Appendix I

ESSENTIAL FISH HABITAT ASSESSMENT

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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

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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

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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

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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^{o}45'N and 79^{o}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.

2.3.9 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 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 Ceriantheid 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.

<u>3.3.7 Coral, Coral Reefs, and Live/Hard Bottom Habitat</u>

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.

<u>3.3.8 Sargassum</u>

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.

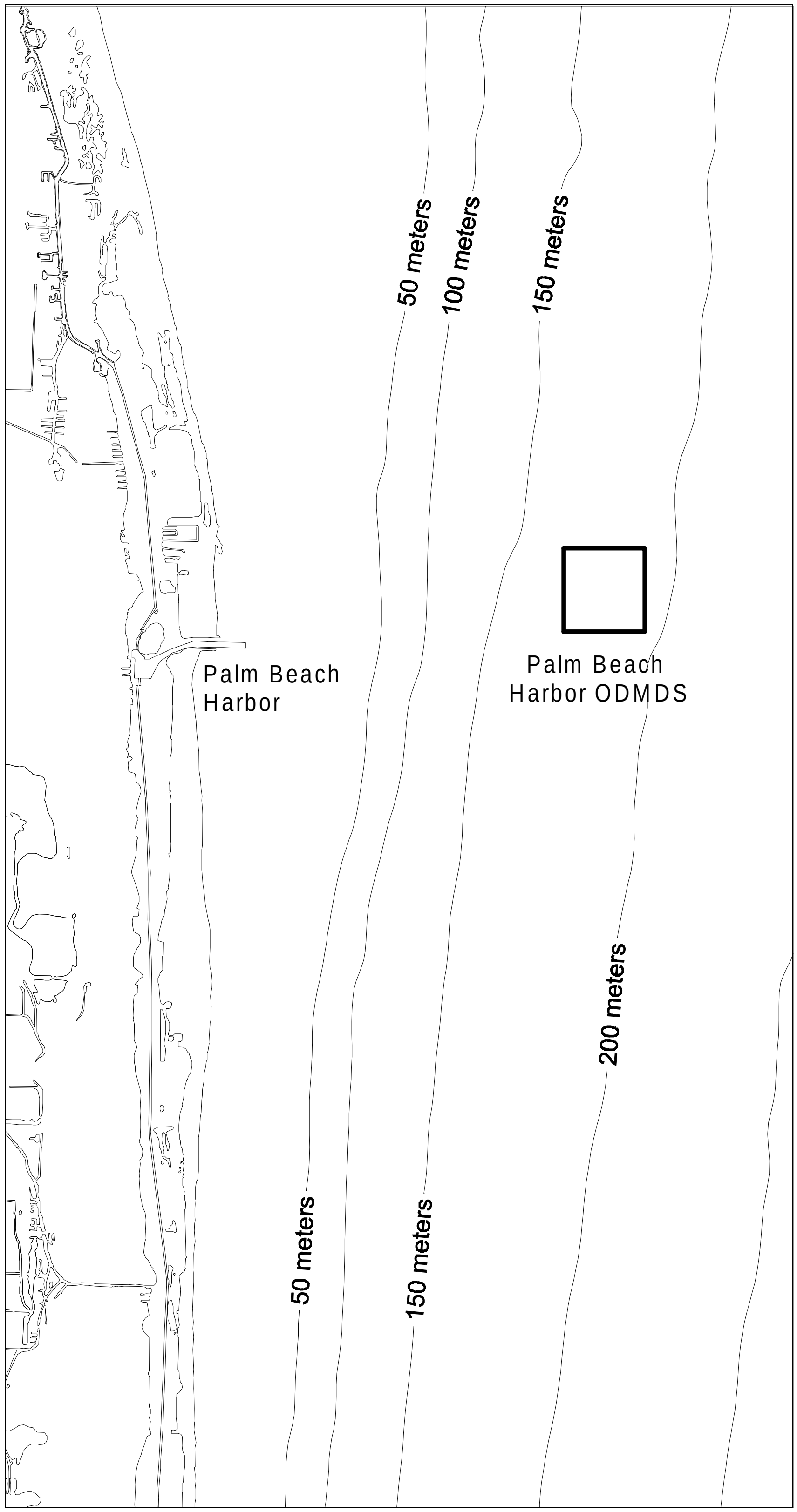

Figure 1: Proposed Palm Beach Harbor ODMDS Location

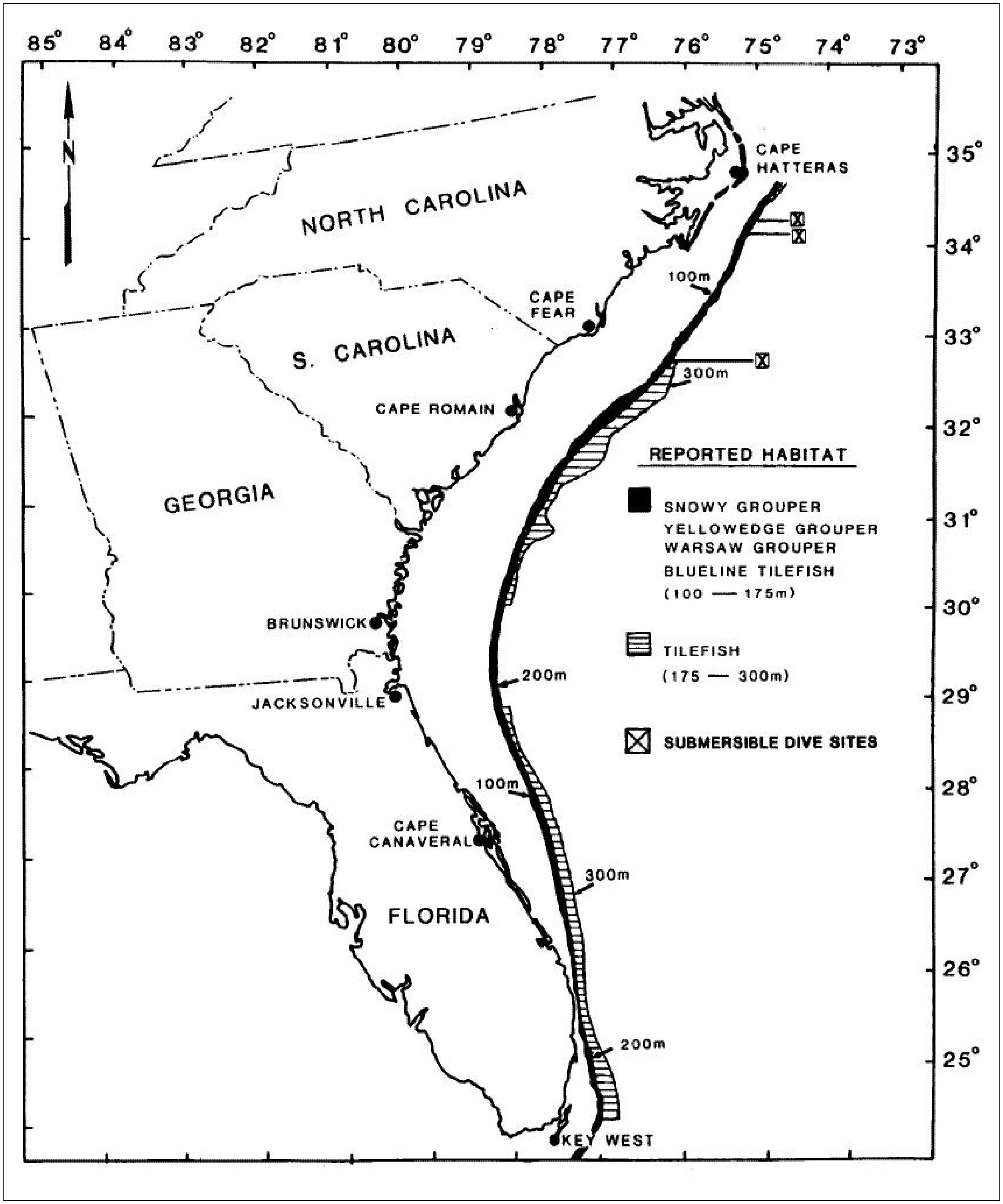

Figure 2: Deepwater reef fish habitat reported by commercial and recreational fisherman (Parker and Mays, 1998)

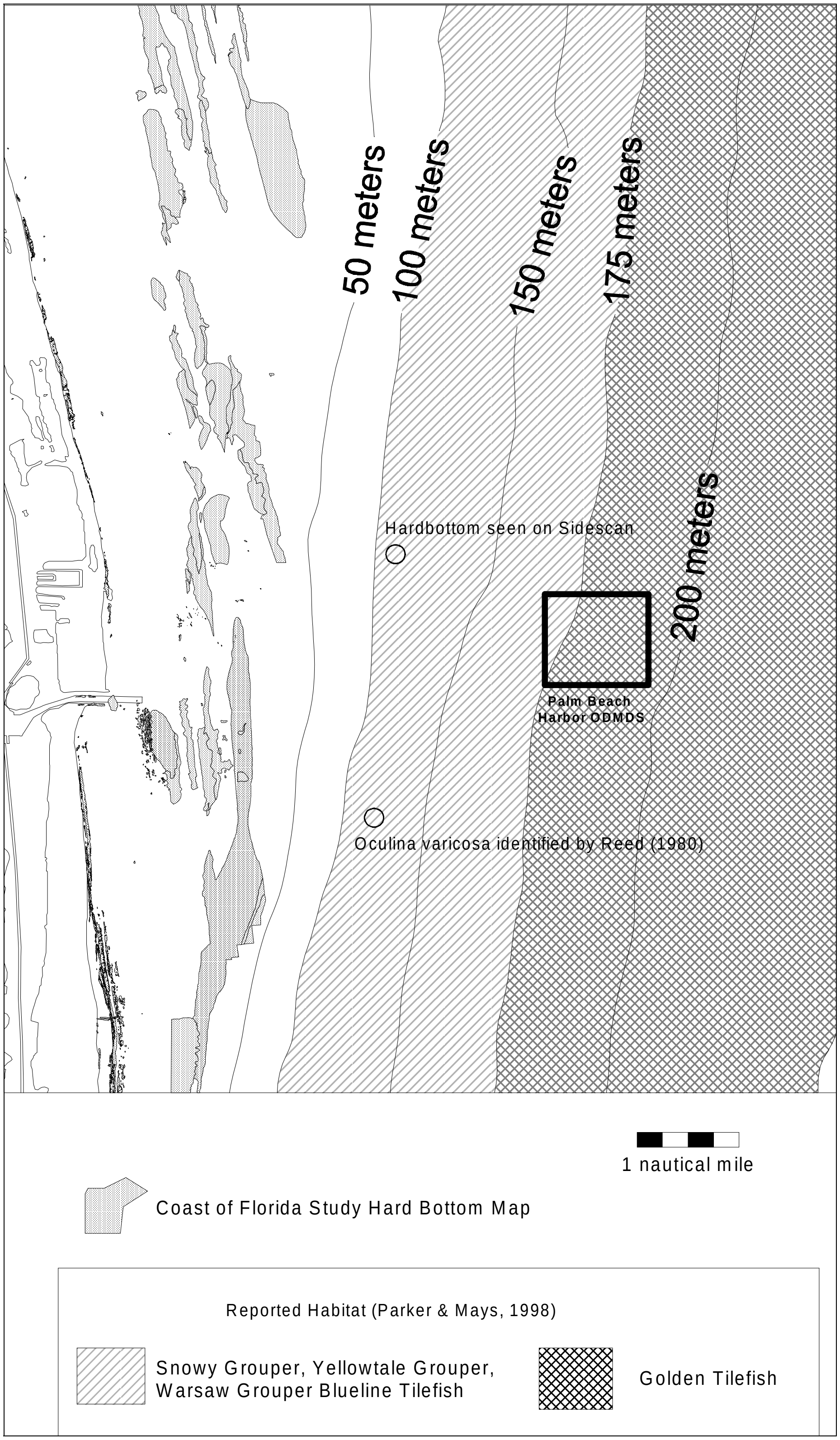

Figure 3: Benthic habitat in vicinity of proposed Palm Beach Harbor ODMDS

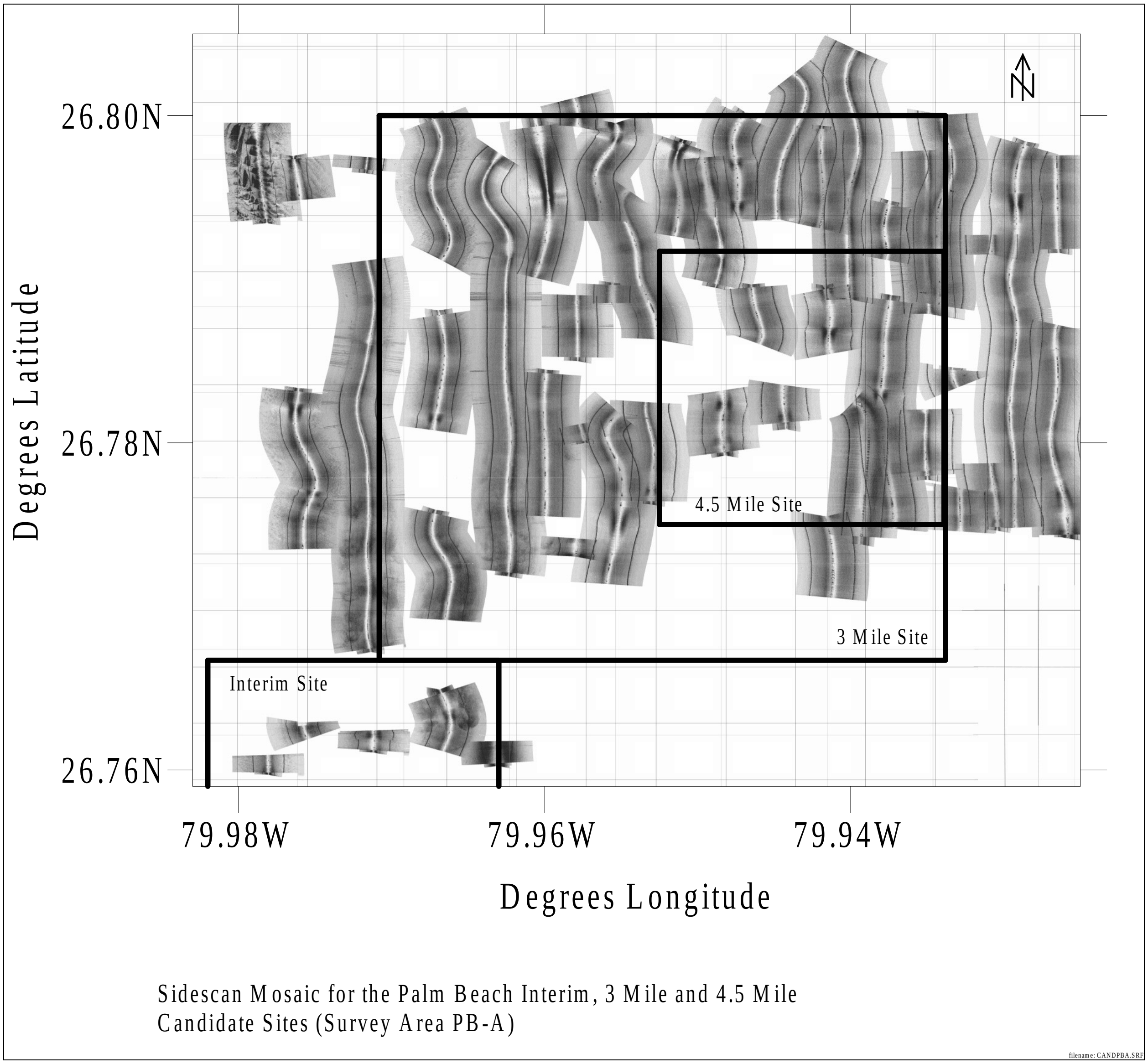

Figure 4: Mosaic of proposed ODMDS

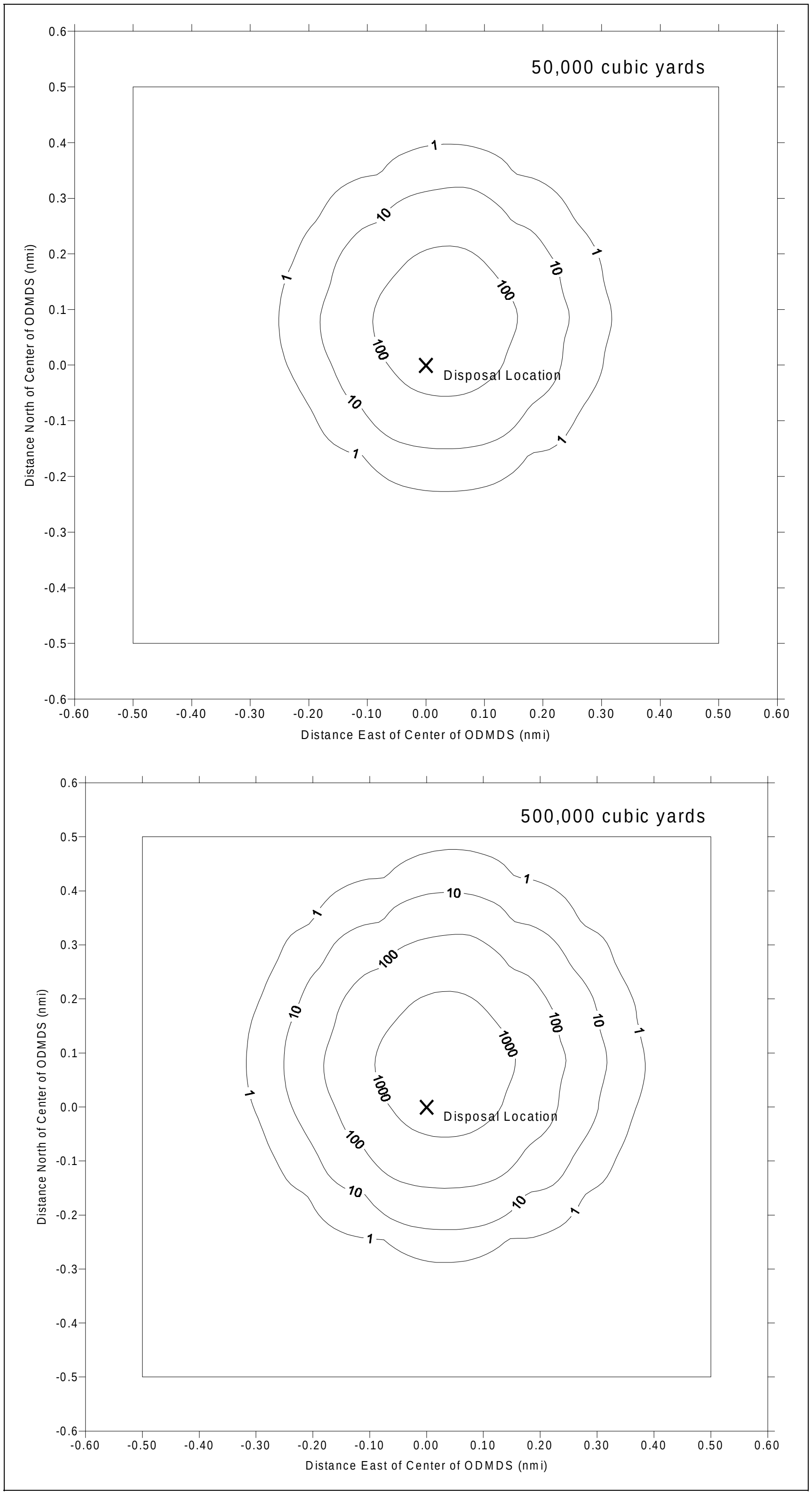

Figure 5: Disposal deposition (mm) for 50,000 and 500,000 cy of dredged material from STFATE model output.

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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°N Blake Plateau & nearshore to 200m	No No No
Atlantic skipjack tuna	eggs/larvae juvenile to adult	south of 28.25°N, 200m to EEZ 25-200m isobath	Yes No
Atlantic yellowfin tuna	eggs/larvae juvenile to adult	south of 28.25°N, 200m to EEZ north of 31°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°N, 100m-EEZ south of 30°N, 200-2000m south of 29.5°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^{o}N, inlets, estuaries, waters<25m FL	No
Lemon shark	juvenile adult	Bulls Bay, SC-28^{o}N & south of 25.5^{o}N, inlets, estuaries, waters<25m 30^o-31^{o}N & south of 27^{o}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^o-33^{o}N, coastal waters to 25m	No
Scalloped hammerhead shark	juvenile adult	shoreline to 200m north of 28^{o}N, 25-200m	No No
Dusky shark	juvenile adults	north of 33^{o}N & south of 30^{o}N, inlets, estuaries, waters <200m north of 28^{o}N, 25-200m	No No
Sandbar shark	juvenile adults	north of 27.5^{o}N, coastal waters-25m coastal waters to 25m	No No
Spinner shark	early juvenile juvenile/adult	south of 32.25^{o}N, coastal waters- 25m 30.7^o-28.5^{o}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°04.00'N, 80°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

<u>3.3.1 Royal Red Shrimp</u>

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.

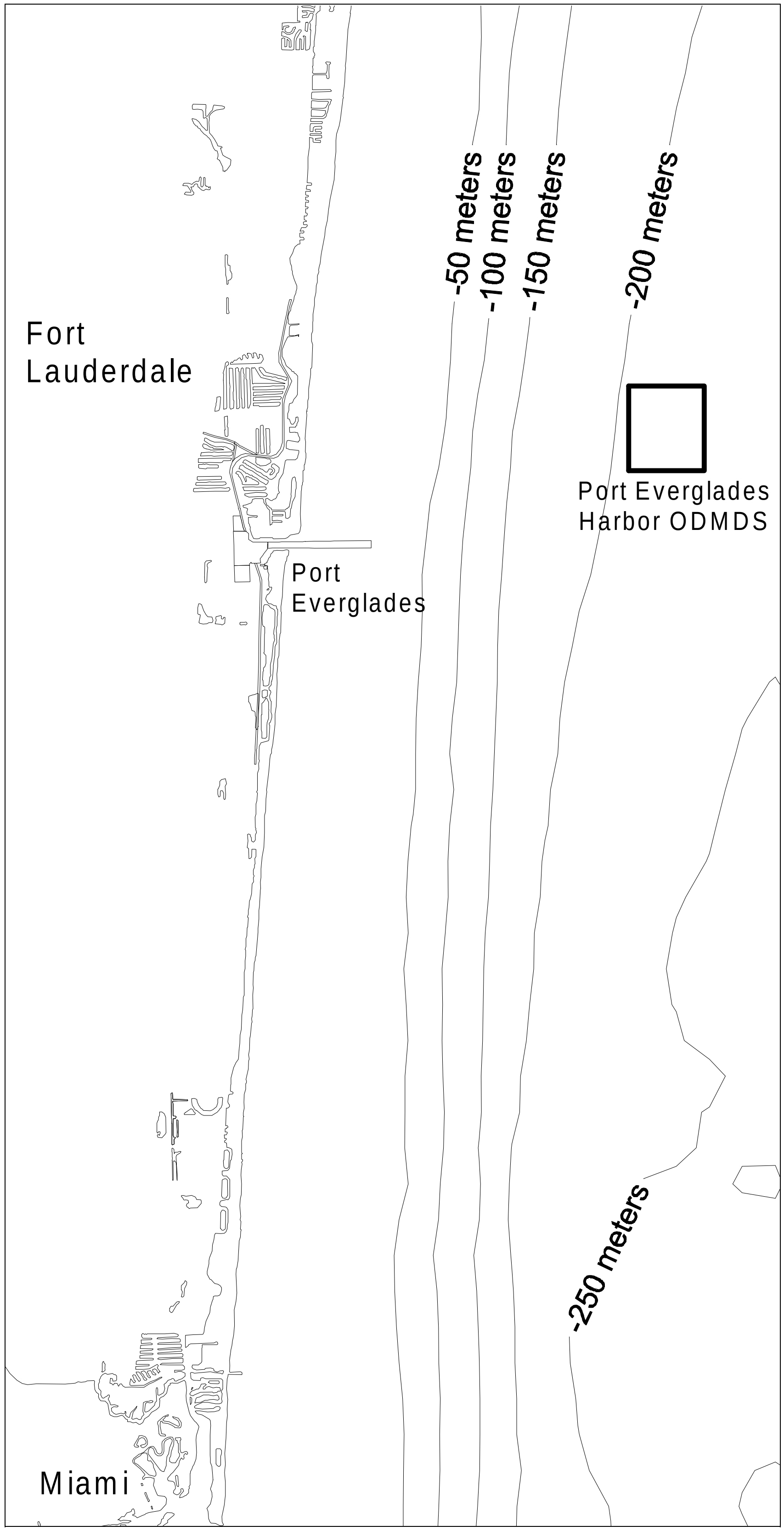

Figure 1: Proposed Palm Beach Harbor ODMDS Location

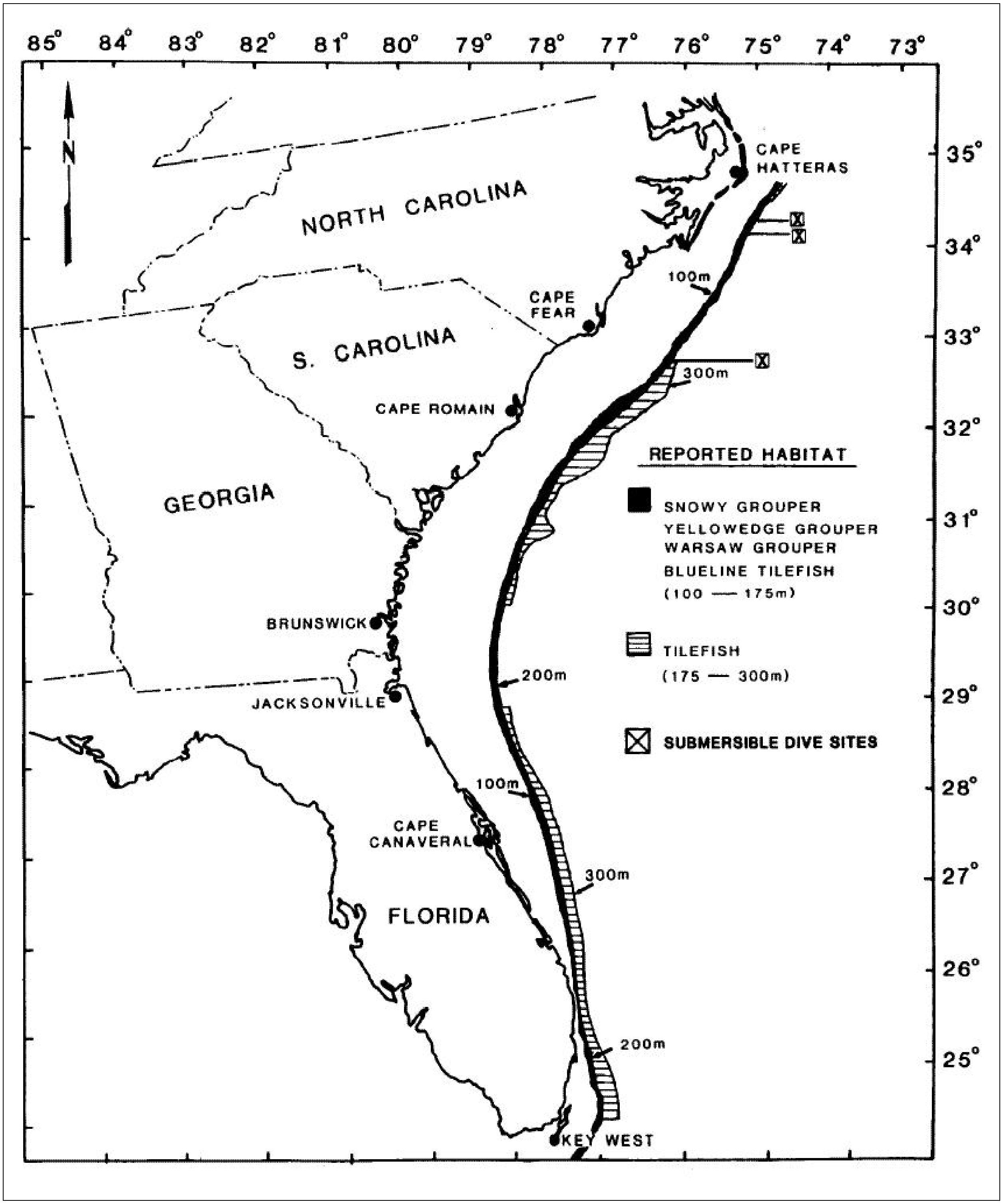

Figure 2: Deepwater reef fish habitat reported by commercial and recreational fisherman (Parker and Mays, 1998)

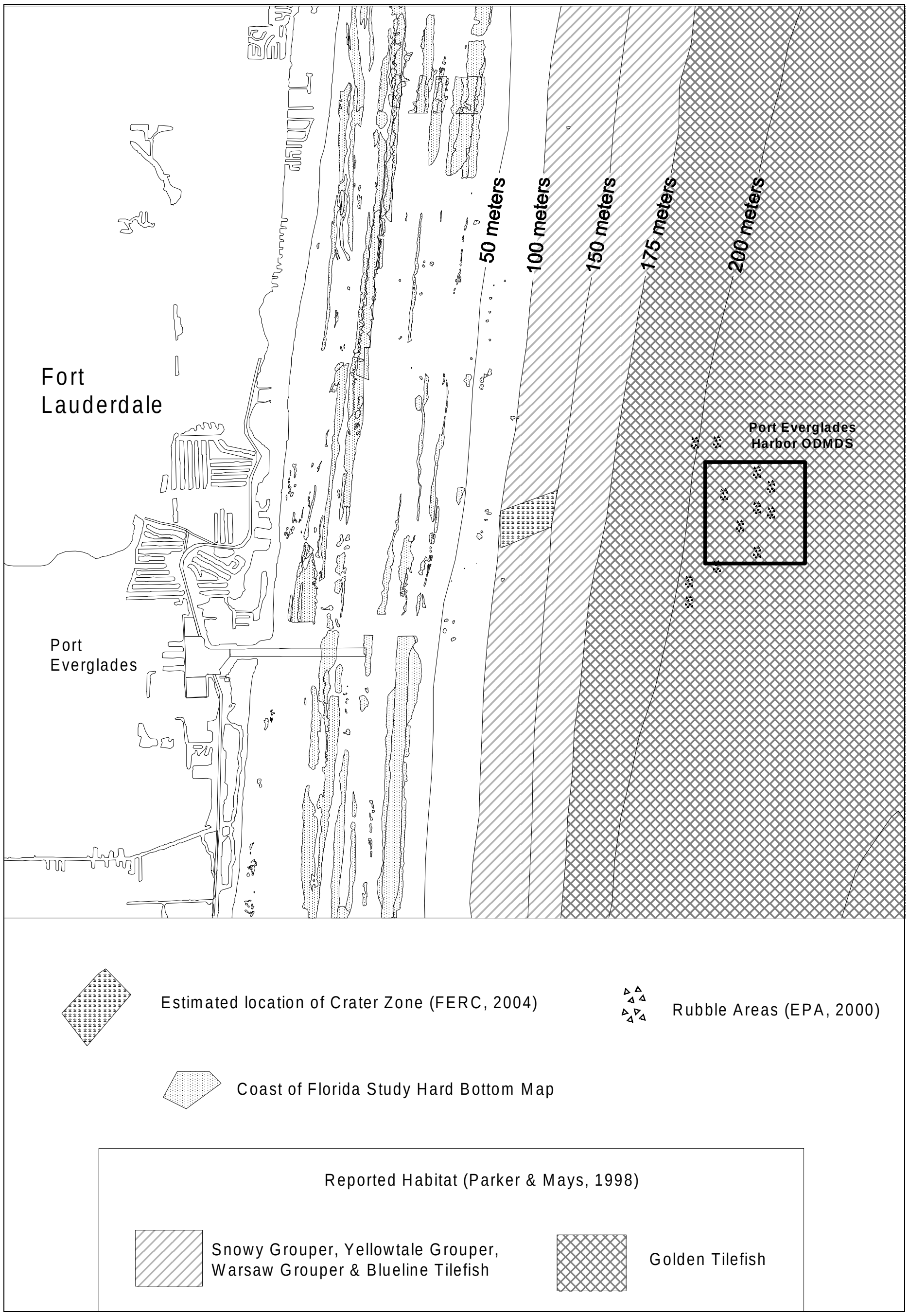

Figure 3: Benthic habitat in vicinity of proposed Port Everglades Harbor ODMDS

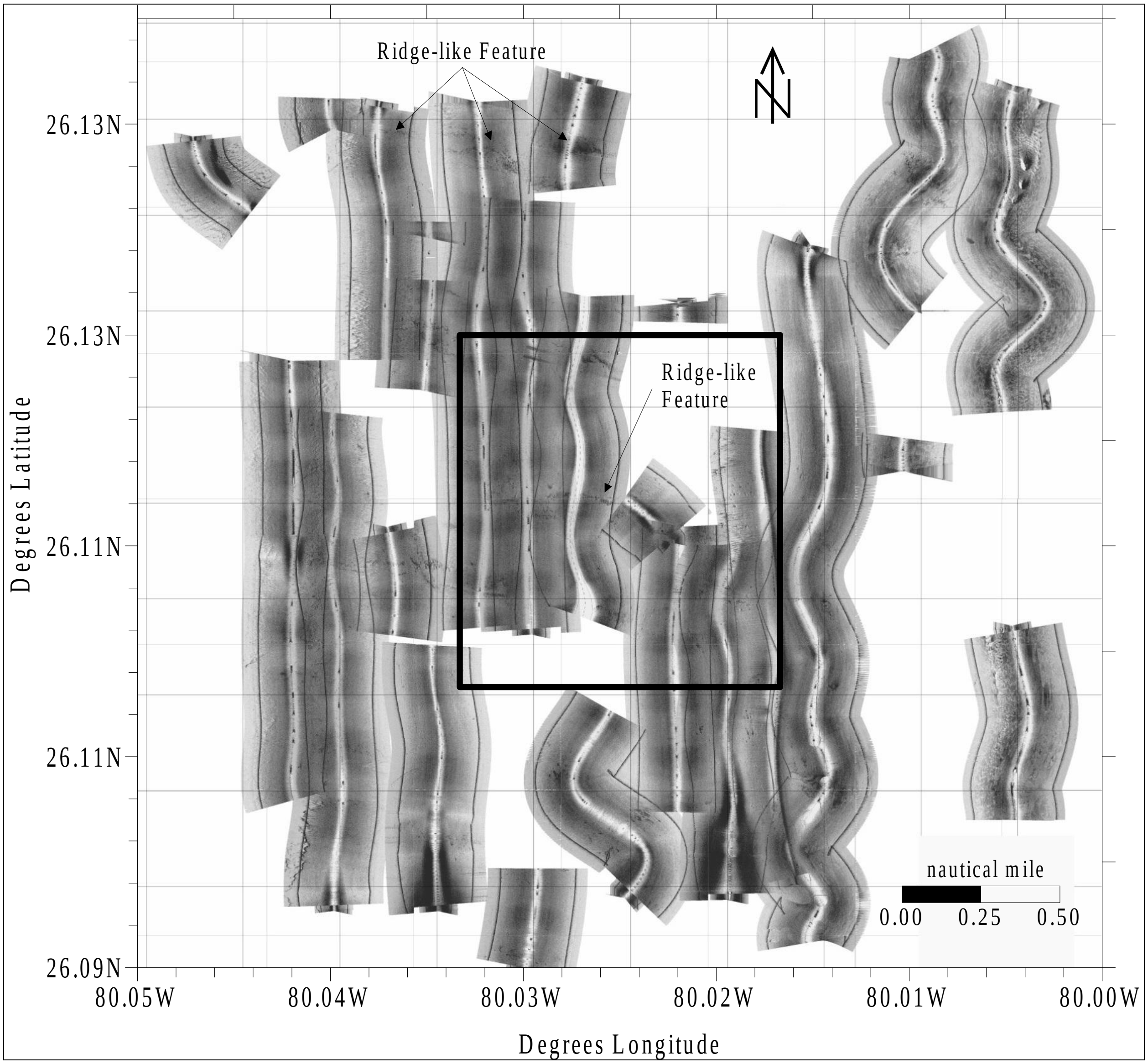

Figure 4: Sidescan Sonar Mosaic of proposed ODMDS

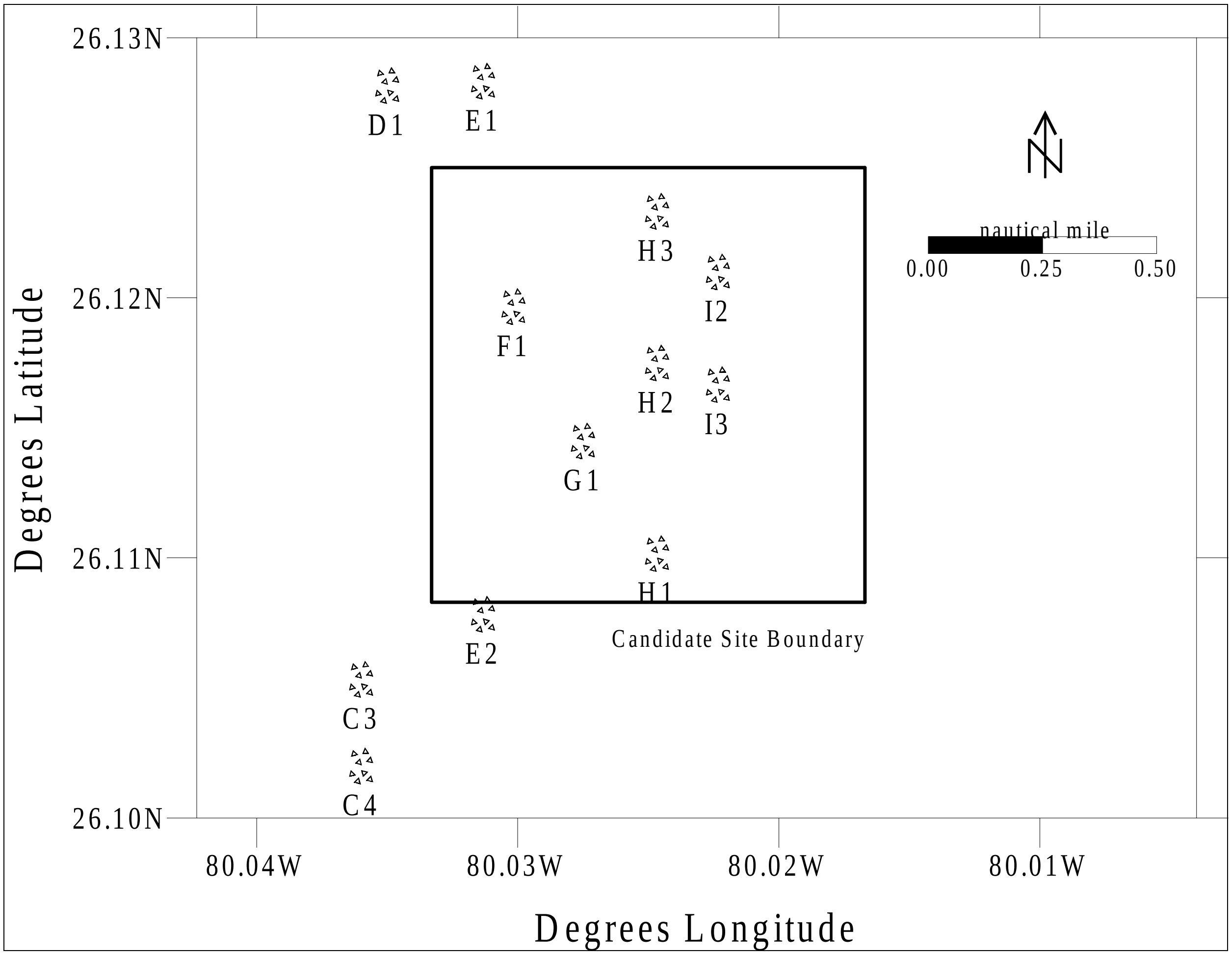

Figure 5: Areas of Scattered Low-Relief In and Near the Port Everglades Harbor Proposed ODMDS. Labels correspond to images presented in EPA (2000).

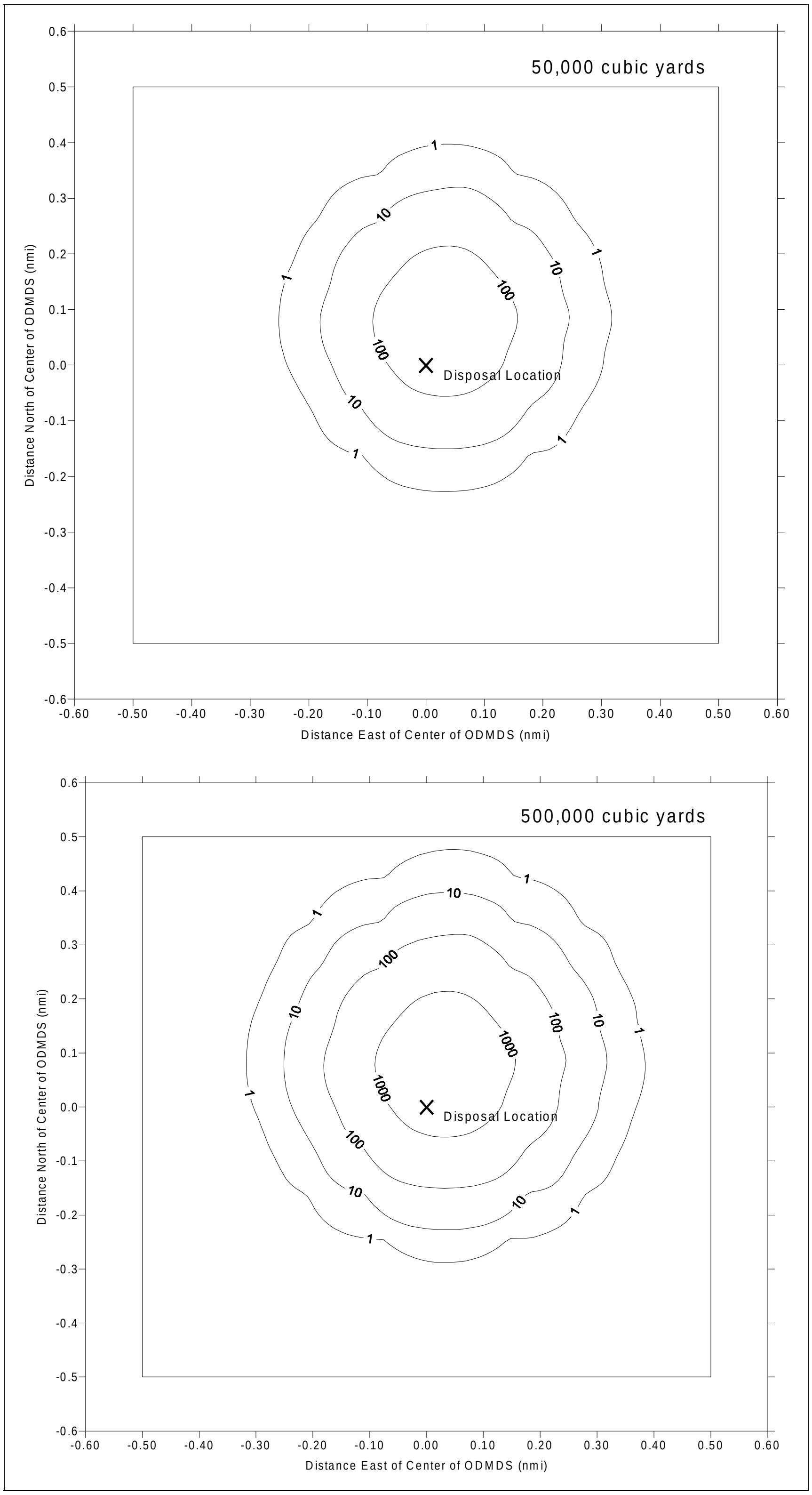

Figure 6: Disposal deposition (mm) for 50,000 and 500,000 cy of dredged material from STFATE model output.

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