment compositions were simulated, 80% and 85% solids by weight. Table 3 shows the volume fraction of sand and silt.

Table 3. Palm Beach sediment characteristics

% solids by weight	% fines	Volume fraction fines	Volume fraction sand
80	6	.0368	.5664
85	6	.0417	.6426

The maximum concentration is the maximum within the grid over the duration of the simulation. The total concentrations were calculated at five water depths to describe the variation of the total concentration in the water column. Figures 21-36 show the reconstructed total concentrations versus offshore locations from the reef (grid origin) at each model simulation time step. The original model outputs contain maximum concentration values at offshore distances from the reef of no less than 3600 m. This distance is mainly a function of model simulation time, water depth, disposal location and grid boundaries.

For Palm Beach applications, sediment was disposed approximately 5500 m from the grid origin and not 5300 m as was mentioned in the previous study. The sand concentration diminished to a value of 1 mg/l within 2900 m of the reef location and the silt-clay concentrations diminished to approximately 1 mg/l within 3810 m of the reef location (Cialone, M. A. and Lillycrop, L. S., 1998). In the previous study each portion of the sediment was estimated separately and consequentially the above-mentioned values represent concentrations at different distances from the reef and for different velocity input conditions.

The present results indicate that under the most severe conditions (N99: 85%), the maximum total sediment concentration within 3800 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 1.6 mg/l.

The previous and the present studies describe the same model results and the difference in the stated concentration values and their offshore distances is due to the use of calculated total sediment concentration.

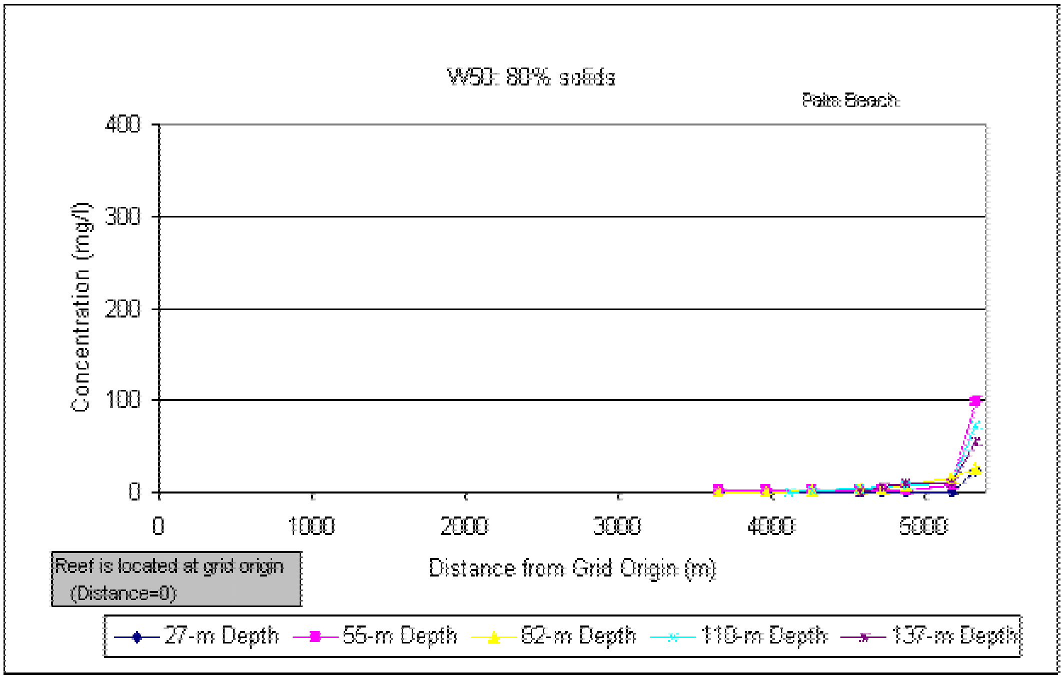


Figure 21. Total sediment concentration

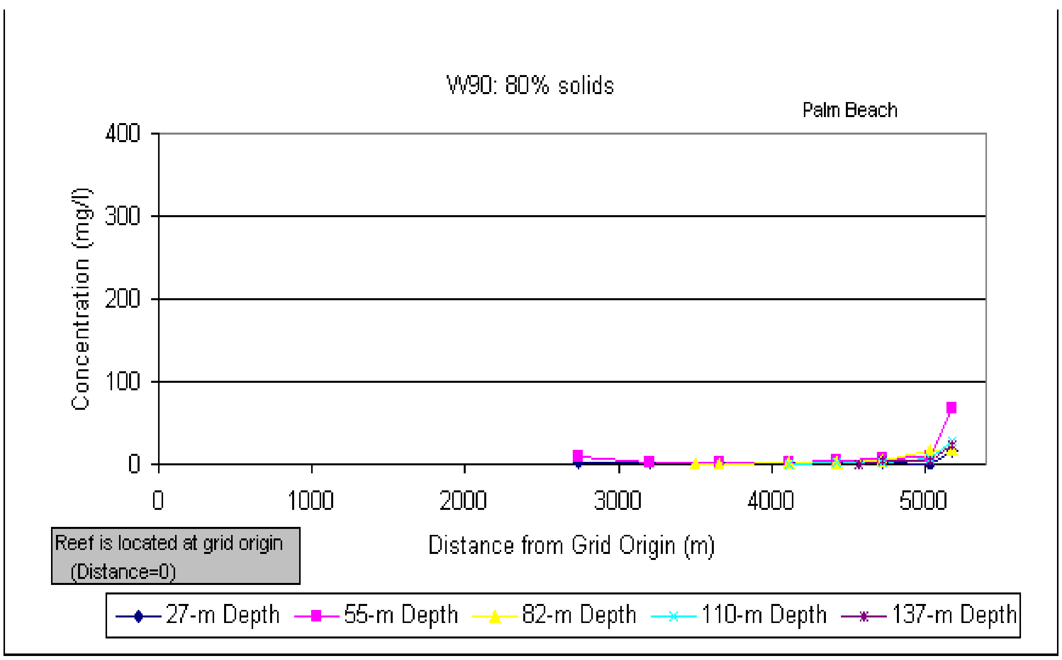


Figure 22. Total sediment concentration

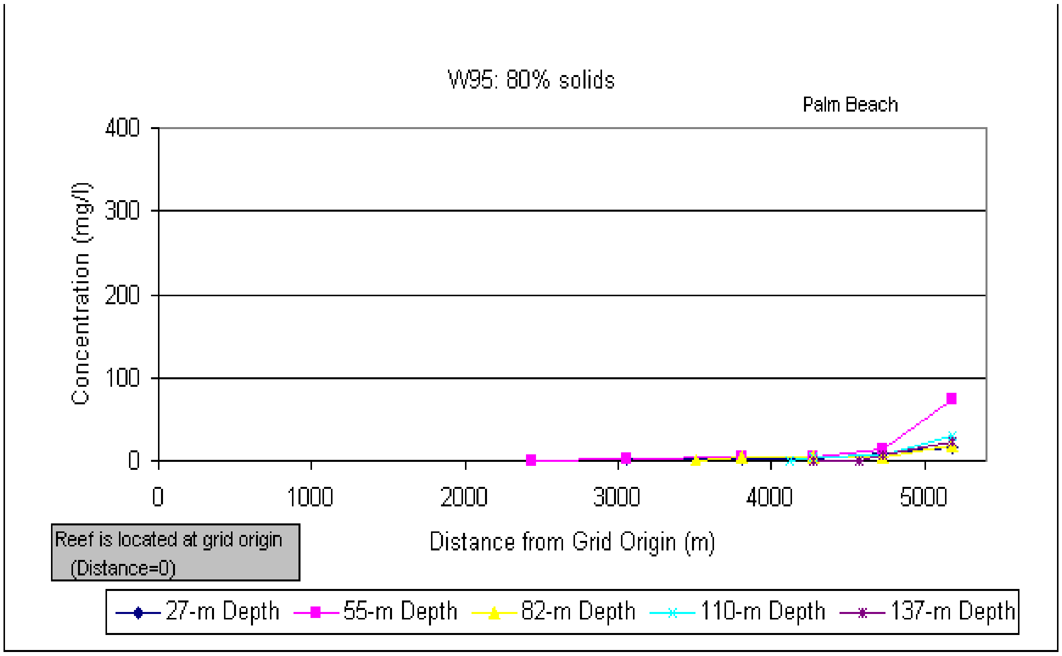


Figure 23. Total sediment concentration

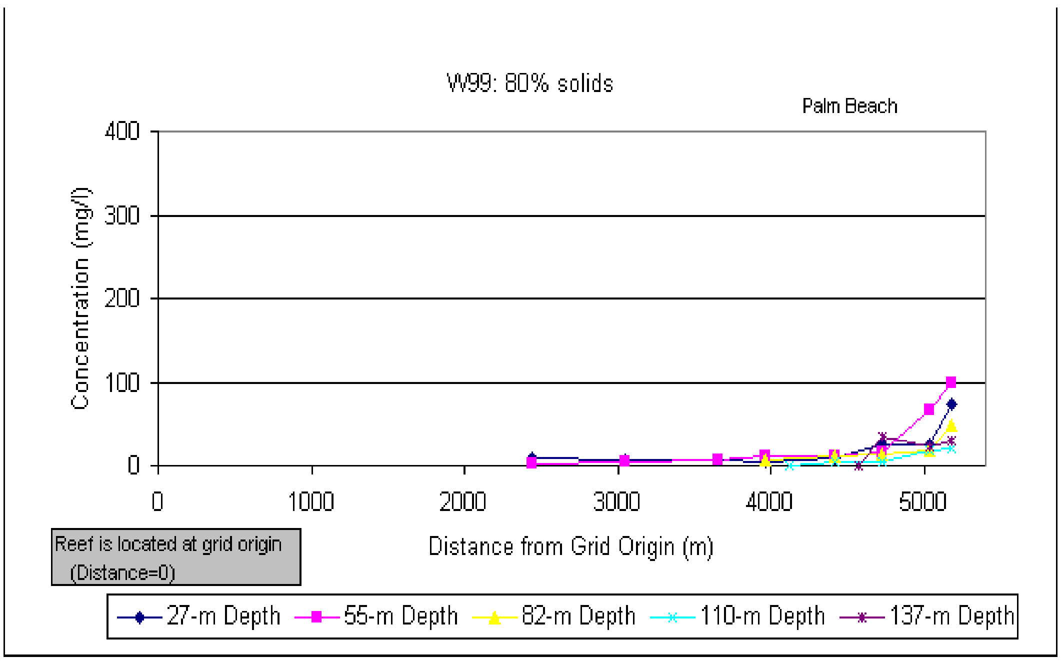


Figure 24. Total sediment concentration

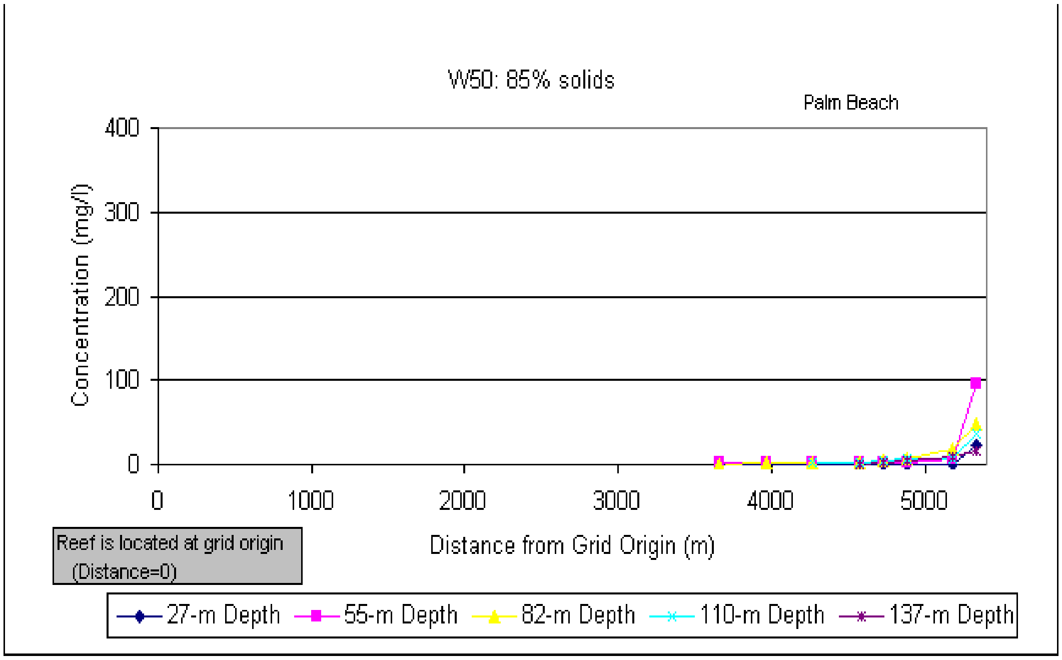


Figure 25. Total sediment concentration

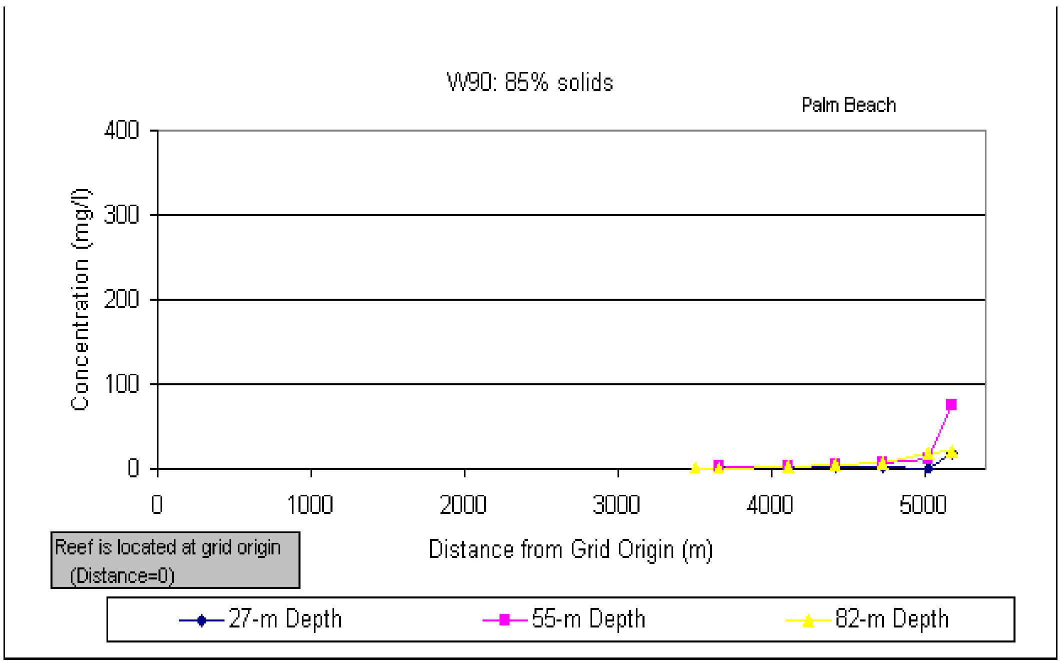


Figure 26. Total sediment concentration

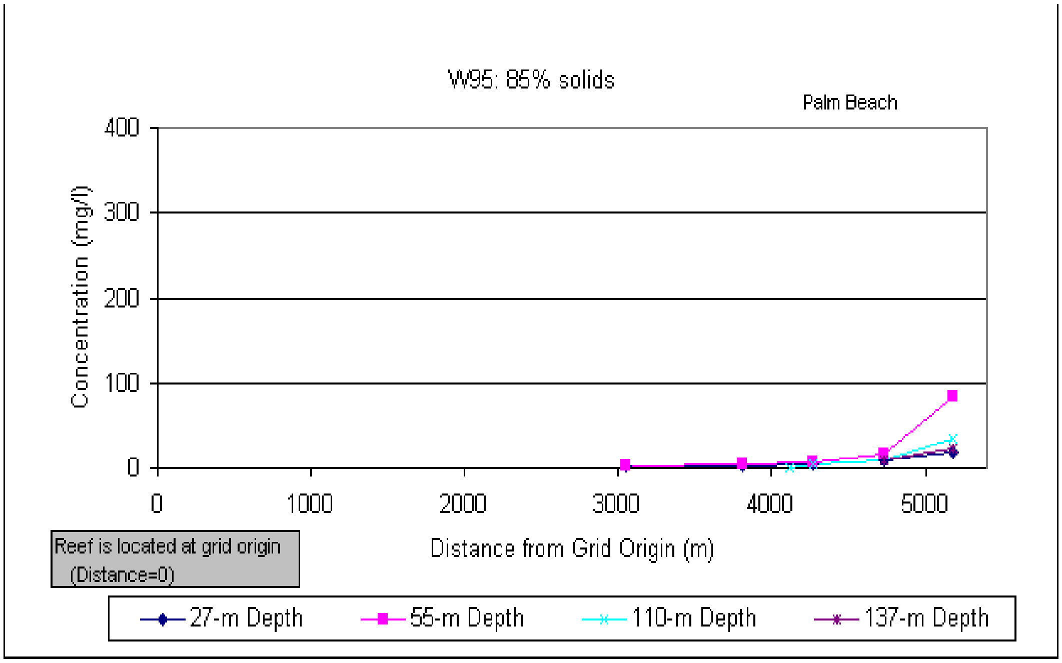


Figure 27. Total sediment concentration

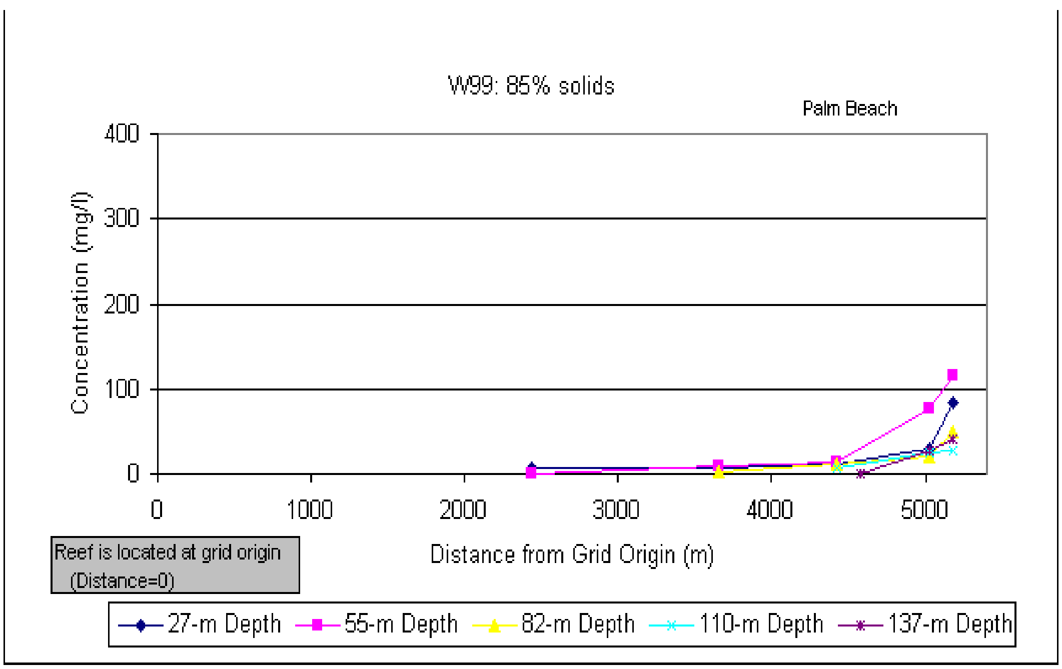


Figure 28. Total sediment concentration

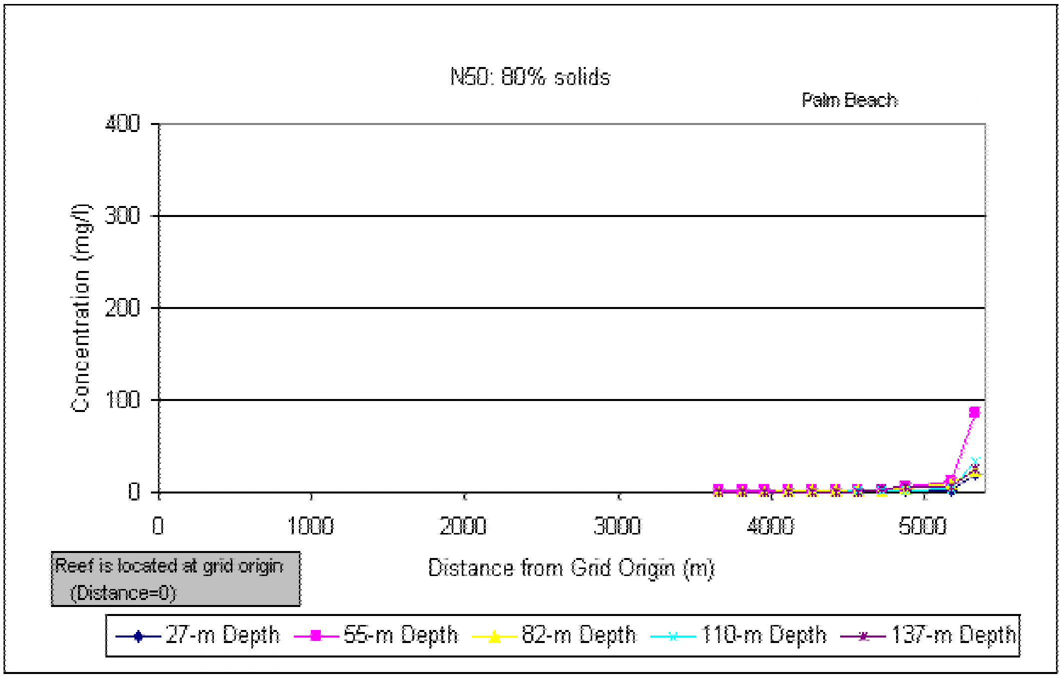


Figure 29. Total sediment concentration

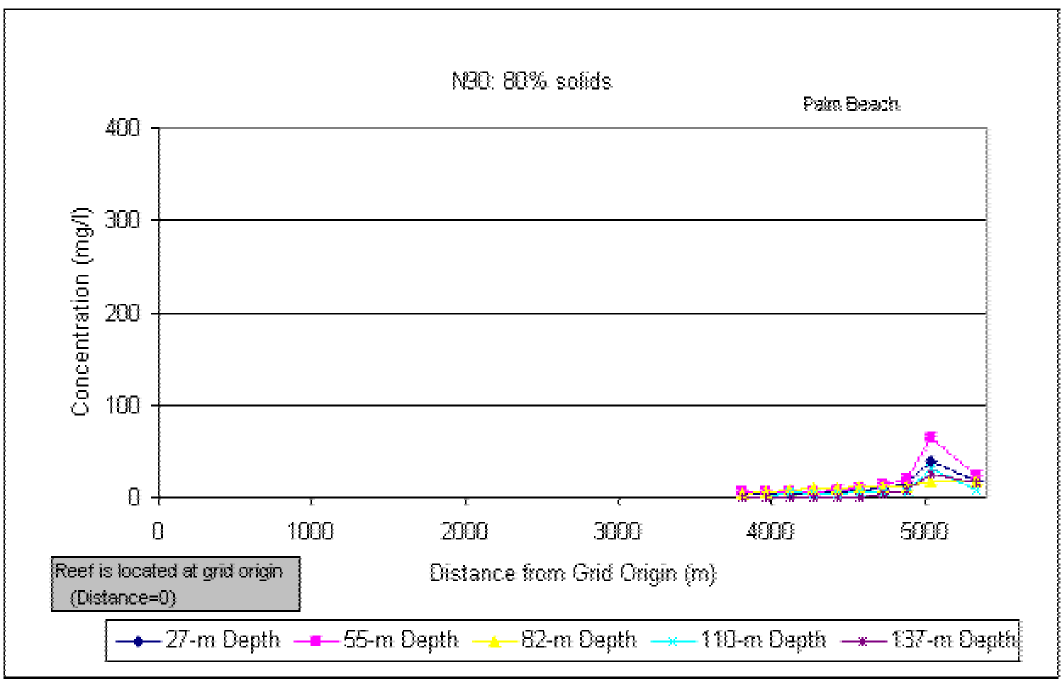


Figure 30. Total sediment concentration

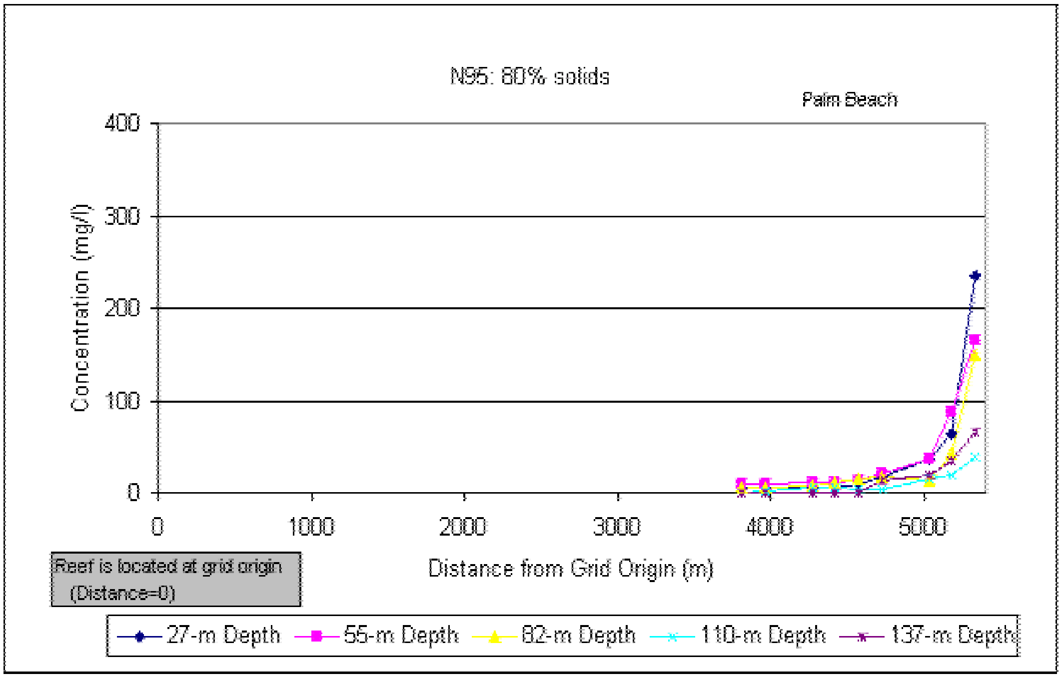


Figure 31. Total sediment concentration

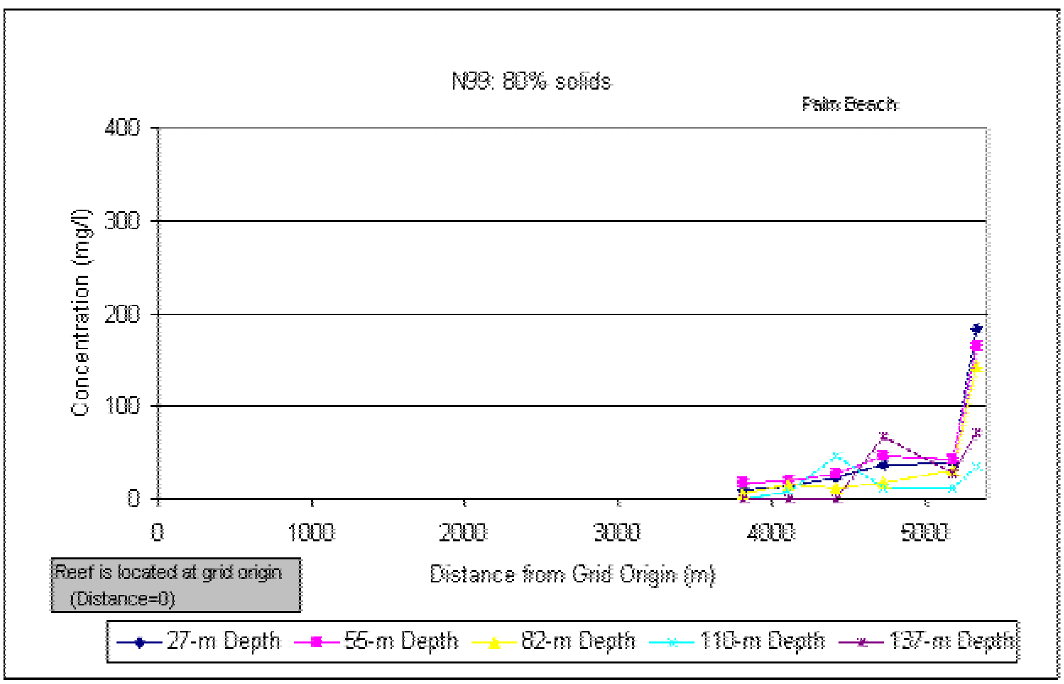


Figure 32. Total sediment concentration

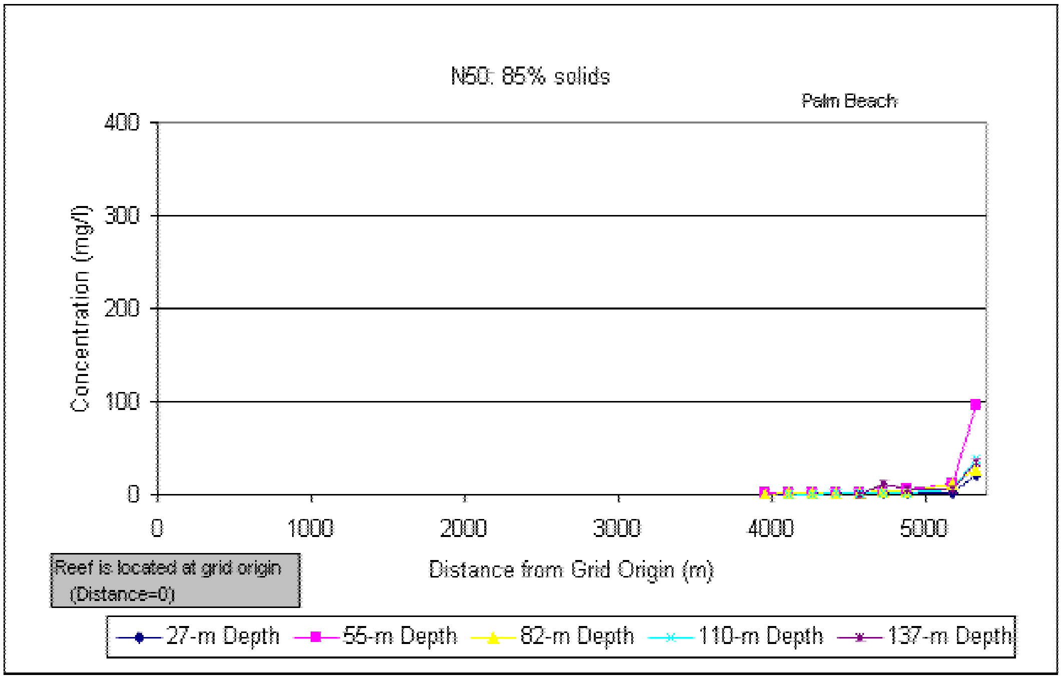


Figure 33. Total sediment concentration

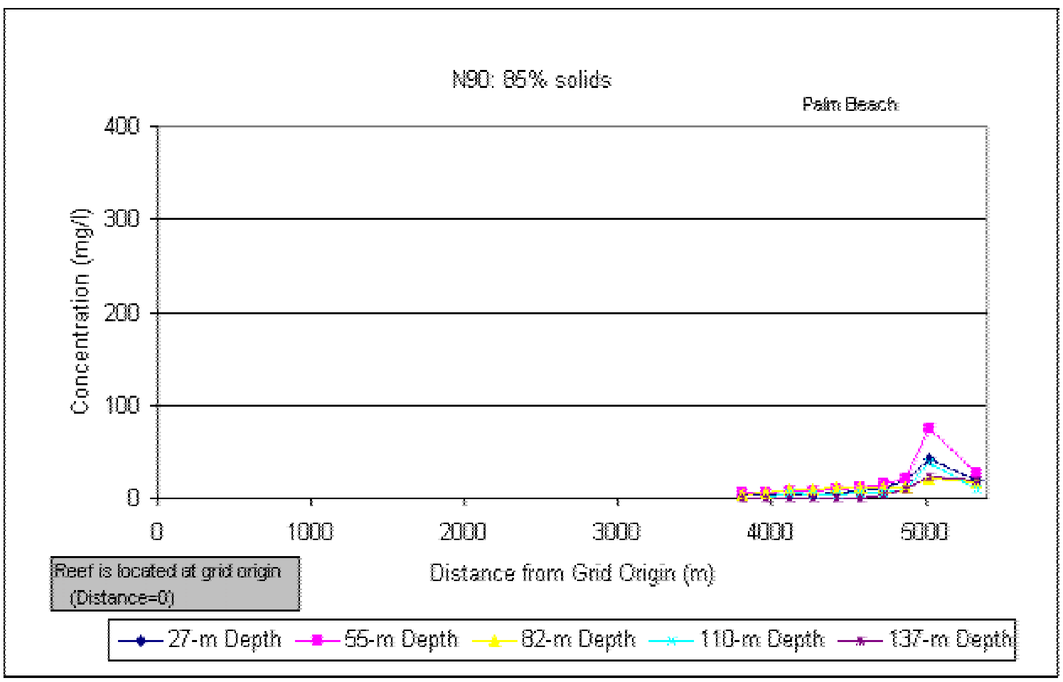


Figure 34. Total sediment concentration

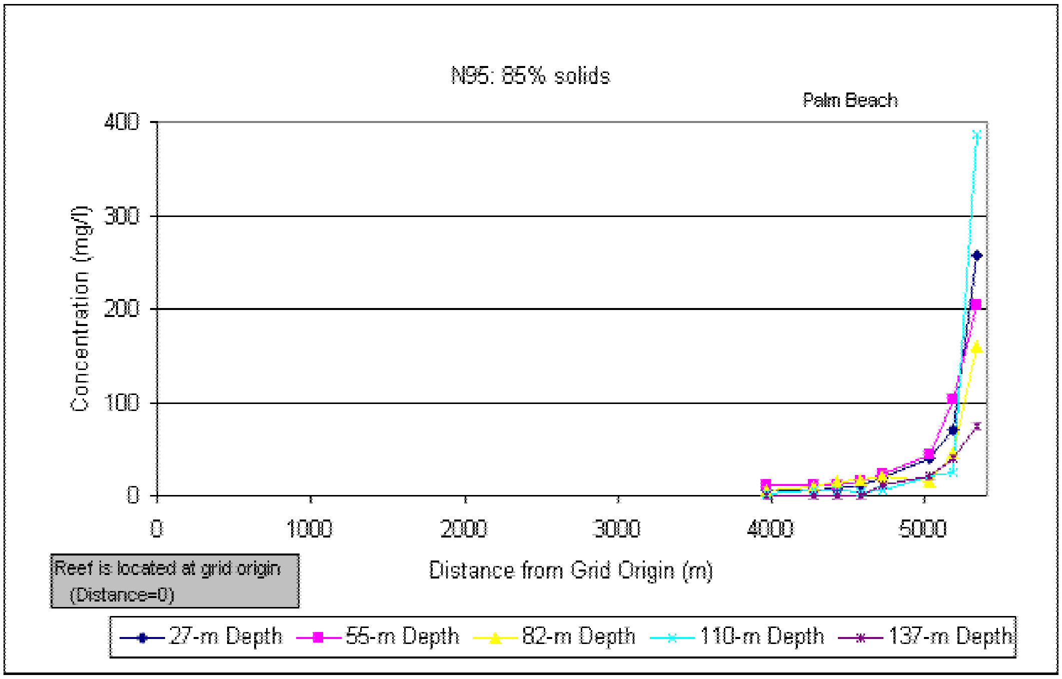


Figure 35. Total sediment concentration

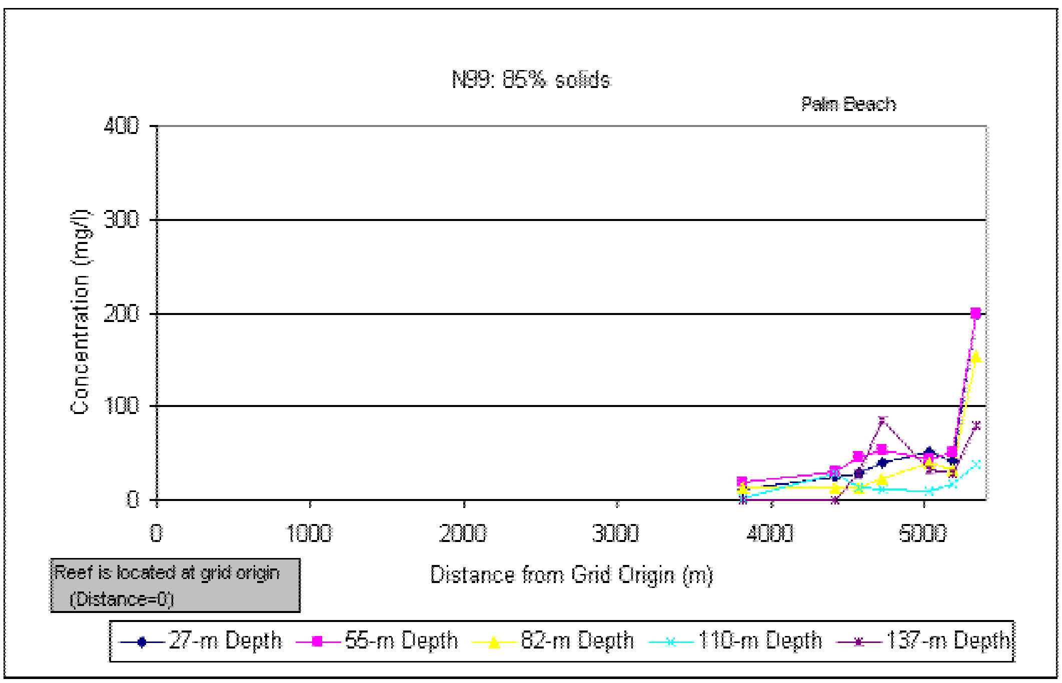


Figure 36. Total sediment concentration

Velocity Data for the Palm Beach Site

The ADCP data analyzed for the previous study represented the best-known source of long-term data at the time of the study. Figure 37 shows the location of the ADCP with respect to the Port Everglades and Palm Beach ODMDS sites. The Palm Beach site is about 70 km to the north of the ADCP, therefore a search for additional velocity data for Palm Beach was requested by SAJ to determine if current data closer to Palm Beach ODMDS has become available.

Numerous personal contacts were made and web sites were searched for velocity data in the Palm Beach area as shown in Tables 4 and 5. No data closer to the Palm Beach site than the previously used ADCP were found. Therefore, the Environmental Protection Agency (EPA) suggested writing a brief description of the Florida Current to justify the use of the ADCP data for the Palm Beach ODMDS. It was then requested by SAJ that a brief description of the Florida Current be prepared.

Florida Current

The origin of the Gulf Stream begins as the Atlantic and North Equatorial Current system combines with the South Equatorial and Guyana Current system. This combined flow discharges through the Caribbean Sea and Yucatan Channel into the southeastern portion of the Gulf of Mexico. Because the waters are colder than the surrounding Gulf of Mexico, a density differential is created which results in a deflection of the current from the Gulf of Mexico toward the Straights of Florida (EPA, 1995).

Figure 37. Location of the ODMDSs with respect to the ADCP

Table 4. Personal Contacts

Name	Affiliation	Search Findings
Margaret Sabol	CHL	No data was found.
Jack Davis	CHL	No data was found.
Norman Scheffner	CHL	No data was found.
Robert Dean	University of Florida	They measured velocity data in very shallow water (4 m) offshore of Palm Beach. The Palm Beach ODMDS site is located in water depths of about 170 m which is further offshore. Also some data was collected during the late 1970's offshore of Ft. Lauderdale but the ADCP data, used in the study, collected more recent data (1995-1997) offshore of Ft. Lauderdale.
Don Slinn	Florida Atlantic University	They deployed an ADCP approximately 12 miles offshore of Ft. Lauderdale. The position of the ADCP used in the previous study is about 3 miles offshore of Ft. Lauderdale which is closer to the study area. Also, the data cannot be made public for approximately another year.
Ryan Smith Doug Wilson	NOAA Atlantic Oceanographic and Meteorological Laboratory (AOML)	No reply.
E-mail contact	Oceanographer of the Navy	No reply.
Bill Venezia	South Florida Ocean Measurement Center	They do not have velocity data off Palm Beach and they are interested in such data. They are collecting real time velocity data from an ADCP southeast of Port Everglades in 520 ft water depth. This is the same location from which ADCP data used in the original study were acquired (26 degrees 4' N by 80 degrees 3.5' W).

Table 5. Web Sites Table	
Web Site	Search Findings
Center of Operational Oceanographic Products & Services (NOAA)	No data was found.
South Florida Information Access Database (USGS)	No data was found.
Naval Surface Warfare Center (NAVY)	No data was found.
Ocean Planet: Ocean Currents (NASA)	No data was found.
Interactive Marine Observations (FSU)	No data was found.
National Oceanographic Data Center (NODC)	The only data collected by NODC close to Palm Beach was the data used in the original study.

The movement of the Gulf Stream through the continental shelf often creates rotational patterns which propagate away from the main body of the Stream. These patterns generally represent unstable meanders which become detached from the main body of the Stream. These detached secondary currents are referred to as spin-off eddies. Richardson (1985) identifies three distinct zones of the Gulf Stream. These are the clockwise rotating onshore eddy, the axis or main body of the Stream, and the counterclockwise rotating offshore eddy. The high velocity axis of the Gulf Stream acts as a barrier separating the onshore and offshore regions. Depending on the environmental conditions, detached onshore eddies can propagate to the north, shoreward, or to the south with short-lived periods ranging from 2 days to 2 weeks. The meandering process is well illustrated in an example presented by Bane and Brooks (1979). In Figure 38, a 64-week period of Sea Surface Temperature data is used to show the shoreward and seaward envelope of occupation of the Gulf Stream in relation to the location of the time-averaged mean axis shown by the dashed line.

The Florida Current is that 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 et al., 1977). Over most continental shelves, circulation is primarily governed by tides and winds. Off the southeast coast of Florida, circulation is also strongly influenced by the Florida Current.

The Florida Current influences coastal circulation on the southeast Florida Shelf in two ways, depending on the degree of intrusion of this current over the continental shelf (EPA, 1973). According to the EPA (1995), “When the western edge of the Florida

Current is over the shelf, the current draws the coastal waters north, though velocities may be considerably reduced due to bottom friction. When the western edge of the Florida Current is seaward of the continental shelf, cyclonic spin-off eddies are formed. These eddies, with an average diameter of 10-30 km, are usually carried north, but cyclonic currents inside the eddies may control local current patterns. Following their formation, spin-off eddies usually travel northward along the continental margin at speeds ranging from 20 to 50 cm/s. At these rates, it generally takes less than one day for an eddy to pass a fixed point (Lee et al., 1977). Eddies occur, on average, once per week and can be recognized as disruptions of prevailing temperature and salinity fields and of local current patterns (Lee and Mayer, 1977)." These cyclonic eddies play an important role in coastal exchange processes, removing coastal water and replacing it with waters from the Florida Current.

The western boundary of the Florida Current is distinguished from the inshore waters by a sharp rise in sea surface temperature. Movement of the western boundary near Fort Pierce was studied by Fornshell (2000) using satellite imagery for a period of 51 days from January 21, 1998 to March 13, 1998. At Fort Pierce, which is north of the study area, Fornshell found the average distance from shore to the western boundary of the Florida Current was 29.3 km. There were five incursions onto the continental shelf by the Florida Current during the study with an average recurrence interval of 10 days. This is approximately the same periodicity as the spin-off eddies reported by Lee (1975) and Lee et al. (1977) based on measurements made south of the study area. During the 51-day period, the average distance from shore to the western boundary of the Florida current was 8 to 60 km. Figure 39 shows the observed positions of the Florida Current during the 51 days of the study. At this location near Fort Pierce, the distance from the shoreline to the shelf break is about 40 km.

Figure 40 shows the bottom topography in the study region. Locations where Fornshell (2000), Lee (1975), and Lee and Mayer (1977) examined the Florida Current, the Palm Beach and Port Everglades ODMDSs, and the location where the ADCP data used in this study were acquired, are also shown. The mean axis of the Gulf Stream (see Figure 38) and the shelf break (Figure 40) are nearly parallel in the study region. As seen in Figure 38, the meander deviation decreases with increasing proximity to the study area. The width of the shelf and the distance from shoreline to shelf break also decreases with increasing proximity to the study area. The shelf break plays a dominant role in steering the Florida Current. It is important to note the similarity in both shelf topography, and the distance from shore to the shelf break at the Palm Beach and Port Everglades ODMDs and at the location where the ADCP data were acquired. The ODMDS sites and the ADCP site are located about 3 km west of the shelf break, i.e., about 7 km from the average position of the western boundary of the Florida Current. North of Palm Beach and south of Port Everglades, the topography varies (shelf widens and distance from shore to shelf break increases), but at these three locations and in the region between them, the topography is quite similar. With the dominant current flowing to the north, steered by the shelf break, and with a mean Gulf Stream position that is located a similar distance from shore at both Palm Beach and Port Everglades (see Figure 38), it is logical that the predominant current flowing along the shelf would be similar in magnitude at the two sites. In general, the currents might be slightly less at Palm Beach, since the shelf begins to widen at this location, and continues to widen with increasing distance north of the site.

The EPA has expressed concern regarding the fate of the dredged material disposed at the ODMDSs due to their proximity to the Gulf Stream and its spin-off eddies. The average

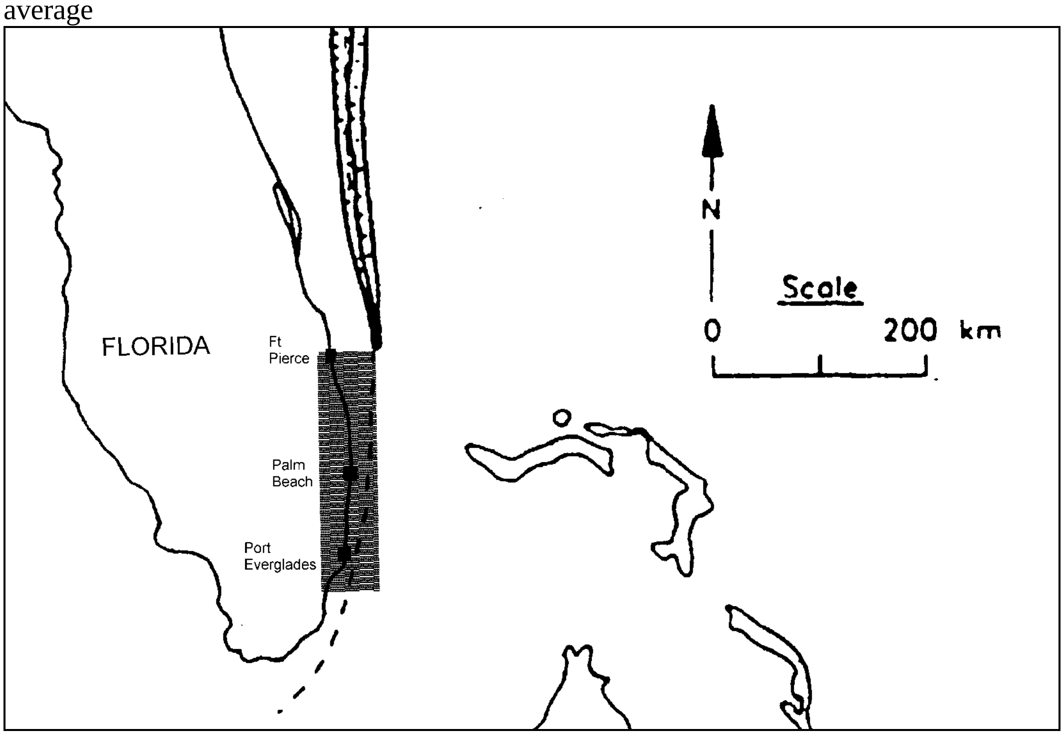


Figure 38. Mean position (dashed line) and meander deviation of the Gulf Stream surface (Bane and Brooks, 1979). The black box shows the study area

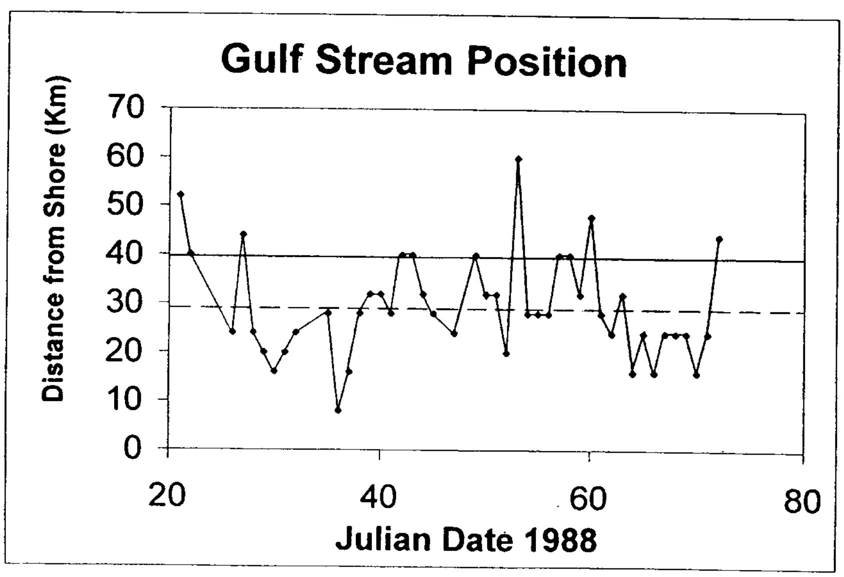


Figure 39. Observed positions of the Florida Current at Fort Pierce. The solid horizontal line represents the shelf break and the dashed line is the average position of the western boundary

of the Florida Current. (Fornshell, 2000)

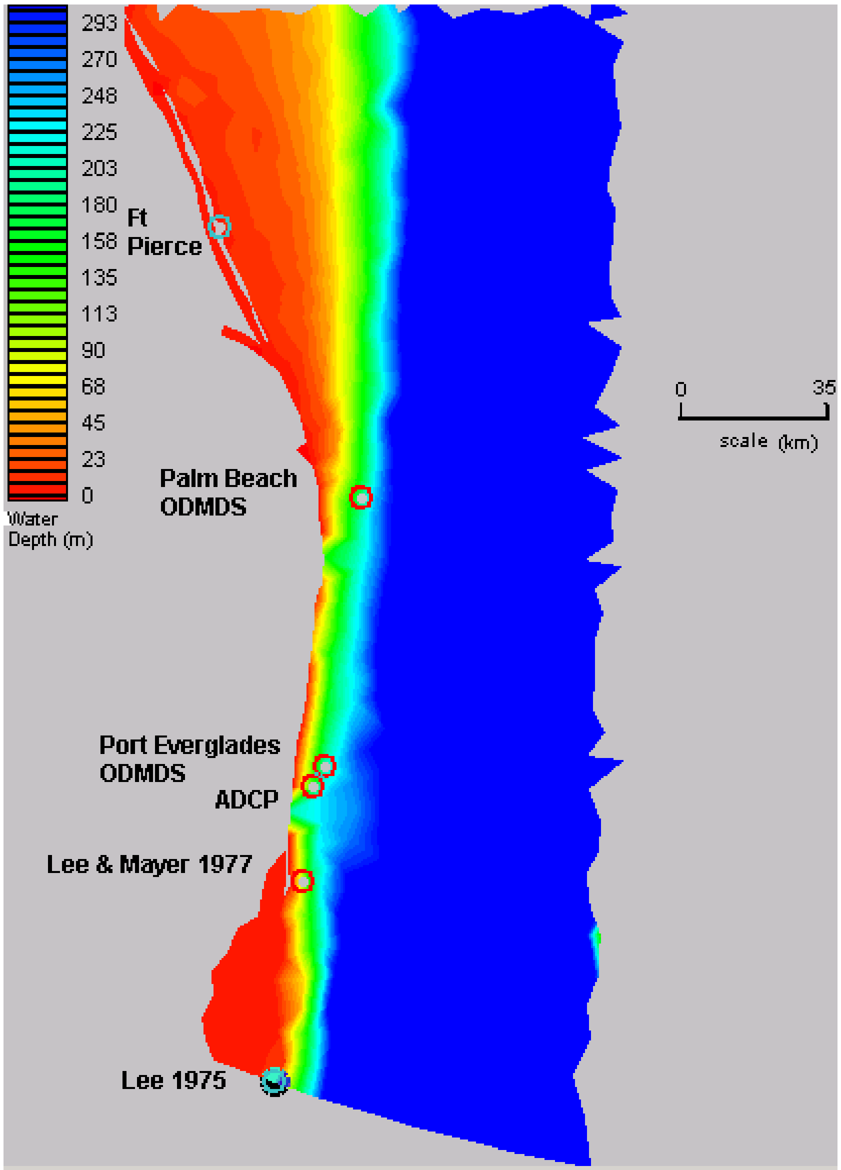


Figure 40. Topographic map for the study area

diameter of the spin-off eddies in this region is about 10 to 30 km. The small distance between shoreline and shelf break in the study region (about 10 km) probably constrains the formation and propagation of eddies, compared to areas where the shelf is much wider. However, the similarity in shelf topography at both ODMDS sites, and at the ADCP site, suggests that eddies are constrained in a similar way at all three sites. The ADCP and the ODMDS sites are expected to experience similar effects of the spin-off eddies. In light of the length scale of the eddies, similarity in shelf topography, and similar proximity to the western boundary of the Florida Current, currents at the three sites can be expected to be similar. Therefore, it is justified to use the ADCP current data for the Palm Beach ODMDS.

STFATE Modeling of “Typical” Current Profile

The typical (V_{50}) velocity profile modeled using STFATE was derived from analysis of the 0-5 deg angle band described in Cialone and Lillycrop (1998). Simulating sediment transport under these conditions will provide a description of phenomena under typical conditions. Figure 41 shows the typical velocity profile to be modeled using STFATE. In the previous study, STFATE modeling involved either a varying bathymetry or a varying velocity profile. Available model technology did not incorporate variation in both depth and velocity. Therefore, to complete this task, model modifications to adopt a four-point velocity profile were made. Also, a MATLAB routine was used to read the STFATE concentration output file and spatially add the sand and silt-clay concentrations to estimate the maximum total concentration within the grid.

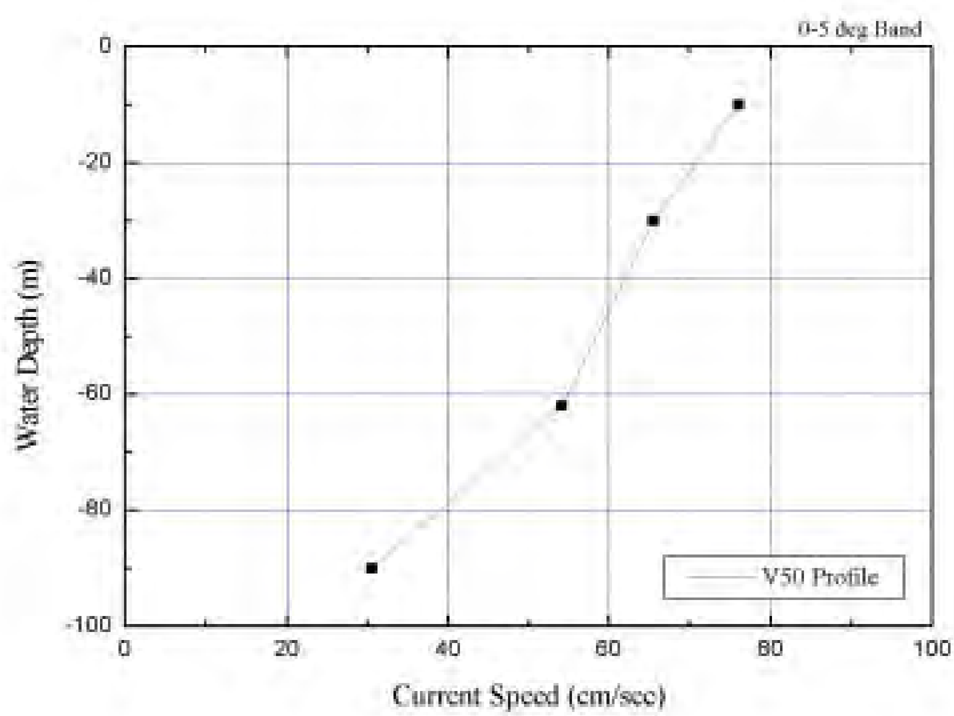


Figure 41. Typical velocity profile

Port Everglades

The input files of the original model simulations were not retrievable. Where possible, the input parameters were extracted from the available original output files. Most of the input parameters were retrievable and the rest were assumed.

Before running the STFATE model for the typical profile, STFATE was run for a northwesterly-directed velocity of 1% exceedance and 60% solids (N99: 60%) case with a one point (constant of 200 cm/s) velocity profile. The goal of the STFATE run was to verify that the retrieved and assumed input data could reproduce the same output as the original simulation. Figures 42-44 show the comparison of the old and new output data for sand and silt-clay sediment concentrations. The results showed a consistent pattern and very good agreement in values for some cases. Inconsistency in the results can be attributed to the assumed values in the input file.

The concentrations of sediment subjected to a typical velocity profile were obtained by running the modified version of the STFATE model. Figures 45-47 show the comparison between the results for the typical 4-point velocity profile input and the one-point velocity input. It can be seen from the results that the general pattern is conserved and close agreement is seen for the sand case. For the silt-clay sediment, the general pattern is similar for the typical 4-point velocity profile input and the one-point velocity input.

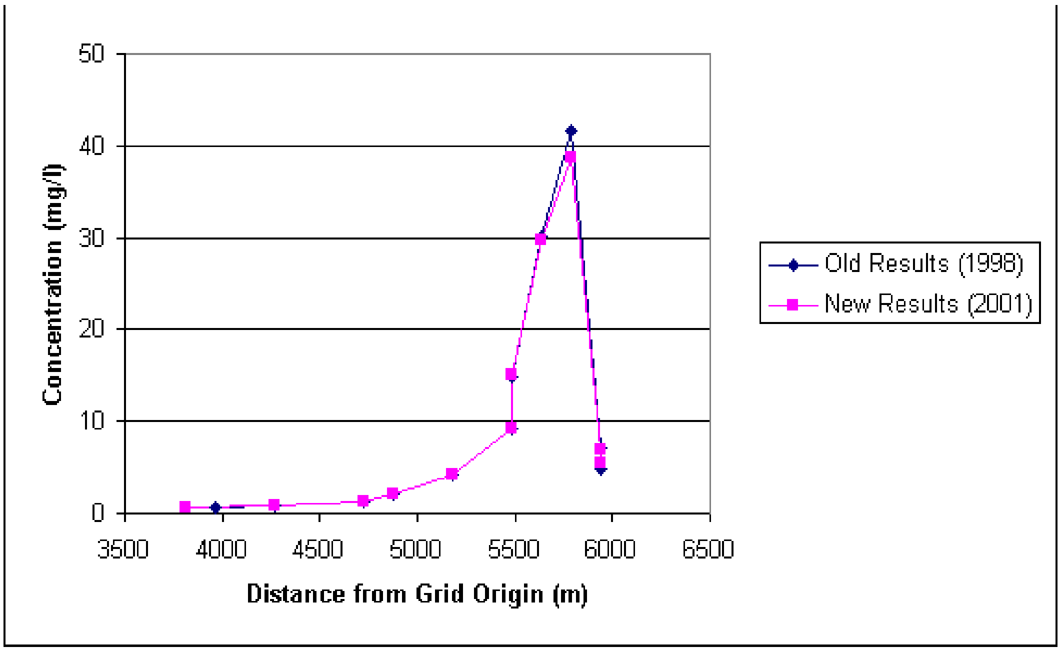


Figure 42. Comparison between old and new output data for sand at 46-m depth

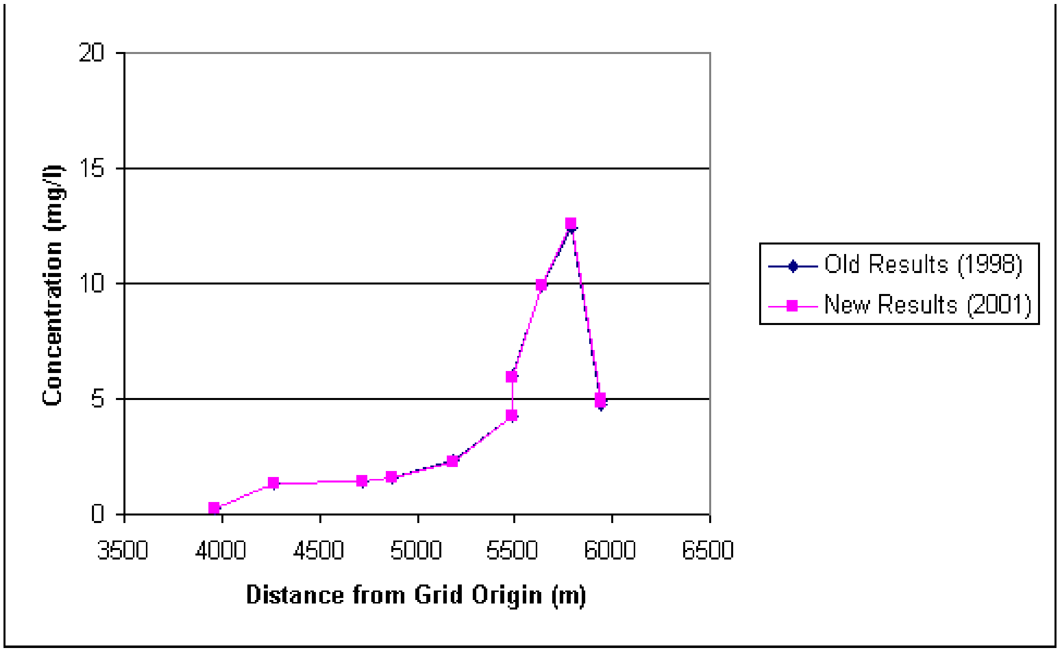


Figure 43. Comparison between old and new output data for sand at 168-m depth

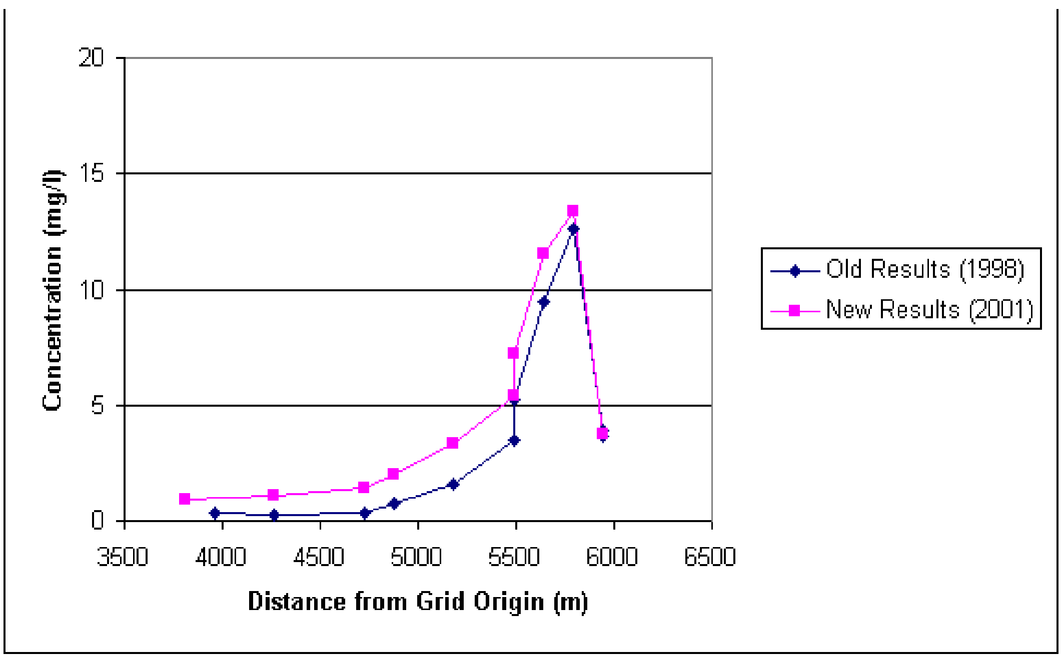


Figure 44. Comparison between old and new output data for silt-clay at 107-m depth

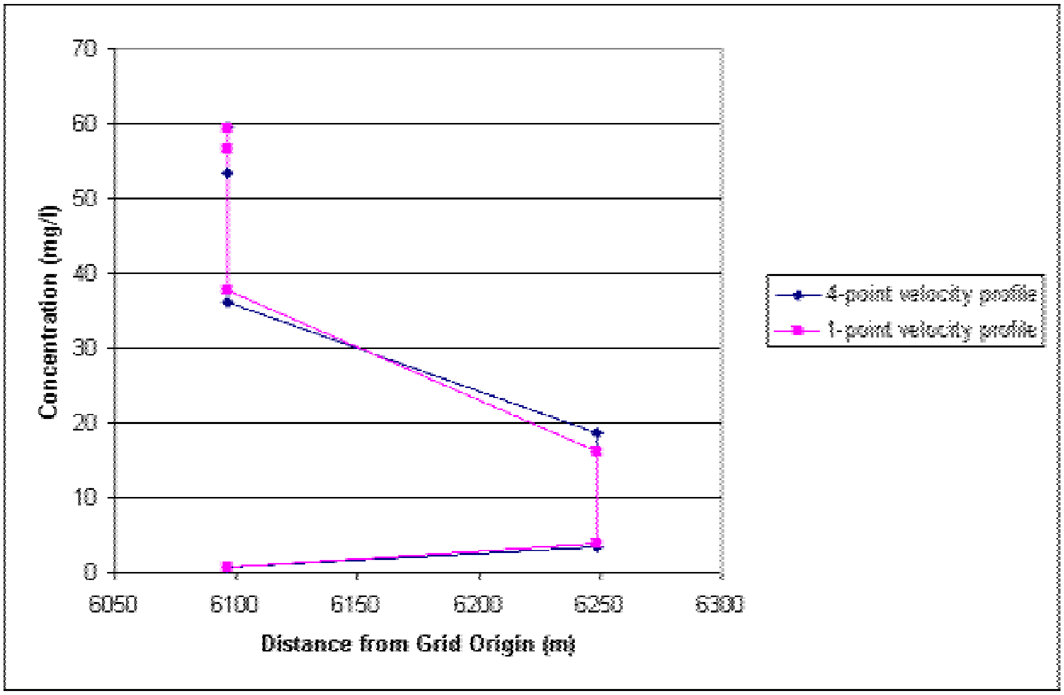


Figure 45. Comparison between STFATE results for typical 4-point velocity profile input and the one-point velocity input for sand at 46-m depth

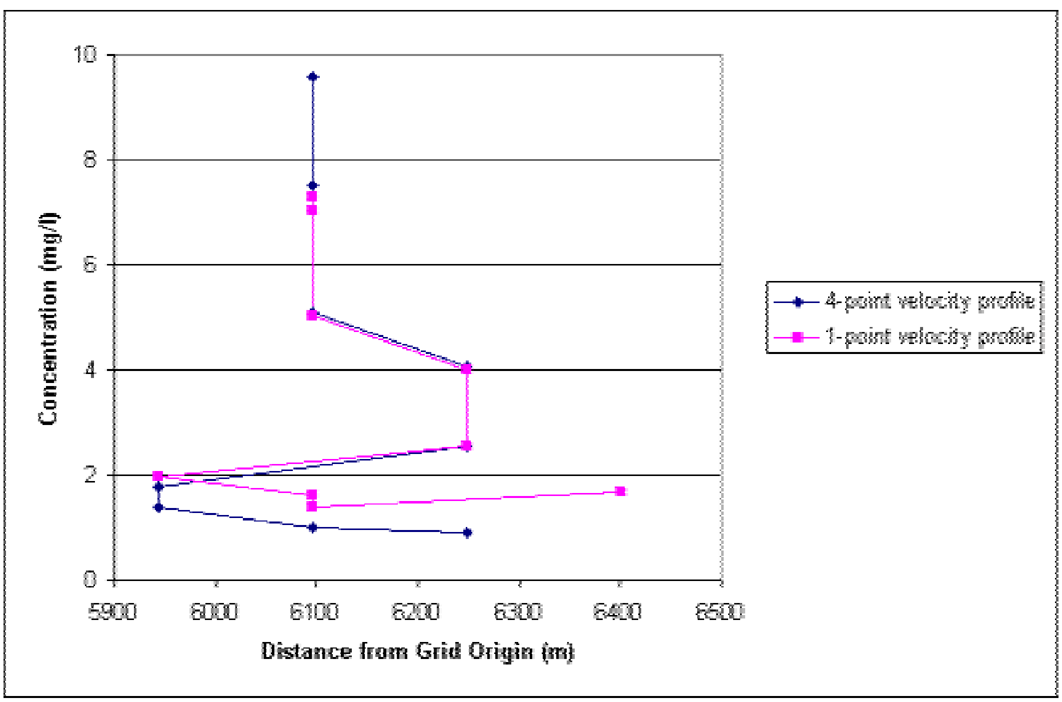


Figure 46. Comparison between STFATE results for typical 4-point velocity profile input and the one-point velocity input for sand at 168-m depth

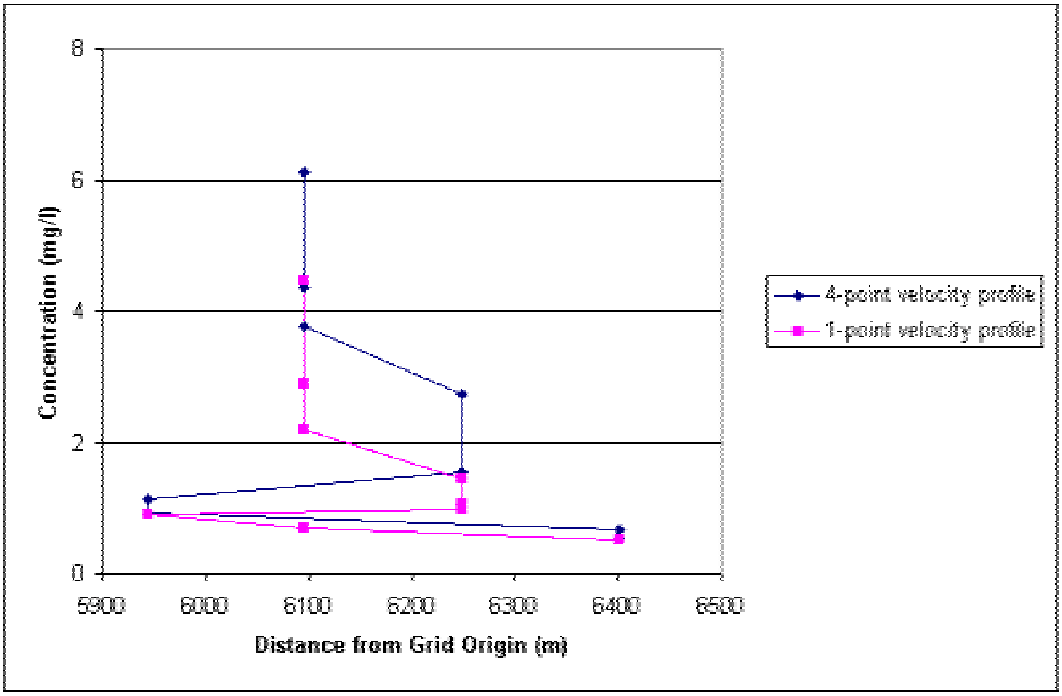


Figure 47. Comparison between STFATE results for typical 4-point velocity profile input and the one-point velocity input for silt-clay at 107-m depth

The flow direction associated with the typical profile is approximately to the north and the sediment was disposed 6100 m from the grid origin (reef location). The total concentration results for the 60% solids and 70% solids are shown in Figures 48 and 49 respectively. The bubble size is proportional to the total concentration value. Concentration values are also listed. The maximum concentration in the water column after 1200 sec was 74.6 mg/l for the 60% solids case and 91.5 mg/l for the 70% solids case. After 6000 sec, the maximum total concentration in the water column recorded for the 70% solids case was 2 mg/l and at a distance of 6250 m from the reef.

Results from the previous study show that the maximum total concentration in the water column recorded for the N50: 70% case was 0.85 mg/l and was 2.03 mg/l for the W50: 70% case at a distance of 5000 m from the reef in both cases. The distance of 5000 m from the reef was the minimum distance for which the maximum total sediment could be calculated for both the W50: 70% case and the N50: 70% cases. When the direction of the velocity was toward the west a higher value of concentration was recorded at a distance of 5000 m from the reef than when the velocity was directed toward the northwest.

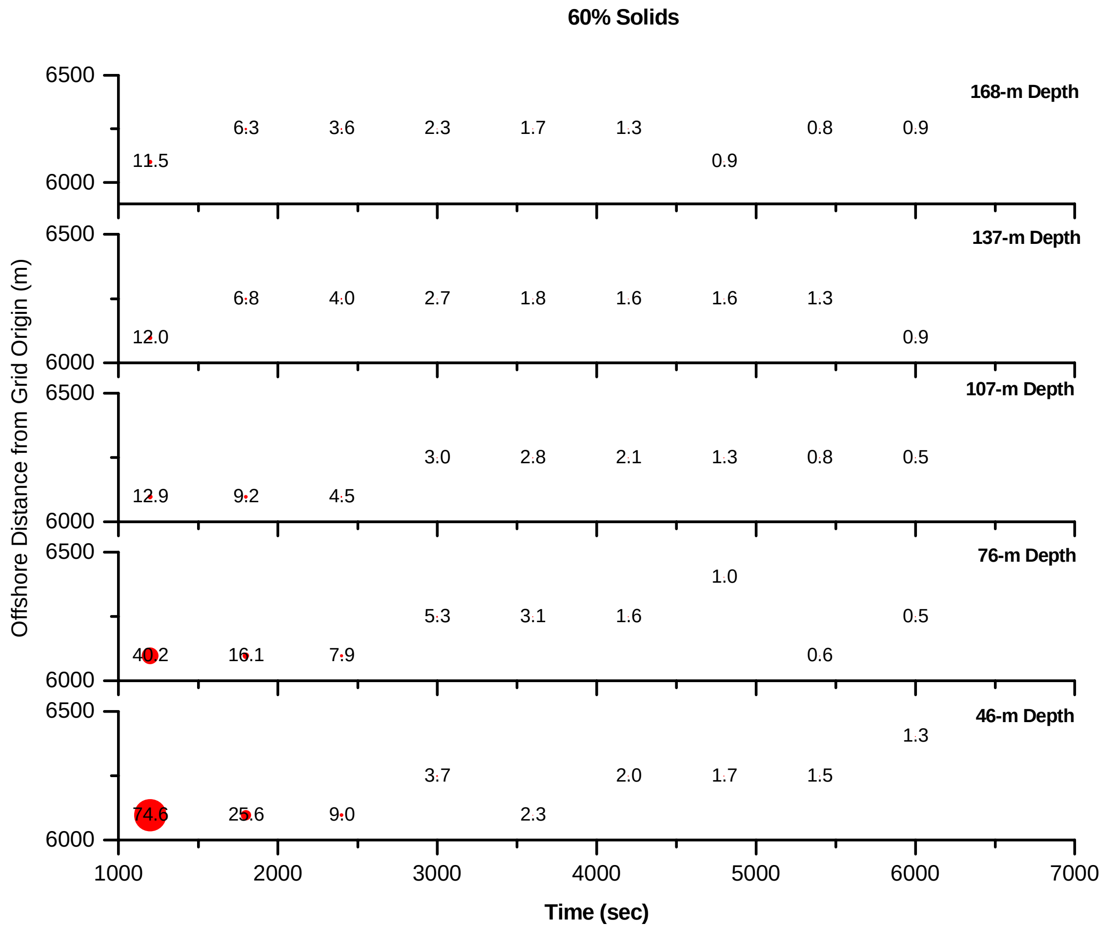


Figure 48. Total sediment concentration in mg/l at Port Everglades
(depths are measured from the water surface)

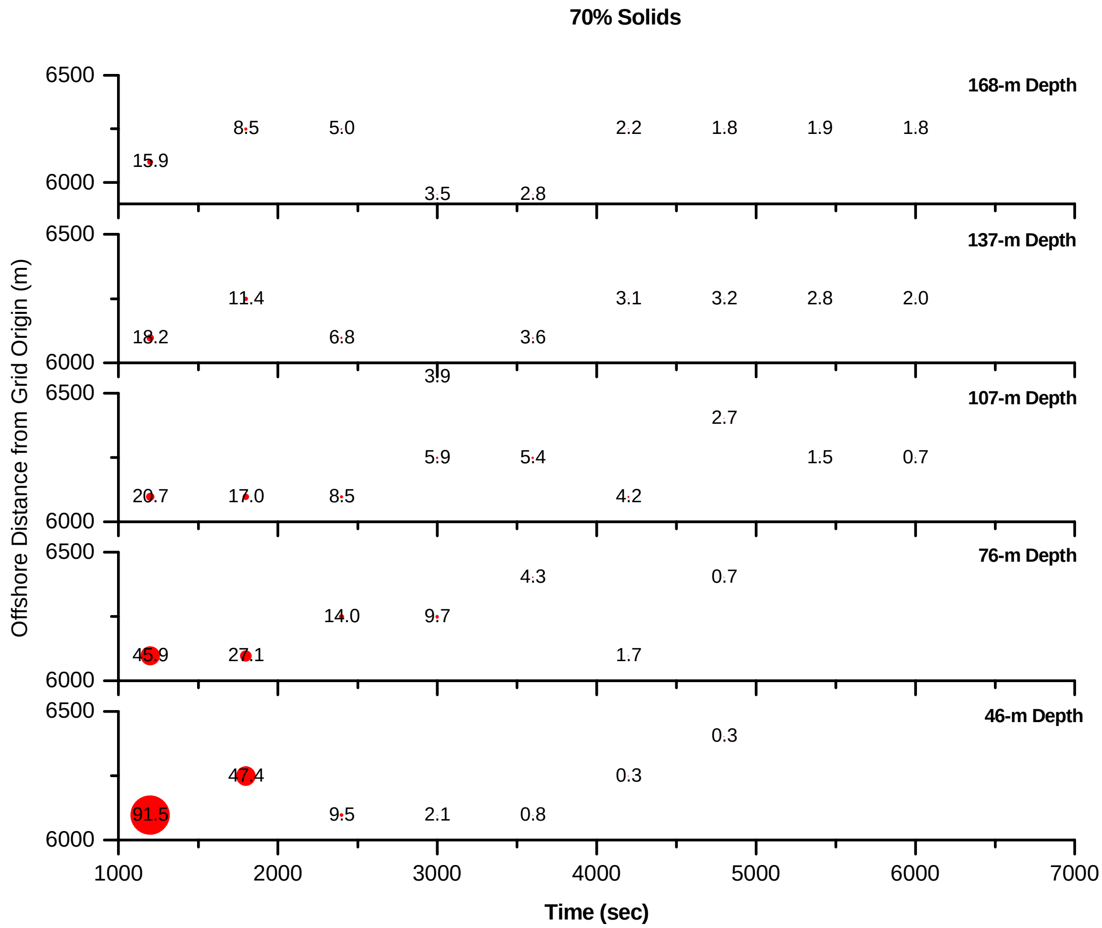


Figure 49. Total sediment concentration in mg/l at Port Everglades (depths are measured from the water surface)

However, in the case of the typical velocity profile the sediment was moving toward the northeast and not toward the reef. Concentrations 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. The direction of the velocity is a main factor in directing the sediments toward or away from the reef. Therefore it can be concluded that there is no potential for sediment movement from the ODMDS at Port Everglades onto the reef.

Palm Beach

The input and output files from the original model simulations were not completely retrievable. Therefore some input parameters were recreated and others were assumed. The depth input matrix was not available and was recreated from NOAA Chart 11466. Another main input assumption was the alongshore position of the sediment disposal.

Before running the STFATE model for the typical profile, STFATE was run for a northwesterly-directed velocity of 1% exceedance and 80% solids (N99: 80%) case. As for Port Everglades, the goal of the STFATE run was to verify that the retrieved and assumed input data could reproduce the same output as the original one. Figures 50-52 show the comparison of the old and new output data for sand and silt-clay sediments. The results showed similarity in the general pattern of the concentration profiles. The comparison of the old and new results for Port Everglades showed better agreement than those for Palm Beach because more input data were assumed for the Palm Beach case.

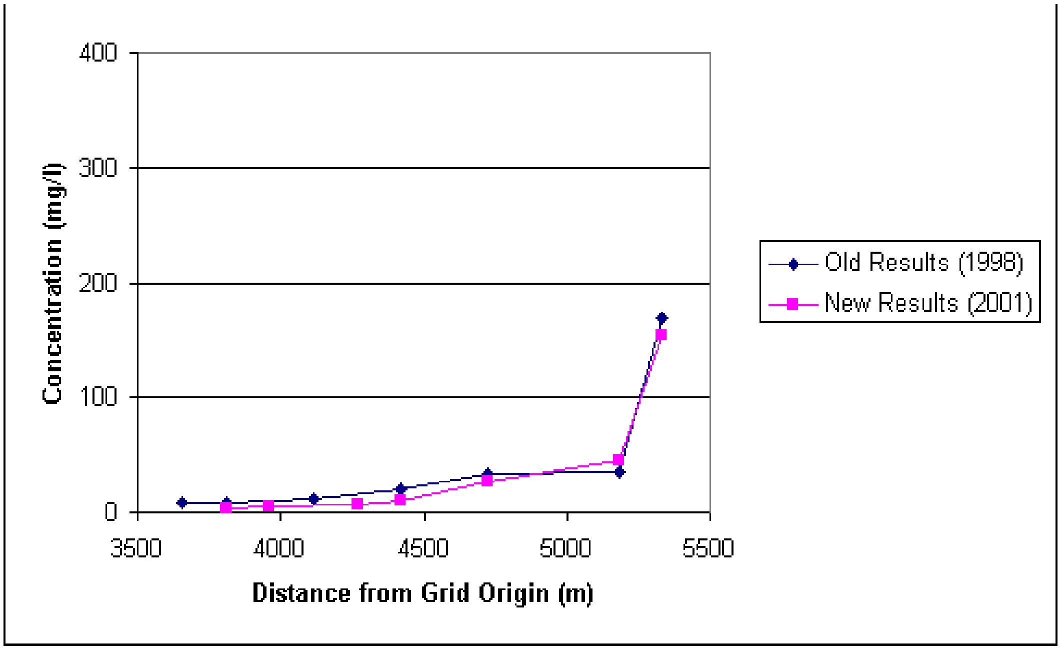


Figure 50. Comparison between old and new output data for sand at 27-m depth

The direction of the typical velocity profile is approximately to the north and the sediment was disposed 5500 m from the grid origin. The results for the 80% solids and 85% solids cases are shown in Figures 53 and 54 respectively. The bubble size is proportional to the total concentration value. The maximum concentration over the depth after 1400 sec was 91.9 mg/l for the 80% solids case and 124.4 mg/l for the 85% solids case. The maximum concentration over the depth recorded after 6300 sec and at a distance of 5800 m from the reef was 2 mg/l for the 85% solids case.

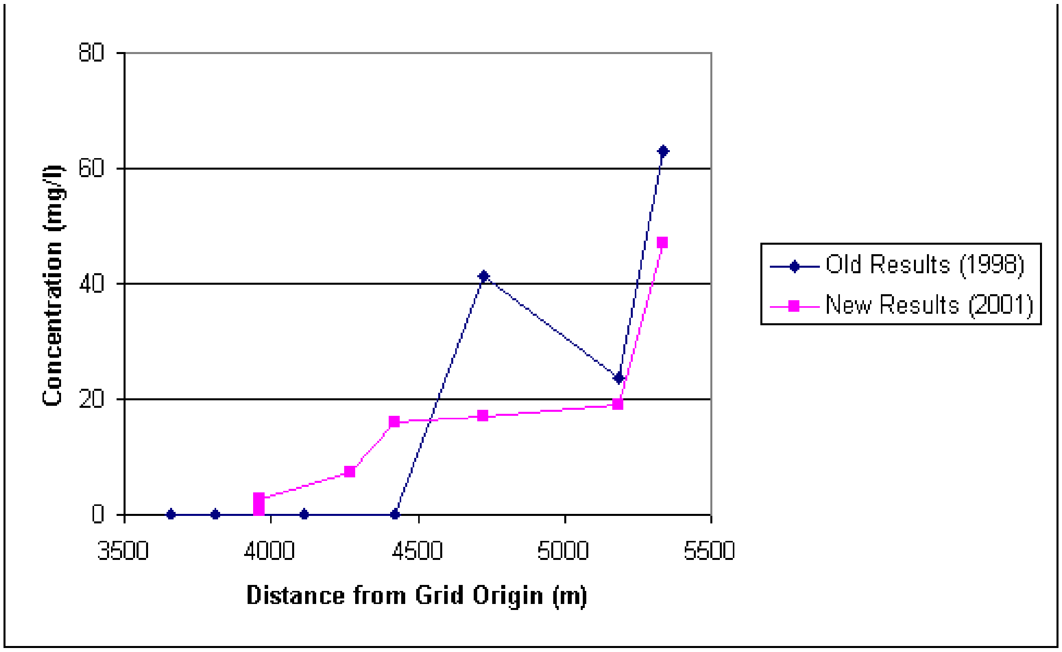


Figure 51. Comparison between old and new output data for sand at 137-m depth

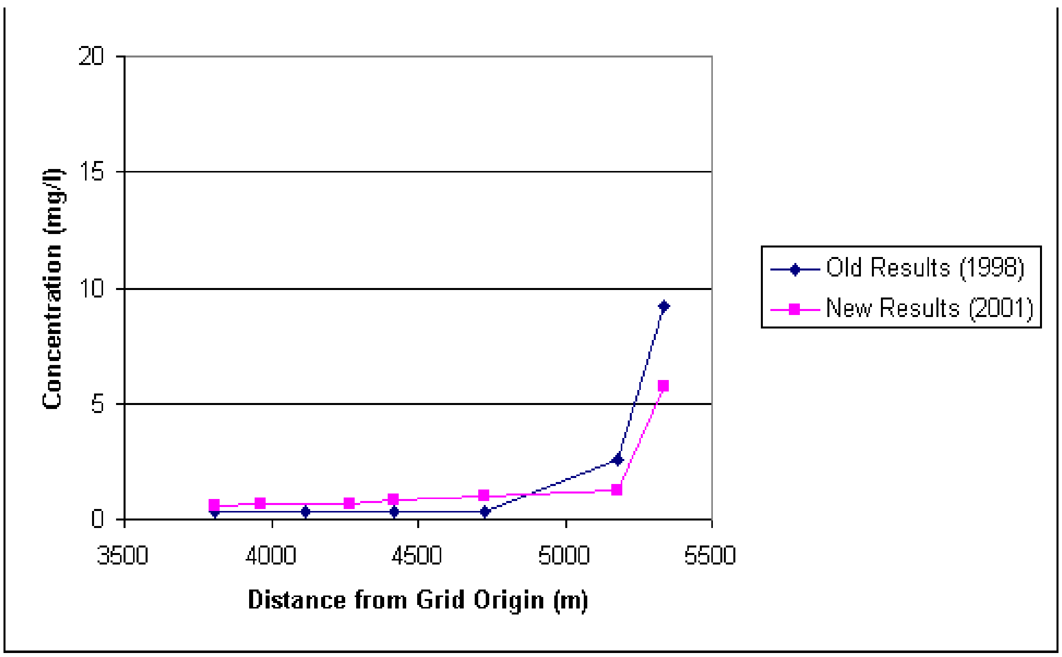


Figure 52. Comparison between old and new output data for silt-clay at 82-m depth

Results from the previous study show that the maximum concentration over the depth for the N50: 85% case at a distance of 4300 m from the reef was 1.69 mg/l and was 2.36 mg/l for the W50: 85% case. The distance of 4300 m from the reef was the minimum distance for which the maximum total sediment could be calculated for both the W50: 85% and the N50: 85% cases. When the direction of the velocity was toward the west a higher value of concentration was recorded at a distance of 4300 m from the reef than when the velocity was directed toward the northwest. In the case of the typical velocity profile the sediment was moving toward the north and the northeast. Concentrations of 0.3 mg/l and of 0.4 mg/l were recorded 300 m to the west of the 5500 disposal location for the 80% solids case the 85% case respectively. In general the sediment was moving toward the north away from the reef.

The results show that the sediment is moving toward the north and approximately parallel to the shore away from the reef. Therefore it can be concluded that there is no potential for sediment movement from the ODMDS at Palm Beach onto the reef.

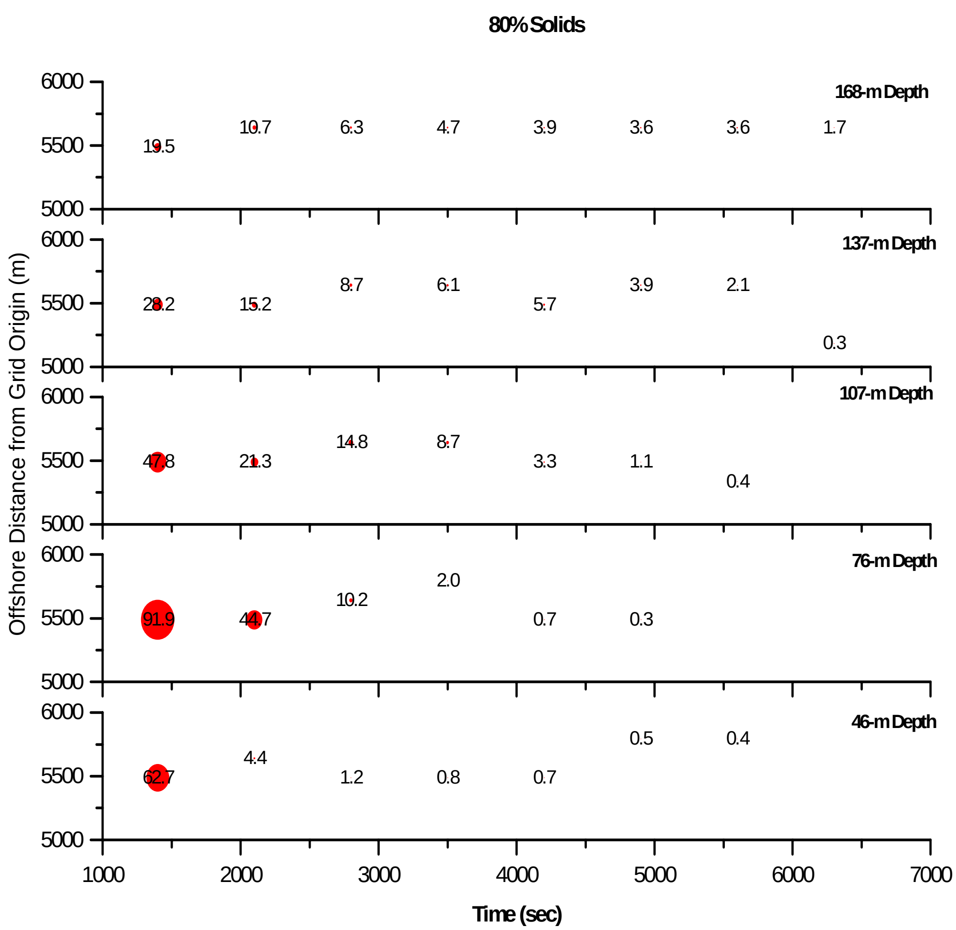


Figure 53. Total sediment concentration in mg/l at Palm Beach (depths are measured from the water surface)

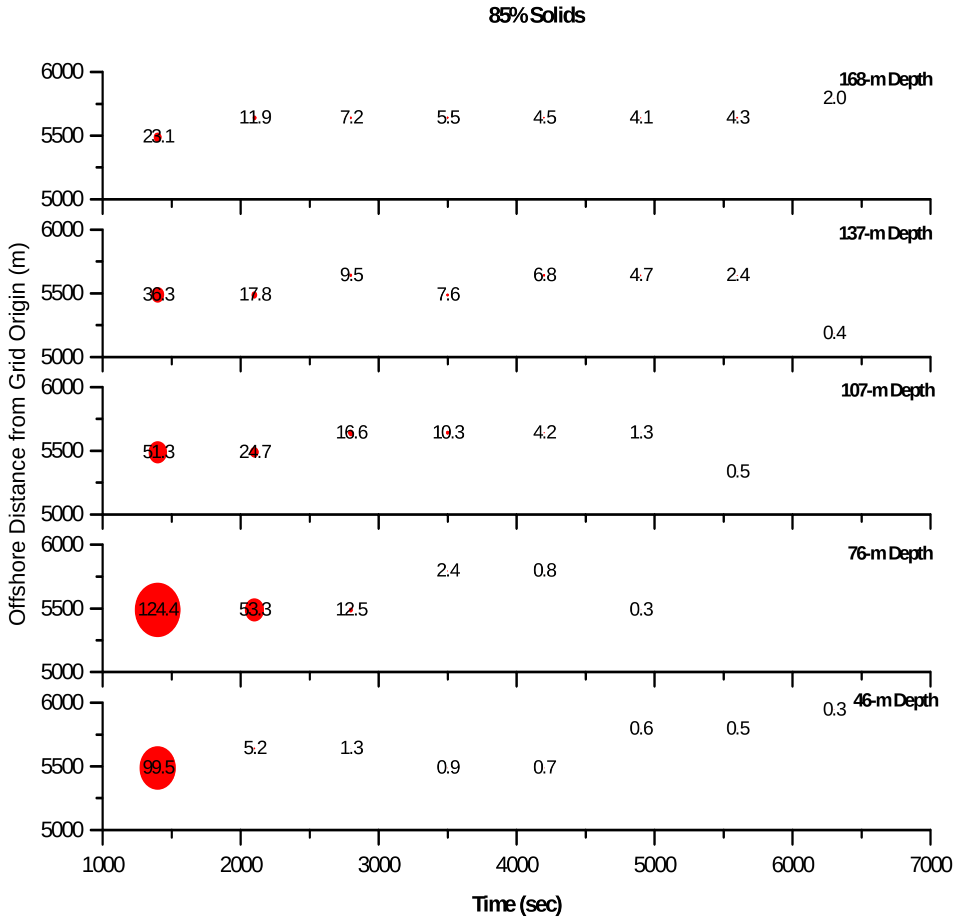


Figure 54. Total sediment concentration in mg/l at Palm Beach (depths are measured from the water surface)

Screening Level Model Application

In the original work a screening level erosion model was used to estimate the long-term response of the dredged material mounds at the Port Everglades and Palm Beach ODMDSs to local environmental forcing functions. In the previous study the screening level erosion modeling was completed for the three largest historical storms selected from the National Hurricane Center's HURDAT database. An additional case of a severe extratropical storm was simulated for the Port Everglades 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 × .41 m square mound configuration was assumed for a 50,000 c. y mound. This volume represents the annual amount that each disposal site is expected to accommodate. The total sediment loss 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 shown in Table 6.

SAJ suggested applying the screening level erosion model for a larger mound of 500,000 c. y (ten 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 $\times$ 965 m $\times$ .41 m. The depth of the assumed mound was kept the same as what was assumed in the previous study. It is a normal tendency of the disposal mounds to be spread horizontally and maintain a depth of less than 1 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, in which the peak flux was assumed to occur for four hours across one side of the 965 m $\times$ 965 m disposal site, are shown in Table 6.

It can be seen from Table 6 that when the mound size is increased 10 times the new total sediment loss for each storm increased about 3 times. The loss per unit width of the mound is a function of the mound elevation, which was the same as the original study. The total volume loss corresponds to the increased width of the mound. The maximum computed total sediment loss is 11 m^3, which is associated with the tropical storm 353 at Port Everglades, and is less than .003% of the disposed mound volume of 500,000 c. y. Therefore, even during the most severe storms and with mounds ten times larger than the annual amount that each disposal site is expected to accommodate, the mounds at Port Everglades and Palm Beach will not be significantly eroded.

Table 6. Total volume (m^3) eroded from Port Everglades and Palm Beach mounds

	Port Everglades				**Palm Beach**		
	Storm 276	Storm 292	Storm 353	Severe Extra-tropical Storm	Storm 276	Storm 292	Storm 353
Present Study	0	0	11	4	0	0	10
Previous Study	0	0	3.5	1.3	0	0	3

Summary and Conclusions

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.

In all Port Everglades applications sediment was disposed 6100 m from the grid origin (reef location). Two sediment compositions were simulated, 60% and 70% solids by weight, with 38% and 5% fines, respectively. Results indicate silt-clay concentrations diminish to approximately 1 mg/l or less at a distance of 1500 m of the disposal location. Higher current speeds carry sediment from the disposal location more rapidly, but silt-clay concentrations still drop below about 1 mg/l within 1500 m of the disposal location. A major portion of the dredged material is sand. Sand concentrations diminish to 1 mg/l or less at a distance of 2440 m of the disposal location. Since the previous study was dealing with each portion of sediment alone, the above mentioned values correspond to different distances from the reef and different velocity input conditions.

The present results indicate that under the most severe conditions (N99: 70%), the maximum total sediment concentration within 4000 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. The sand concentration was 2.7 mg/l while the silt-clay concentration was 0.5 mg/l.

In all Palm Beach applications sediment was disposed 5500 m from the grid origin (reef location). Two sediment compositions were simulated, 80% and 85% solids by weight, with 6% fines. Silt-clay concentrations diminish rapidly to 1 mg/l or less within 1500 m of the disposal location. Higher current speeds carry sediment from the disposal location more rapidly, but silt-clay concentrations still drop below 1 mg/l within 1500 m of the disposal location. A major portion of the dredged material is sand. Sand concentrations diminish to 1 mg/l or less within 2400 m of the disposal location.

The present results indicate that under the most severe conditions (N99: 85%), the maximum total sediment concentration within 3800 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 EPA has expressed concern regarding the fate of the dredged material disposed at the ODMDSs due to their proximity to the Gulf Stream and its spin-off eddies. The current data used in the previous study was obtained from an ADCP positioned about 70 km to the south of the Palm Beach ODMDS site and in close proximity to the Port Everglades site. It was not possible to obtain additional velocity data near Palm Beach. Therefore, a brief description of the Florida Current was prepared to evaluate the use of ADCP velocities for the Palm Beach ODMDS. Ocean currents in the vicinity of the sites are generally along the north-south axis steered by shelf break. The shelf topography and distance from shoreline to the shelf break at both ODMDS sites and the ADCP location are quite similar. At times, the Florida Current does generate, or contribute to, shoreward directed velocity fields which may affect the disposal sites. The ODMDS sites and the ADCP are located about 3 km from the shelf break, i.e., about 7 km from the average position of the western boundary of the Florida Current. Since the average size of the spin-off eddies is about 10- 30 km, then the ADCP and the ODMDS sites are expected to experience similar effects of the spin-off eddies. Because of the proximities of both ODMDSs and the ADCP to the shelf break and the Florida Current and its spin-off eddies and because of similarities in shelf topographies and distances between shoreline and shelf break at the ODMDSs and ADCP sites, currents at the three sites can be expected to be similar. Therefore, it is justified to use the ADCP current data for the Palm Beach

ODMDS. The current data used to evaluate the dispersion and movement of sediments at the ODMDSs is obtained from the ADCP which includes data associated with spin-off eddies that might lead to transporting sediment toward the shore. Therefore, the model results which indicate the movement of the sediment did include the effects of the spin-off eddies.

The typical velocity profile, modeled using STFATE, provides a description of phenomena under typical conditions. In the previous study, STFATE modeling involved either a varying bathymetry or a varying velocity profile. Available model technology did not incorporate variation in both depth and velocity. Model modifications to adopt a four-point velocity profile were made in this study.

Sediment was disposed 6100 m from the grid origin (reef location) at Port Everglades. The maximum concentration in the water column after 1200 sec was 74.6 mg/l for the 60% solids case. The maximum concentration after 1200 sec was 91.5 mg/l for the 70% solids case. The maximum total concentration recorded for the 70% solids case was 2 mg/l after 6000 sec, at a distance of 6250 m from the reef. The maximum total concentration over the depth recorded from the previous study for the N50: 70% case at a distance of 5000 m from the reef was 0.85 mg/l and was 2.03 mg/l for the W50: 70% case. The distance of 5000 m from the reef was the minimum distance for which the maximum total sediment could be calculated for both the W50: 70% case and the N50: 70% case. It can be concluded that when the direction of the velocity was toward the west a higher value of concentration was recorded at a distance of 5000 m from the reef than when the velocity was directed toward the northwest. However, in the case of the typical velocity profile concentrations were never observed west of the disposal location and the sediment was moving toward the northeast and not toward the reef.

The sediment was disposed 5500 m from the grid origin (reef location) at Palm Beach. The maximum concentration in the water column after 1400 sec was 91.9 mg/l for the 80% solids case and 124.4 mg/l for the 85% solids case. The maximum concentration after 6300 sec was 2 mg/l for the 85% solids case, at a distance of 5800 m from the reef. The maximum concentration recorded from the previous study for the N50: 85% case at a distance of 4300 m from the reef was 1.69 mg/l and was 2.36 mg/l for the W50: 85% case. The distance of 4300 m from the reef was the minimum distance for which the maximum total sediment could be calculated for both the W50: 80% case and the N50: 85% case. It can be concluded that when the direction of the velocity was toward the west a higher value of concentration was recorded at a distance of 4300 m from the reef than when the velocity was directed toward the northwest. In the case of the typical velocity profile, some concentrations associated with the disposal were recorded 200 m to the west of the disposal location but the sediment was generally moving toward the north and not toward the reef.

The direction of the velocity is a main factor in directing the sediments toward or away from the reef. Even for extreme velocities directed to the west and northwest, concentrations decrease substantially with distance away from the disposal location. In general the sediment is moving toward the north and approximately parallel to the shore away from the reef in both sites. Therefore it can be concluded that there is no potential for sediment movement from the ODMDSs at Port Everglades and Palm Beach onto the reefs.

The screening level model simulates the dispersive characteristics of a dredged material mound over time. The screening level erosion modeling was completed for three largest historical storms selected from the National Hurricane Center's HURDAT database. An additional case of a severe extra tropical storm was simulated for the Port Everglades site. A 965 m $\times$ 965 m $\times$ .41 m square mound configuration was assumed, associated with a 500,000 c. y of dredged material that represents 10 times the annual amount that each disposal site is expected to accommodate. The maximum computed total sediment loss of 11 m^3, which is associated with the tropical storm 353 at Port Everglades, is less than .003% of the disposed mound volume of 500,000 c. y. In the previous study, the maximum computed total sediment loss of 3.5 m^3, which is associated with the tropical storm 353 at Port Everglades, is also less than .003% of the disposed mound volume of 50,000 c. y (a negligible quantity). Therefore, even during the most severe storms and with mounds ten times larger than the annual amount that each disposal site is expected to accommodate, the mounds at Port Everglades and Palm Beach will not be significantly eroded.

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Appendix N

COASTAL ZONE CONSISTENCY EVALUATION REPORT

Appendix N

OCEAN DREDGED MATERIAL DISPOSAL SITES
PALM BEACH HARBOR AND PORT EVERGLADES HARBOR
FLORIDA COASTAL ZONE CONSISTENCY PROGRAM
FEDERAL CONSISTENCY EVALUATION PROCEDURE

PROJECT SUMMARY

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.

Alternative sites considered for Palm Beach Harbor include sites located approximately 3 nautical miles, 4.5 nautical miles, and 9 nautical miles offshore (oriented east northeast of the Lake Worth Inlet). Alternative sites considered for Port Everglades Harbor include sites located approximately 4 nautical miles and 7 nautical miles offshore (oriented east northeast of Port Everglades). 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 offshore, respectively. The preferred sites (each approximately 1 square nautical mile [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.

CONSISTENCY DETERMINATION

1. Chapter 161, Beach and Shore Preservation. This chapter establishes the State of Florida’s Beach Management Plan and associated inlet management programs. The goals of the Beach Management Plan include the extension of the life of beach nourishment programs and the maximization of the infusion of beach quality material into systems. The chapter also establishes a coastal construction permit program, the intent of which is to regulate construction projects located seaward of established coastal construction control lines which might have an affect on natural shoreline processes.

Consistency Statement: *Beach placement is the preferred method of disposal for beach-quality sediments in Palm Beach and Port Everglades Harbors. Ocean disposal site designation provides an alternative disposal site when material is not compatible for beach placement or a beach placement alternative is not available. If beach placement is not the preferred cost effective alternative, the USACE has various legislative authorities to share the incremental costs of* *beneficial use options. For example, Section 145 of the Water Resources Development Act (WRDA) of 1976 as amended by Section 933 of WRDA 1986, Section 207 of WRDA 1992, and Section 217 of WRDA 1999, authorizes the USACE to place suitable dredged material on local beaches if a State or local government requests it. The incremental costs of beach placement under this authority are shared on a 65% Federal and 35% non-Federal basis. This project does not include construction activities that would affect beach or shoreline protection. Therefore, this work will be consistent with this chapter.*

2. Chapters 186 and 187, State and Regional Planning. These chapters establish the State Comprehensive Plan that sets goals to articulate a strategic vision for the State of Florida's future. The purposes to define in a broad sense, goals, and policies that provide decision-makers directions for the future and long-range guidance for orderly, social, economic, and physical growth.

Consistency Statement: *The proposed project will comply with the strategic vision of the State of Florida as mentioned in the State and Regional Planning Chapters.*

2. Chapter 252, Disaster Preparation, Response, and Mitigation. This chapter creates a State Emergency Management Agency, with authority to provide for the common defense; to protect the public peace, health, and safety; and to protect and preserve the lives and property of the people of Florida.

Consistency Statement: *The designation of off shore dredged material disposal sites for Palm Beach and Port Everglades Harbors will not jeopardize the public health, safety, or welfare of the area near the project area, but could compliment the chapter's goals. Therefore, this work will be consistent with the intent of this chapter.*

3. Chapter 253, State Lands. This chapter governs the management of submerged State lands and resources within these lands. This includes archeological and historical resources; water resources; fish and wildlife resources; beaches and dunes; submerged grass beds and other benthic communities; swamps, marshes, and other wetlands, mineral resources; unique natural features; submerged lands; disposal islands, and artificial reefs.

Consistency Statement: *The proposed action does not occur within State waters. Additionally, modeling has demonstrated that dredged material deposited at the sites will not be transported to State submerged lands. No reasonably foreseeable significant impacts to State submerged lands or resources within these lands are expected as a result of implementation of the proposed project. Therefore, the project is consistent with this chapter.*

4. Chapters 253, 259, 260, and 375, Land Acquisition. These chapters authorize the State to acquire land to protect environmentally sensitive areas.

Consistency Statement: *Due to the off shore location of the proposed disposal sites, there is no provision for State acquisition. These chapters do not apply.*

5. Chapter 258, State Parks and Aquatic Preserves. This chapter authorizes the State to manage State parks and preserves. Consistency with this chapter would include consideration of projects that would directly or indirectly adversely impact park property, natural resources, parks programs or management or operations.

Consistency Statement: *The proposed action does not include any activity within a State Park or Aquatic Preserve. No reasonably foreseeable significant impacts to State Parks or Aquatic Preserves are expected as a result of implementation of the proposed project. Therefore, the project is consistent with this chapter.*

6. **Chapter 267, Historic Preservation**. This chapter established the procedures for implementing the Florida Historic Resources Act responsibilities.

Consistency Statement: *The proposed designation of dredged material disposal sites has been coordinated with the State Historic Preservation Officer. The work will be consistent with the goals of this chapter. There are no know features of historical importance in the vicinity of the proposed sites, and therefore it is unlikely that the proposed site designations will result in any impact to these areas. Bottom video surveys and sidescan sonar surveys of the alternative sites did not reveal any such areas.*

7. **Chapter 288, Economic Development and Tourism**. This chapter directs the State to provide guidance and promotion of beneficial development through the encouragement of economic diversification and promotion of tourism.

Consistency Statement: *The areas in which the proposed disposal sites are located do not support any viable tourist or economic resource. The goals in this chapter are not applicable.*

8. **Chapter 334 and 339, Public Transportation**. This chapter authorizes the planning and development of a safe and efficient public transportation system.

Consistency Statement: *The proposed disposal site designation will not affect public transportation. Therefore, this chapter does not apply.*

9. **Chapter 370, Living Saltwater Resources**. This chapter directs the State to preserve, manage, and protect the marine, crustacean, shell and anadromous fishery environment; to regulate fishermen and vessels of the state engaged in the taking of such resources within or without state waters; to issue licenses for the taking and processing of fishery products; to secure and maintain statistical records of the catch of each species; and to conduct scientific, economic, and other studies and research.

Consistency Statement: *The designation and utilization of the offshore disposal sites will not result in long-lasting, adverse affects the activities covered by this chapter. The implementation of the proposed action will be consistent with the provisions of this chapter. Most commercial and recreational fishing activity in the vicinity of the proposed sites is concentrated in inshore and nearshore waters. No natural hardbottom areas are known to occur in proximity to the proposed sites. In short, the proposed sites do not represent a unique habitat for any of the important commercial or recreational fisheries. Use of the sites will smother the non-motile or slow moving benthic organisms at the sites. However, the ability of these organisms to recolonize in similar sediments renders this impact short-term.*

10. **Chapter 372, Living Land and Freshwater Resources**. This chapter establishes the Game and Freshwater Fish Commission and directs it to manage freshwater aquatic life and wild animal life and their habitat to perpetuate a diversity of species with densities and distributions that provide sustainable ecological, recreational, educational, scientific, aesthetic, and economic benefits.

Consistency Statement: *The proposed action does not affect or involve any freshwater aquatic communities or wildlife habitat. Therefore, this chapter is not applicable.*

11. Chapter 373, Water Resources. This chapter provides the authority to regulate the withdrawal, diversion, storage, and consumption of water.

Consistency Statement: *The proposed project does not include the usage of water resources as described in this chapter.*

12. Chapter 376, pollutant Spill Prevention and Control. This chapter regulates the transfer, storage, and transportation of pollutants and the cleanup of pollutant discharges.

Consistency Statement: *The transportation or discharge of pollutants is not included in the proposed actions of this project. Inadvertent spills of pollutants, such as fuels, will be handled per conditions set forth in the contract. Project work will conform to the intent of this chapter.*

13. Chapter 377, Oil and Gas Explorations and Production. This chapter authorizes the regulation of all phases of exploration, drilling, and production of oil, gas and other petroleum products.

Consistency Statement: *The actions proposed for this project do not include the exploration, drilling, and/or the production of oil, gas, or any other petroleum product. Goals and concerns within this chapter do not apply.*

14. Chapter 380, Environmental Land and Water Management. This chapter establishes criteria and procedures to assure the local land development decisions consider the regional impact of large-scale development.

Consistency Statement: *The proposed actions for this project have been coordinated with the local regional planning council and the work will conform to the goals of this chapter.*

15. Chapter 388, Arthropod Control. This chapter provides for a comprehensive approach for abatement or suppression of mosquitoes and other arthropod pests within the state.

Consistency Statement: *Actions taken under the proposed project will satisfy the goals and intents of this chapter.*

16. Chapter 403, Environmental Control. This chapter authorizes the regulation of pollution of the air and waters of the state by the Department of Environmental Protection.

Consistency Statement: *The USACE and EPA will evaluate all federal dredged material disposal projects in accordance with the EPA criteria given in the Ocean Dumping Regulations (40 CFR 220-229), the USACE regulations (33 CFR 209.120 and 209.145), and any state requirements. The USACE will also issue permits to private dredged material disposal projects after review under the same regulations. EPA has the right to disapprove any ocean disposal project if, in its judgment, all provisions of the Marine Protection, Research, and Sanctuaries Act and associated implementing regulations have not been met.*

17. Chapter 582, Soil and Water Conservation. This chapter establishes policy for the conservation of State soils and water through the Department of Agriculture. Land use policies will be evaluated in terms of their tendency to cause or contribute to soil erosion or to conserve, develop and utilize soil and water resources either on-site or on adjoining properties affected by the work. Particular attention will be given on or near agricultural lands.

Consistency Statement: *The proposed project area is not located near agricultural lands. Goals and concerns addressed in this chapter are not applicable.*

CONCLUSION

The proposed project as described in the project EIS is consistent to the maximum extent practicable with the enforcement policies of the above Florida Statutes.